GLOBALIZATION AND THE TEXAS METROPOLISES:

COMPETITION AND COMPLEMENTARITY IN THE TEXAS URBAN TRIANGLE

A Dissertation

by

JOSÉ ANTÓNIO DOS REIS GAVINHA

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

December 2007

Major Subject: Geography

GLOBALIZATION AND THE TEXAS METROPOLISES:

COMPETITION AND COMPLEMENTARITY IN THE TEXAS URBAN TRIANGLE

A Dissertation

by

JOSÉ ANTÓNIO DOS REIS GAVINHA

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Approved by:

Chair of Committee,	Daniel Z. Sui
Committee Members,	Robert S. Bednarz
	Hongxing Liu
	Michael Neuman
Head of Department,	Douglas J. Sherman

December 2007

Major Subject: Geography

ABSTRACT

Globalization and the Texas Metropolises:
Competition and Complementarity in the Texas Urban Triangle. (December 2007)
José António dos Reis Gavinha, B.A., Universidade do Porto; M.Sc., University of Toronto
Chair of Advisory Committee: Dr. Daniel Z. Sui

This dissertation examines relationships between cities, and more specifically the largest Texas cities, and the global economy. Data on headquarters location and corporation sales over a 20-year period (1984-2004) supported the hypothesis that globalization is not homogeneous, regular or unidirectional, but actually showed contrasted phases. Texas cities have been raising in global rankings, due to corporate relocations and, to lesser extent, the growth of local activities. By year 2004, Dallas and Houston ranked among the top-20 headquarters cities measured by corporation sales The Texas Urban Triangle had one of the major global concentrations of oil- and computer-related corporation headquarters; conversely, key sectors like banking, insurance and automotive were not significant.

Standardized employment data in major U.S. metropolitan areas was examined through principal components analyses. Overall, larger places showed higher degrees of diversity, and no trend toward economic convergence. The TUT also presented a degree of intra-regional diversity comparable to other urban regions. Findings confirmed the relevance of oil- and information-related activities, along with construction, and weakness of activities linked to finance and corporate management.

Traffic and air linkages in Texas cities were contrasted to other American gateways. Dallas and Houston have been major nodes in global air transportation, with very important roles as transit hubs for domestic (the former) and short international (the latter) flights. For long-haul international traffic both cities were second-level American gateways, with Houston mobilizing better connected to Western Europe and Mesoamerica, and Dallas to South America and East Asia. Dallas central location strengthened its role in the domestic market, as the center of one of the five major subsystems in the country and a top gateway in enplanements, number of linkages and connectivity measures. The Texas air travel network hierarchical organization was

relatively unbalanced, with two strong nodes at the top, three little-relevant middle nodes, and several very poorly interconnected gateways at the bottom.

Finally, the high supply of regional flights between primary destinations, namely Dallas and Houston, resulted in significant effects of time-space convergence. Such effects were only found between highly-connected major gateways, and completely bypassed other places, independently of their size and relative location.

DEDICATION

To my Parents, to my Pong,

they are irrefutable proof of how privileged is the life I was given to live.

ACKNOWLEDGEMENTS

I am deeply thankful to my Chair, Dr. Daniel Z. Sui. I would have been unable to pursue this dissertation without his guidance and encouragement, his enormous patience, personal advice, and financial support. He is a point of reference in terms of teaching, scholarship and career devotion in the extremely competitive and demanding academic world.

I must also thank my other committee members, Dr. Robert S. Bednarz, Dr. Hongxing Liu and Dr. Michael Neuman for their direction, assistance, and encouragement. They were always ready to share some of their time, start friendly discussions, and provide fruitful suggestions.

To the Department of Geography at Texas A&M University, and especially its head Dr. Douglas J. Sherman and assistant head Dr. Jonathan Smith, I am indebted for providing all the resources necessary to pursuing this degree, as well as helpful mentoring and good advice. I should also extend my special thanks to the entire faculty and to the department's staff, and especially to Kathy Lamarque, Cathy Bruton, Delbra Davis, Toya Meriweather, Orlando Karam, Barry Hunter, and Mohammed Rayee for their assistance. And to my good friends and mentors Igor Vojnovic, who convinced to come to Texas and never stopped supporting me, and Horacio Capel, always a model of academic and personal excellence.

I always found strength and encouragement in many of my fellow graduate students. This degree will always be associated with people like Gillian, Joni, Wendy, César, Wei, Zengwang, Aldo, Jongwon, Veit, Edward, Wei-Ming, and many more, and to the beginning of enduring friendships. My life in College Station would have been much harder without the giant heart and generosity of Teri and Randi Price, the camaraderie of my volleyball gang, and the support of larger-than-life people like Dr. Robert Carter and Dr. James DeGeere.

I must also thank all my family and all my friends from their encouragement, endless confidence and continuous support. They are too many to name, but they also know how much they mean to me, and why a long list is not necessary – we are, and we will remain close.

Last but not least, there many other friends I no longer have the chance to share this moment with. Let this be my sincere and grateful way to allow them to share in this moment. Deep in my heart are my cousins Rosa, Angélica and Abílio, Jorge, Rogério, and Herculano; my aunts and uncles Maria and António, Alcinda and Ezequiel, Estela and António, Ernesto, Mercedes and José, Celina and João, and my four grandparents. Also are there, in no particular

order, my primary-school teacher Rosa Freitas, Georgina and Vitorino, Ângela and David, Carolina and João, Leonor, Fernanda and José, Zulmira and João, Salette and António, Arminda and Vítor Daniel, Lavínia, Florinda and Francisco, Ilídia, Fernando and José Sobral, João Campos, Rosa e Domingos, António Trindade, José Alfredo, José Verde, Germano, Cândido and Sílvio Simões, Inocêncio and Luís Pedro, António Morgado, Joaquim Portela and Joaquim Malheiro, Flora, Isabel and Angel, Artur, José Alegria, Natália, Etelvina and Noémia, Maria Armanda, Rosa and Ermelinda, Florentina and Ricardo, Maria Ângela and Maria Albina, Alice, Cândida and Alípio, Maria José, Benilde, Ana e Domingos, Maria, Vitalina and Esperança, Francisco, Aida, José, Domingos and Augusto, Maria and António Pereira, Lourdes and Luís, Purificación, Carneiro da Silva, John Bonar II, Dolphene, George, Rui and António, Ernesto Feu, Diogo, Fernando, Armando, and many others. Despite your physical absence, I am celebrating this degree with all of you in mind, and you will always remain with me.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF FIGURES (Continued)

FIGURE Page

LIST OF TABLES

TABLE Page

LIST OF TABLES (Continued)

CHAPTER I

INTRODUCTION

I see my path, but I don't know where it leads.
Not knowing where I'm going is what inspires me to travel it.

Rosalía de Castro, Galician poet

1.1 Research background

This dissertation is about the relationships between cities, and more specifically the large cities of Texas, and the global economy.

The last decades of the 20th century and the beginning of the 21st century have been characterized by a process of convergence generally referred as globalization. Through this process people, their ideas and their activities became more and more interconnected and interdependent within a social space that tends to be the whole earth (Forer 1978; O'Brien 1992; Dicken 1998/2002; Frankel 2000; Held and McGrew 2002). This global convergence was both facilitated and accelerated by new technological innovations, especially in the areas of transportation and telecommunications. Globalization also implies a compression of both space and time, as movements of people, goods and ideas between distant parts of the world are getting easier, cheaper and faster (Harvey 1989; Ohmae 1990/2002; O'Laughlin *et al*. 2004).

The effects of globalization have affected practically every aspect of modern societies. Most authors identify three major components in the process, the economic, political and cultural, whereas the first is considered as the dominant (Featherstone 1990; Camilleri and Falk 1992; Pacione 2001/2005; Ingimundarson et al. 2004). Fundamental in the development of the new globalizing economy are transnational movements of capital, products and information. Political globalization has proceeded through new institutional arrangements exemplified by the GATT trade negotiation rounds the World Trade Organization or the regular summits of G8 leaders (Bayne 1995, 2000; Cohn 2000/2005; Ostry 2002). And cultural globalization includes

---

This dissertation follows the style of the *Annals of the American Association of Geographers*.

the creation of global markets in areas like sports and cinema, and the role of English as the emerging *lingua franca* (Miller *et al.* 2001; Dor 2004; Leigh 2004; Lim 2006).

But globalization has not proceeded uniformly. It has been a process commanded by large transnational corporations based in advanced western societies, and progressed along the expansion of the activities of such corporations throughout the world (Barnet and Muller 1974; Hardt and Negri 2000; Porter 2005). Previously disconnected activities have been vertically integrated in the international economy through dense (and constantly changing) networks of relationships involving mergers, acquisitions, partnerships, subordinations and subcontracting of firms (Davidow and Malone 1992; Hudson 1999; Kang and Sakai 2001; Mathews 2002). Consistently with this trend, globalization has been characterized by the decreasing interference (or rescaling) of national states, more and more unable to control the growing cross-border flows of goods, capital and information passing through their spaces (Perroux 1968; Claude 1988; Held 1995; Osterhammel and Peterson 2003/2005; Brenner 2004a). Functions traditionally provided by the public sector have also been privatized and their delivery opened up to competition involving private groups, often international (Sclar 1997; Norbäck and Persson 2003; Thomas *et al*. 2004).

A fundamental distinction is emerging in this new economy, where a declining ‘old economy’ dominated by manufacturing is contrasting with an emerging ‘new economy’ based on information and specialized services (Kelly 1998; Daniels 2004). Traditional manufacturing processes have been fragmented and decentralized to places offering cheaper labor and lower taxes and controls, often in poorer countries. At the same time, concentrations of highly-specialized service providers have strategically developed in major markets, targeting the needs of large corporations in the most competitive sectors like finance and telecommunications (Castells 1989; Sassen 1994/2000; Beaverstock *et al*. 1999).

Across scales the process of globalization also does not proceed uniformly, resulting in links of different relevance, and consequently in a new hierarchy of places. Global decision-making activities are concentrated in a few large cities of developed countries, noted by their concentration of corporation head offices, upper-level specialized services, and superior infrastructure (Friedman 1986; Sassen 1991/2001; Castells and Hall 1994; Graham and Marvin 2001). The relevance of these few cities – the so-called ‘world cities’ and ‘global cities’ – in the world economy is increasing, and they have become attractive magnets for migrants from both their surrounding regions and the rest of the world (Sandercock 1998; Purcell 2003; Gow

2005). As the population of global cities is increasingly international (and multicultural), the divide between the rich and the poor has also been widening. The global cities are becoming more alike in their comparable diversity, and at the same time more contrasted in its internal inequalities (Ross and Trachte 1983; Cox 1997a; Fainstein 2001; Swyngedouw 2004).

Academics have devoted significant theoretical and empirical efforts to this process. Several new ontological categories related to cities emerged from their efforts. First were the concepts of ‘world cities’ (Hall 1966; Friedmann and Wolf 1982; Friedmann 1986) and ‘global cities’ (King 1990; Sassen 1991/2001; Abu Lughod 1999), the large urban centers that are leading the change and where most corporative power is concentrated. But since modern metropolises have become larger and more complex, often stretching over space as networks of several cities, there was a need to introduce the concept of global regions (Scott 1996, 2001), new spatial arrangements of neighboring cities often acting as a unit on the global scale. And over time it became evident there both global cities or regions were not special categories of urban places unlike any other, but just those that were going through a more complex stage of a process that was affecting every place on earth; thus for some authors it would be more adequate to talk about globalizing cities (Marcuse and van Kempen 2000; Scholz 2000; Short 2004). A long list of empirical studies has coupled these efforts discussing either how to approach the measurement and description of the emerging network of global cities (Beaverstock *et al*. 2000a, 2000b; Taylor *et al*. 2001), the hierarchical position of specific cities in the network (King 1990; Nijman 1996; Scholz 2001, 2003; Hofmeister 2002), or the transformations due to globalization and/or the stage of the process reached by specific cities (Sandercock 1998; Short and Kim 1999; Taylor 2000a; Krätke 2004).

The effects of globalization also required the attention of public administrations, as places were increasingly competing to attract capital investments, corporation headquarters and services, even major events (Brenner 1998; Short 2004). This led to a fundamental change in the approach of public planning, as local and national governments increasingly change old practices oriented towards assisting less favored areas in favor of initiatives to increase the competitiveness of their leading urban centers. In the current economic conditions, where mobility of capital and information are key factors, the ability to play a prominent role in the globalization process is of fundamental importance for the continued prosperity of cities and their surrounding regions (Ward 1998; Graham and Marvin 2001; Taylor 2003). Countries like the United Kingdom, France or the Netherlands have made a national priority to build or upgrade existing financial districts and urban infrastructure to make their top cities more competitive at the global scale (Brenner 1998, 2004b).

A new idea of the world is emerging. Places are becoming more and more interconnected, and their prosperity is closely linked to the capacity to develop and take advantage from good connections (Castells 1996/2000; Maskell 1999; Oinas 2002). In this new globalizing world some cities, and especially a few large and better-connected ones, are playing the key roles. And at the global level cities must no longer be considered as single administrative units, as most of the times they are large urban conurbations reaching out 60 miles, even 100 miles from their centers (Friedmann 1986; Sudjic 1992). The global metropolises are becoming a network of cities of contrasted sizes, and world itself a complex network of urban regions.

In this new emerging scenario, the roles of Texas and its urban regions are not clear. Even though the economy of Texas is one of the largest in the world, the role of its metropolises in the globalization process has been either of little relevance (if each metropolitan unit is taken individually) (Beaverstock *et al*. 1999; Taylor *et al*. 2001) or insufficiently studied (if they are approached as a single urban region).

This project deals with the role of the larger metropolitan areas of Texas in the ongoing process of globalization. Do Texan metropolises have any relevance in this ongoing global process ? And the triangular area containing the four large metropolitan areas in Texas – the area called the Texas Urban Triangle (TUT) – does it operate as a global unit or a set of geographically-close rival units, especially in those sectors considered by specialists as key in the globalization process? If the TUT operates as a global unit, the region as a whole must present a structural composition similar to other global units elsewhere. At the same time, and in order to be a functional unit, its major elements must have some type of specialization to both complement other elements and strengthen the whole.

The goal here is neither to celebrate the fetishist side of globalization and global cities, nor to pass judgment in processes that have winners and losers, but to explore to what extent Texas cities are participating, and unveil some part of their role.

1.2 Research objectives

This project has several objectives at three different scales:

1. at the global scale it aims to compare the TUT (and its major elements) with selected global units and investigate its relevance in terms of concentration of

corporation head offices, especially in key sectors in the ongoing process of economic globalization;

2. at the national scale it aims to compare the TUT (and its major elements) with the most relevant global cities and regions in the United States through the relevance of key economic variables, and to investigate if some of these areas show signs of economic specialization; and
3. at the regional scale it aims to investigate if the major elements of the TUT, and especially its four main metropolitan areas, are connected in a comparable way with international, national and state destinations, with connectedness measured by air linkages and passenger flows, and to test if there is a significant level of time-spatial convergence within the TUT.

Within this global city/global region theoretical framework, this project will explore which concept better suits the TUT. Is the TUT a global region or, alternatively, made up by several mid-ranked global cities?

If the TUT is constituted of a few global cities following the approaches of Sassen (1991/2001) or Abu-Lughod (1999), then each of them must perform comparable global functions, witness the same type of restructuring processes that are taking place elsewhere and have significant connections with major cities outside the TUT. If that is the case, sectors identified as most representative of the ongoing globalization process should have a substantial representation within each major component of the TUT.

If the TUT is better defined as a global region, it is necessary to address the same issues from a different perspective and answer two basic questions. First, does the TUT operate as a single functional unit, requiring both the specialization of and complementarity between its components? If the answer is yes, some specific sectors should be far more significant in some of the major components of the TUT than in the others, while serving the whole region (Batten 1995; Parr 2004). At the same time some degree of time-space convergence between the components of the TUT must be expected. And second, is the TUT as a whole developing the same processes and functions that are currently characteristic of other global urban regions such as those containing New York, Los Angeles or Chicago?

This discussion leads to a fundamental question – is there any evidence that the TUT is more than an abstract concept used to describe the distribution of urban population in Texas? In other words, does the TUT, at least in some key economic areas, shows clear signs of operating as a functional unit at both the national and global scales? If the answer is no, the largest Texan metropolitan areas must be considered as contenders in a still-unresolved competition for regional dominance. But if the answer is yes, the TUT should be considered as both a national megalopolis and a global region. The TUT then would be a new type of urban form – a networked molecular megalopolis – large but discontinuous, where most population and activities are concentrated in a few points located in border nodes, like the atoms of a molecule, and separated by relatively wide but little urbanized spaces. In this case, it would also provide additional empirical evidence that discontinuous urban forms, unlike the global cities and global regions traditionally discussed in literature, can successfully operate in a globalizing world economy without the need for a single dominant urban unit or a physically continuous urban form.

Along with addressing these broader questions, more specific objectives in this project are:

1. to investigate if the TUT plays a significant role at the global level, evidenced by significant involvement by large companies based in the TUT in the current globalization process;
2. to investigate if the relative importance of key economic sectors in the components of the TUT – individually and/or collectively – is comparable to those found in other global urban areas in the United States; and
3. to determine if there is evidence of specialization in the TUT components, especially in those activities identified as most relevant in the current process of globalization, as well as of time-space compression within the study area.

1.3 Study relevance

This project presents three innovative aspects. At the global level it will address economic globalization from a temporal point of view, by identifying major trends by economic sectors and headquarters cities over the last two decades. Secondly, it will be the first comprehensive piece of research addressing the TUT as a functional unit, looking primarily at relationships and complementarity between its components. And thirdly, it will expand the concept of global region to discontinuous spatial units that are defined primarily in functional terms rather than the traditional view requiring continuity of physical forms.

Demonstrating that the TUT operates as a functional unit in the current process of globalization also has important public implications, especially at the state level, since policies reinforcing complementarity between and specialization of metropolitan areas would more likely succeed in a context of global competition then policies to balance the weight of and promote convergence of intra-states rivals.

1.4 Structure of the dissertation

This dissertation is organized in nine chapters. The four initial chapters set the context. Chapter I provides a brief introduction to the topic, identifies the research objectives, and discusses the relevance of the project. Chapter II provides a review of the literature, including a broader discussion of key concepts including time-space compression, globalization and global cities and regions. Chapter III presents the study area, the Texas Urban Triangle (TUT), and describes recent transformations in its size, population and economy. Particular attention is given to changes that have occurred since the 1980s, especially in segments identified as key in the globalization process. Chapter IV explains the research methodology and the data used in the project, with special attention to forms to identify and/or measure centrality, competition and complementarity for major urban areas.

The following three chapters address research questions. Chapter V starts by identifying major stages and key economic sectors in the process of economic globalization, and then analyzes the location of corporation headquarters in Texas, the United States and the rest of the world, in order to address the role of both the TUT and its components. Chapter VI deals with recent changes in the composition of employment in the TUT and other major American metropolises and urban regions, and more specifically in economic segments considered as key in the process of globalization. Chapter VII analyzes the air connections of Texas gateways in the context of global, national and regional networks in order to compare their roles in different scales, and assess time-space compress within the TUT.

Finally, Chapter VIII presents a summary of the major theoretical, methodological and policy-related conclusions of this study, including a discussion on its limitations and future steps.

Five appendices are annexed at the end of the study. The first includes background data about Texas and the TUT. The following three appendices present information on the location of corporate headquarters, the relative significance of key economic segments, and air linkages for TUT cities and other comparable urban areas. The last includes the Visual Basic Application (VBA) used to address the topic of time-space convergence and data on airline linkages within the state of Texas.

CHAPTER II

LITERATURE REVIEW

The two elements the traveler first captures
in the big city are extra human architecture
and furious rhythm. Geometry and anguish.

Frederico García Lorca, Spanish poet

2.1 Introduction

The literature presented in this section is organized around a core concept: globalization, the ongoing process of convergence affecting all human societies, and especially its economic aspects. Within this background the focus is on three major topics. The first topic relates to world and global cities and regions, new categories having emerged from the analysis of globalization effects at different scales. The second deals with internal changes in urban economies, and especially in the composition of employment, as cities and regions take new roles in globalization processes. The third outlines the impacts of faster and non-ubiquitous forms of communication, namely air transportation, in the new relationships between urban areas taking advantage of time-space convergence and space fluidity.

These steps will further assist in discussing the role of Texas metropolises in the new global dynamics, identifying areas of convergence and/or divergence when they are compared to other metropolises, and finally verifying if the ongoing processes are supporting regional integration or increasing competition in the Texas Urban Triangle.

2.2 Theorizing globalization

One of the most popular buzzwords of the last two decades, globalization refers to a complex set of processes operating in contemporary human societies that have been analyzed in contrasted areas like pop culture, market economics and geopolitics (Featherstone 1990; Waters 1995; Cox 1997a; Rupert 2000; O'Loughlin *et al.* 2004). There is a general agreement that globalization processes are transforming contemporary human societies, but there is wide discord about the nature, reach and intensity of these processes.

What is globalization about?

Globalization can mean different things for different people, like most social constructs (Steger 2003). Most definitions in literature tend to be abstract and all-encompassing, a result of the need to include the multiplicity of processes and layers. For Roland Robertson (1992) globalization refers to both "the compression of the world and the intensification of consciousness of the world as a whole," while for David Held (1995) globalization denotes "the stretching and deepening of social relations and institutions across space and time."

In its current formulation the concept emerged in the 1960s, when media theorist Marshall McLuhan (1964) argued that the whole world was becoming one single unit, where everybody and everything were closer – a 'global village' – as a consequence of convergence provoked by new electronic communications. Since then the debate spread to other areas like politics, economy and social science, even being approached by some scholars as a potential emerging paradigm (Mittelman 2004).

There is plenty of empirical evidence brought to the debate. Some authors noted the convergence of political systems, as more countries have adopted forms of liberal or representative democracy (Potter *et al*. 1997), along with the implementation of a system of international governance formalized in international law, treaties, and supranational organizations (Keohane 1984; Ferro 1997). Other authors emphasized the magnitude of global economic integration, evidenced by the growing role of transnational corporations, already accounting for more than 20% of the world production, 11% of the world gross domestic product, and 70% of world trade (Perraton *et al*. 1997; UNCTAD 2002; Dicken 1998/2002; Porter 2005), and the growth of foreign exchange markets, whose daily turnover exceeds some sixty times the annual level of world exports (Held and McGrew 2001/2003). But others authors pointed out to the widening gap between rich and poor, both between and within countries (Beetham 1995; Cox 1997b; Birdsall 1998; Fainstein 2001; Drainville 2004). Like Janus, globalization has many faces.

The diversity of processes allows for much contrasted approaches. David Held and Anthony McGrew (2002), subdivided the globalization debate in three major blocs:

- the first group includes the so-called *hyperglobalists*, firm believers in market dynamics, which should be left operating without interference. Globalization is seen as a natural (and positive) step in the dynamic evolution of capitalism, characterized by a supra-territorial reorganization of the economy commanded by financial and corporate capital. Unable to control global markets, national governments have been weakening and welfare policies dismantled;

- in the second group are the *globalization skeptics*, who dispute the existence of a single global economy. They also argue that the current process of convergence is comparable to, if not more modest than, previous waves of globalization like the one of 1890-1914. Most evidence of globalization has been confined to OECD states, while in other parts of the world capitalism evolves through very different patterns. It is also argued that the post Cold War global system is better characterized by its fragmentation in blocs and the return of older forms of geo-politics and neo-imperialism; and
- the third group, the *transformationalists*, occupies an intermediary position by considering that the debate should be about the many aspects of power (economic but also political, military and cultural) since globalization is primarily related to processes of spatial re-organization and re-articulation. Globalization is multidimensional, its forms and effects differ in different parts of the world, different sectors and different social groups. It implies the shrinking of the world for some, but also a distancing in and disembedding of power relations for the majority. And even though globalization is not a new process, its current forms have several unique and fundamental attributes.

As John Rennie Short (2004) stated, the "most popular conceptions of globalization are that it is a new thing, it makes everywhere the same, and it is a bad thing. The only real consensus is on the lack of consensus."

Is globalization new or unique?

Roland Robertson (1992) identified three major streams in the globalization debate: 1) globalization has been a cyclical process over historic times, and currently we are going through another cycle of accelerated convergence; 2) globalization is the specific outcome of the historical development of capitalism and modernity; and 3) globalization is a recent phenomenon associated with new social changes. The first stream perceives globalization as the current phase of an historical process that had comparable episodes in the past; for the last two streams, it is a completely new phenomenon.

Some authors attempted to identify earlier rounds of globalization, even beyond historical times (Kristiansen 1993; Modelski 1999; Chew 2002). And there is plenty of documented evidence on previous waves during historic times (Hirst and Thompson 1996/1999; Osterhammel and Petersson 2003/2005). It is possible to claim that both the Greek and Roman expansions not just led to intercontinental trade, but also to the diffusion of international languages, an alphabet and a legal system (Moore and Lewis 1999). Several centuries later the Islamic expansion spread technological innovations in irrigated agriculture, and generalized the use of a more flexible numerical system (Hogendijk and Sabra 2003). The consequences of Chinese expansion through Central Asia led to the introduction of new fruits, ink and paper, and gunpowder in other continents (Mote 1999). And more recently, European colonial expansion provoked a global exchange of species, the generalization of sea trade, and the transference of new populations, languages and religions into 'new' continents (Exenberger 2004).

For some authors, what we are facing is not completely new, neither in scale nor in processes. The current expansion of capitalism and the relative freedom to transfer financial capitals are comparable in scope and nature to processes seen by the end of the nineteenth century (Frankel 2000; Ferguson 2005), which led to a 'first globalization debate' and the emergence of theories on Imperialism. And arguments on the impact of new electronic communications are very similar to those made by authors like R.D. McKenzie (1927) when writing about the telegraph, and especially the telephone and radio (Meyer 2003).

But some fundamental aspects are completely new. Growing empirical evidence suggests that the current wave of globalization can only be traced back to the end of the Cold War and the emergence of stable regimes in other parts of the world, especially in Latin America, East Europe, and the Far East (Brummer 1977/1999). The new neoliberal order has spread beyond global trade and the diffusion of a dominant culture, accompanied by political systems inspired in western models and the integration of national states in a supra-national global structure promoting that order. For John Agnew (2001) the entire fabric of global economic institutions, such as the International Monetary Fund (IMF), World Bank, and World Trade Organization (WTO), exists only to realize the ideals and practices sponsored by US governments since the late 1940s. In other words, some processes are specific to this historical context.

Authors like Marshall McLuhan (1964) and Manuel Castells (1993, 1996/2000) have stressed the uniqueness of the current phase. They emphasized the role of new technologies, especially electronic information flows, in the emergence and reconfiguration of activities and relations that operate at contrasting scales, either interregional or intercontinental. The notions of territory and place are being reconstructed under contemporary globalization within conditions that are entirely new and unique (Castells 1996/2000; Dicken 1998/2002).

Beyond this dialectical debate between supporters of cyclical (deterministic) and situational (exceptionalist) approaches, some scholars consider that globalization became no more than a superficial and imprecise term of limited use (Strange 1995). Skeptics argue that many ‘global’ processes could more adequately be defined as ‘international’ or ‘regional,’ or related to ‘triadization,’ the ongoing consolidation of three major economic blocks – North America, Europe and East Asia (Ruigrok and Tulder 1995; Hirst and Thompson 1996/1999). Accordingly, globalization is just an ideological construct, a myth created to advance the global expansion of neoliberal goals (Gordon 1988; Hoogvelt 1997). For some critics there is more hype than meat in what has been said about globalization, and most analysis can be compared to what congresswoman Clare Booth Luce coined as ‘globaloney’ in 1943 when referring to the global thinking of then Vice President Henry A. Wallace (Favel 2001; Feigenbaum 2002): a synonym of fanciful claims about real or imaginary events at the global scale.

Broad explanations of economic globalization

Taking the standpoint that contemporary globalization is a distinct phenomenon of modern economies, leading researchers attempted to situate economic globalization in major theoretical frameworks. The most relevant are presented below, following a basic structure proposed by Octavio Ianni (1996).

The internal dialectics of capital. – The idea of western capitalism spreading all over the world and emerging as the dominant economic system can be traced to 19th century writings such as the *Capital* of Karl Marx and the *General Economic History* of Max Weber (Ianni 1996). Dialectic thinking emphasizes processes, flows and relations between elements of contrasted nature, often leading to systems and structures operating in contradictory ways; the notions of space and time are embedded in these elements (Harvey 1996). The resulting conflicts are both sources of internal instability and a drive for evolution and transformation.

The nature of capitalism implies widespread competition, and the larger flexibility of general capital, linked to industrial development, gives it precedence over other productive forces. Contradictions between general capital and less dynamic forms of capital (national-, local- or sector-based), have been solved through the absorption of the former into the latter, and their reinvestment in more profitable activities. The weakening of older or less-efficient productive processes facilitates this absorption (Ianni 1996). In this sense, globalization is both a product of and a condition for the expansion of more dynamic forms of capital. The elimination of barriers protecting national financial markets is leading to the emergence of a truly global financial market.

Among the outcomes of this process is the strategic change in the role of central planning. On the one hand it has been weakened within the public sector (especially in national economies) by deregulation and privatization; but on the other hand has been reinforced within large corporations (and especially financial corporations), as a tool to organize productive processes. For larger economic conglomerates, centralized planning becomes a major technique to materialize additional economic potential (Munkirs 1985; Schutz 1995; Parto 2005). Research and development done within public institutions, especially in science and technology, have being increasingly associated with private funding, and thus integrated in the general capital.

Rationalizing the globe. – The work of Max Weber (1914/1978) suggests that capitalism created a process of increasing rationalization, and many human activities have been developed around criteria of time and/or profit efficiency. Capitalism expansion only brought this approach to new arenas, changing the operation of social processes, and spreading western rationalism through the globe. "In Weber, the globalization force of capitalism was translated into a theory of global rationalization… The de-mystification of the world will make everything in principle subject to rational calculation" (Turner 1990: 353).

For Weber rational law is the culmination of the process of capitalist development as a civilizing process (Weber 1914/1978). Technostructures are systems expressing instrumental rationality. The creation and use of law to codify actions, responsibilities and procedures carries out a significant part of the process of rationalizing relationships and organizations. The same rationale can be applied to economic transactions, financial markets, large corporations, even international organizations (Bottomore 1985).

The ultimate paradox is that this path towards higher quality through rationality, so often linked to the theoretical origins of capitalism, has been increasingly replaced by a pursuit of higher quantity through rationality (Ianni 1996). At first glance, this trend to replace quality by quantity seems a theoretical contradiction between the original simplicity of early capitalism writings and the increasing consumerism linked to globalization. Daniel Bell (1989) disagreed by arguing that the early capitalism rooted in Protestant ethics has been romanticized, since the need to increase consumption was present from the very beginning of the development of the system. By accepting his view, capitalist accumulation is an advanced form of rationalism.

The economy as world system. – The idea of a single global economy was already embedded in the concepts of "world economy" of Fernand Braudel (1966/1984, 1985) and "world system" of Immanuel Wallerstein (1974, 1979, 1984). Both approached the historic evolution of capitalism by trying to identify the dominant processes guiding its global expansion. Their arguments were grounded on political economy, with economics being recognized as the ultimate driving force behind change in human societies.

In this sense human history can be described as a succession of globally-organized economic systems, all characterized by three fundamental elements – a geographic space (territory), a dominant center (or pole), and a (networked) hierarchical organization (the developed core commanding less-developed peripheries). The most recent of these systems, often referred as world empires, has been linked to the raise and expansion of western capitalism (Hugill 1993; Chase-Dunn and Grimes 1995). The world economy is perceived as an evolving single market, composed of national units gravitating around a pole, the dominant economy at each point in time. It is a systemic theory of the world, and especially of international relations, since it implies the progressive weakening of nation-states caused by unfavorable positions within a larger system. Both Wallerstein and Braudel discussed the relevance of technological change and financial integration to increase the international division of labor, along with the emergence of large transnational corporations (Camilleri and Falk 1992).

Wallerstein (1992) tried to identify the roots of hegemony, and especially the contemporary world dominance of the United States, by trying to isolate unique circumstances favoring its emergence as new hegemonic power. In this sense, his work carries a deterministic element, as the history of capitalism was assumed as a succession of cycles where the world economy was reorganized at a higher level from an emerging new core. But little attention was devoted to the nature of transitional periods.

Octavio Ianni (1994a) connected the work of Samir Amin (1976, 1992) on the dependency theory and Andre Gunder Frank (1980, 1989) on uneven development with the approaches of Braudel and Wallerstein. Their interpretations of the global society were still based in economic analyses where the nation-sate was the primary (and relatively homogeneous) unit. Even though the focus was no longer on the succession of world systems, both Amin and Frank explained the different economic performance of nation-states based on unequal relationships between countries, and their degree of (economic) sovereignty or dependency. The theoretical foundation was the role of the relative position, either in the core or the periphery of the global economy.

Finance taking over the world. – The internationalization of financial activities started in the aftermath of the World War II, and intensified after the Cold War. Some authors relate much of the industrialization occurring in Third World countries to strategic investments made by western financial groups to counter the expansion of communism during the Cold War (McQuade 1977), and even argue that a similar motivation could explain the current flow of foreign investment into China (Smith 1993).

The internationalization of financial operations proceeded along with the internationalization of productive processes (Hardt and Negri 2000). With the expansion of a new international division of labor, based on the higher flexibility of the processes of production, transnational corporations have become the real agents of change. Their expansion beyond national boundaries, along with the increasing ease to move capital, made them capable of progressively eliminating barriers inherent to national economies (Perroux 1968; Barnet and Muller 1974; Frankel 2000). This trend has been reinforced by deregulation, privatization of public operations, liberalization of markets, trade regulations negotiated within international bodies and free trade zones (Lipietz 1983). The increase of international transactions has been a key element in the formation of a new type of global capital, more flexible and more developed, dominated by the financial component (Porter 2005). Over time, as this global capital expands across international boundaries, its financial operations increasingly escape to the control of national governments.

New international social hierarchies are emerging, while local labor and markets are being more and more fragmented. The real power is no longer political, but moved to the offices of large corporations (Sweezy 1994). A few authors even went to suggest that the new ubiquity of capital, apparent in global of financial transactions, would ultimately lead to the end of geography (O'Brien 1992). Actually, to maximize accumulation global capital needs to generate and explore spatial inequalities to its best advantage. The emerging new world has been fragmented into a myriad of spaces for local production and consumption, while operating as a single unit for the organization of production and trading, strategically planning by transnational corporations (Hardt and Negri 2000).

A world made of interdependent subsystems. – The world can also be analyzed through the general systems theory, if considered as a single complex system made up of many types of elements, like nations, public institutions, corporations, organizations, and ethnic and social groups.

The current global system would be the result of the evolution of preceding systems and of its component subsystems. This systemic approach emphasizes both the functional synchronism and the articulation between components (Huggett 1980). Within this global system, each subsystem has levels of autonomy and/or subordination of its own. Traditionally, the political and the economic subsystems are considered as the most relevant, both organized around a dominant unit surrounded by secondary elements that can be dependent, subordinated or alienated (Modelski 1987). Each secondary element of a subsystem has its own strategic roles and goals, and success is directly conditioned by the interests and strength of the dominant unit. The interaction between elements of the system takes commonly the form of movements across borders, like the movements of capital, goods, information, or even people.

The notions of sovereignty and hegemony are fundamental to understand the role of each unit within the system. They can explain the way each element accesses and/or controls fundamental resources (like raw materials, sources of capital, and financial markets) and uses competitive advantages in the production of valued goods (Bagwell and Staiger 2002; Keohane 2003). In many ways this concept of global system uses the nation state as the elementary unit, often challenged by private corporations.

Diplomatic relations and international law play a major coordinating role, and international organizations operate like service agencies (Claude 1988). As globalization proceeds, international relations and its outcomes are increasingly negotiated and formalized. Developed states will rely on international organizations to pursue their interests in more predictable conditions, while developing countries will expect formalized protection, assistance and cooperation. The growing number and diversification of agencies like the WTO, the IMF and the World Bank, along regular high-level meetings like the G8 summits and the Davos World Economic Forum (WEF), are steps furthering economic globalization (Neilson 2003).

Globalization through communications. – Global economic convergence has also been approached from the theory of communications, and especially through the work of Marshall McLuhan (1964). In his concept of the 'global village' the whole world is evolving toward a single, integrated community, a consequence of all the possibilities materialized by new communications. People and places became closer in a process of time-space compression, and this proximity altered the nature of human relationships. Information, entertainment, and ideas are quickly produced, traded and consumed like mere goods (Rosenberg and White 1957/1964). McLuhan's construct was built up over a hidden deterministic assumption that change in social life is primarily brought in by technological advances, clearly implying a prevalence of scientific knowledge over social processes. To some extent, the idea of a ‘borderless world’ developed by Kenichi Ohmae (1990/2002) is comparable, as national units become irrelevant due to the increasing volume and complexity of global transactions (and institutions at the global scale).

McLuhan related globalization to the proliferation of new communications tools, allowing a permanent and immediate transmission of information. Ideas, values, or pieces, both real and imaginary, can be sent to any part of the world in no real time, and ultimately adopted globally; since the whole globe became the potential audience. A global culture of masses is emerging, resulting from both the global diffusion of local productions and global trends reaching every place (McLuhan and Powers 1989).

A fundamental role has been played by new electronic communication networks, and especially the Worldwide Web. Electronic media is becoming the intellectual source of information for global centers of power. Many corporations and organizations are already acting like the world is a global village, by planning, producing and promoting products and ideas for a global market. Individuals are increasingly perceived as consumers (of both material products and information) and less as citizens. The globalization of production favors the formation of broad teams of specialists, highly focused in relatively narrow topics, each one complementing the others. The global village is also a product of technocracies and technostructures (Ianni 1996).

With the constant and fast transmission of new content in virtual form it becomes increasingly difficult to separate what is real from what is imaginary (McLuhan *et al.* 1967/1997). Modern techniques for marketing and public relations are increasingly sophisticated and able to influence, maybe even control the public opinion. On this line, the constant production and dissemination of new trends and products is an efficient control tool (Adorno 1990; Lee 2002). Last but not least, English is becoming the language of the global village, in part due to its use in international organizations, cultural products, financial transactions and scientific meetings and publications, and is reinforced by the new electronic forms to disseminate information (Phillipson 1992).

Towards an information society. – According to the pioneering work of Daniel Bell, Alvin Toffler and Manuel Castells human societies are coming together like a large networked mesh made up of virtual linkages. The ‘information society’ (or post-industrial society) as described by Daniel Bell (1973, 1980) is the result of extending technical rationality into the economic, social and political domains; underneath his approach lies the assumption that technical rationality provides superior responses to actual problems. In other words, the new emerging society is increasingly directed and engineered by scientists (Beninger 1986). In the opinion of Yoneji Masuda (1983) the ongoing transition from an industrial society to an information society is provoking an entire social revolution: society can evolve toward a 'computopia', where individuals use new technologies to make superior choices, and leave behind an 'automated state', the society controlled by politicians.

These current processes were integrated in a grand narrative through the concept of the 'third wave' advanced by Alvin Toffler (1980), where human history is presented as a regular sequence of major innovation waves separated by long transitional periods. In his scheme the first wave corresponded to the development of agriculture, and the second to the Industrial Revolution initiated in the 18th century. Currently a third wave is gathering, one that is based on the mind; it can be called the information age, since it has been driven by information technology and social demands for greater freedom and individualization. Among the characteristics of the 'third wave' are the de-spatialization of work (to be performed anytime and anywhere,) the need for continual (re)education, the emergence of hyper-organizations to develop and market products, giant databases on customer transactions, and mass customization of products and services.

The concept of the 'network society,' first advanced by Peter F. Drucker (1995) and refined and expanded by Manuel Castells (1996/2000), incorporates the idea of a world where the old 'space of places' is being replaced with a new information-based 'space of flows.' According to Castells, this network society, one of the main characteristics of the new informational capitalism, results from the convergence of three historical processes: the information technology (IT) revolution, the restructuring of capitalism altering the roles of nations and transnational corporations, and the cultural social movements of the 1960s and 1970s. Even though the emerging social form is structured around networks that concentrate dominant functions, all this dynamism contrasts with the increasing isolation of human beings and local territories, which are being individualized, switched on or off of the main linkages, subcontracted, or even by-passed by the main processes.

Particularly relevant is the operational distinction between world economy (the economy of the whole world) and global economy (the economy of the sectors pushing globalization forward). In this sense the latter is just a small portion of the former, but being the most dynamic is leading the current global convergence (Castells 1996/2000). The importance of quickly accessing, exchanging and possessing information is what guarantees new opportunities, and faster and more efficient responses. Since the position of individuals and groups in the network is different, this will necessarily lead to increasing inequalities. Processes within the network society are generated in and controlled from a small number of large urban spaces. It is in these places, increasingly wealthy, diversified and cosmopolitan, that differences reach extremes – the very rich and the very poor. But it is also in such places that identity-based movements try to affirm experience over instrumentality, meaning over function, the value of life over the values in the networks, opening up new areas of conflict and reorganization (Castells 1983).

The increasingly complex relationships between actors and places led to the emergence of a 'materialized worldwide web' (Weinberger 2002; Sui 2004b). As new communications opportunities increase linkages between actors and places, the world itself is becoming like a giant web of links. This web is a place of enormous variety and hierarchy, as nodes (agents and places) are connected in different ways. For connections between low-order nodes it is often necessary to go up to higher-ranked nodes to explore their higher connectivity, and then down again, in a way explained by small world theory (Adamic 1999; Jiang and Claramunt 2004). The earth as a worldwide web is like a small world with a myriad of connections of different frequency and intensity; the key feature is not the amount of links, but the ease for each element to access the highest (and better linked) nodes in the system to increase its networking opportunities.

Advances in virtual connectivity are transforming the world in a 'bitsphere' (Mitchell 1995). As the human environment becomes increasingly mediated through electronic linkages, this new 'e-topia' is organized around networks from the nano to the global scales, where elements have distinct intelligence and communications capabilities. Networks at different scales will be linked up – the body net will be connected to the building net, this one to the community net, and then to the global net. Human experiences will be increasingly dependent on virtual gathering places (Mitchell 1994). All nets will make up the bitsphere, a densely interwoven system where a human bone will be connected to the *I-bahn* (the information highway).

A very complex globalization

Even though many authors have asserted the complexity of globalization, and acknowledged that it incorporates cultural, economic and political elements (Pacione 2001/2005; Short 2004), there has been a dominant tendency to approach it as a complex but unidirectional process, leading to comparable results in every place – globalization is the driving force building and unifying of the global village. One of the consequences of this assumption has been the equating of the current economic globalization to relatively broad generalizations: from a new cycle of capital expansion, to the Americanization of the globe, to the convergence of the world in a single place unified by communications, among many. It has something of all, but empirical evidence shows that the ongoing processes are far more complex, often contradictory, and include trends not seen before.

At a first glance, empirical data gives a dominant pattern of increasing inequalities at multiple scales:

- despite the assertion that globalization will increase convergence between more and less affluent nations, evidence just shows the existing gap increasing:
    - developed countries are getting an increasing share of the world GDP (Cumings 1999; Milanovic 2005b; BBC News 2007c);
    - in national economies, the ratio between highest and lowest salaries has been rising rapidly, as corporate benefits remain at the top (Krugman 2006);
- growing regional inequalities are also common within countries:
    - significant regional differences have emerged in both developed and developing countries (Milanovic 2005a);
    - regions in the European Union have been showing very contrasted dynamism (Heidenrich 1998);
    - in China, a dual dichotomy east-west and rural-urban is rapidly gaining shape (Lu and Wang 2002; Kanbur and Zhang 2005);
    - the wealthiest regions may even perceive the rest of their countries more as a burden than a complement, like Brazil to Sao Paulo (Friedmann 1995);
- a new social landscape is emerging, both in the developed and developing world, with new class types emerging, others being reinforced, and overall fewer mobility:
    - real salaries and purchasing power of US workers have been decreasing despite increases in worker productivity (Kelly 1998; Greenhouse and Leonhardt 2006);
    - a growing subclass of young NEETs (Not in Education, Employment or Training), who gave up attempting to enter the job market and ended supported by parents, has been growing in the U.K., Japan, and has also emerged in the U.S. (Zachary and Ortega 1993; Woods 2005);

  - in the Third World most of the effects of globalization benefit the existing elites (Hilsenrath 2002);
  - the proportion of informal workers in the developing world already reached about 40% of the workforce (UN-Habitat 2003).

This idea of growing gaps between haves and have-nots is real, but also extremely simplistic, and does not reflect a multiplicity of aspects that appeared with economic globalization. There are plenty of situations where traditional models are of limited use.

- Some basic economic concepts can not properly tackle even very basic data in the new economy; for instance:
  - in the developed world, the U.S. and the U.K. have been operating with large trade deficits, while Japan and Germany with large surpluses; in the developing world, India with a large deficit, and China a large surplus (The Economist 2006);
  - in the U.S. 70% of the GDP was used in consumption in 2005, a figure closer to those of Indonesia (67%), Mexico (69%), Romania (71%), Egypt (71%) and Kenya (75%), rather than to Ireland (45%), Russia (49%), Canada (56%), the Euro area and Japan (both 57%) (The Economist 2006);
- for the first time the leading economy of a globalization wave, now the United States, is increasingly dependent on foreign investment and reached a negative balance in international investments; the primary source of stability is also the primary source of instability; some examples:
  - for the first time the U.S. is paying more to foreign creditors than getting from foreign debtors (Whithouse 2006);
  - in 2002-2005 foreign investors bought about $1 trillion in treasury debt, and $0.7 trillion in mortgage backed securities connected to real estate (Whithouse 2006);
  - the U.S. net foreign indebtedness (the difference between assets owned by Americans abroad and assets owned by foreigners in the U.S). has been negative, and increased by 90% in the period 2000-2005, reaching a record $6.1 trillion (White House, 2007);

- the consequences of the opening of some Third World markets to foreign competition have been often disastrous, like in water and sewage (Budds and McGranahan 2003), and agriculture (Mosley and Suleiman 2007), sometimes with global companies withdrawing to safer niches or markets.

The traditional dualism between a (wealthy and exploiting) developed and a (poor and exploited) developing world is getting blurred, and in growing instances traditional patterns have being reversed. The following are a few examples:

- the area currently concentrating most economic attention (and investment) is a group of countries referred as the BRIC (Brazil, Russia, India and China) and the Middle East (Kirkland 2007); in 2004 direct foreign investment in companies reached $130 billion in the BRIC, $96 in the U.S., $17 in Mexico, and $8 in Japan (The Economist 2006);
- large companies from developing countries have been expanding aggressively in the First World, like:
    - Valedoriodoce, a Brazilian conglomerate, recently absorbed companies in Australia and Canada (BBC News 2006a, 2007a);
    - Tata Steel, from India, bided successfully for an Anglo-Dutch rival (BBC News 2007b);
    - in China, computer Lenovo corporation bought the IBM personal computer brand and car-maker Nanjing Motors acquired MG Rover from the U.K. (Schifferes 2007a);
- services until recently outsourced or offshored to the Third World have been reversely brought back to the First World:
    - HCL Technologies, one of India's biggest global IT services and product engineering companies, opened a call center Belfast, Northern Ireland in 2004 (EMSNow 2004);
    - Tata Consultancy Service Ltd. (TCS) and software giants like Infosys and Wipro are among the IT firms which are re-employing American workers, who had been laid off in the U.S., after retraining them in India (Jayan 2007).

With this diversity of trends and patterns, it was difficult to elaborate an encompassing theory of globalization. Some authors started looking for alternatives.

The case for multiple globalizations

The argument about the multiple dimensions of globalization has proceeded both in theoretical and empirical ways, and has been especially related to the work of researchers like Allen Scott (1988), Steven Graham and Simon Marvin (1996, 2001), and Peter Taylor (2000a, 2004b). Globalization is perceived more like a bundle of processes, not necessarily operating everywhere or affecting everybody, rather than a final end-state. Processes led by large transnational corporations and aided by neo-liberal state policies are just one of the most evident aspects, but are not the only ones – globalization is neither homogeneous nor inclusive.

On this side of the debate, the work of both skeptics and transformationalists can be organized around a major concept – glocalization - and in two major groups. Glocalization is a term related to the production of new scales within pre-existing spaces, the result of local articulations between global processes and local structures (Swyngedow 1997).

One approach deals with glocalization more like a bunch of processes, each with characteristics and dynamics of its own, which keep interacting in different forms with local groups in every place (Scott 1988; Taylor *et al.* 2004; Glückler 2007); consequently, glocalization is a source of diversity, characterized by the prominence of vertical processes affecting all groups in a place, proceeding at different paces from place to place, being heterogeneous, and having the major contrasts between places. The second approach considers glocalization as a selective set of processes, which involves primarily a few local sectors at the top (those with best resources,) which become highly interconnected worldwide, and leave the rest relatively unchanged; in this case, glocalization is a source of social differentiation, horizontal processes involving selected groups are dominant, it proceeds in comparable ways in most places, it is relatively homogeneous, and the major contrasts are found within each place (Smith 2005; Kantor 2007).

There are some fundamental differences between each approach. One is contextual, and lies on the scale used for explanatory purposes. But another relates to the nature of processes, in one case the consequence of differences in local economic dynamics, in the other of local social organization. In one case glocalization results in a mosaic of places, in the other to what Ricardo Petrella (1993) labeled as a new techno-apartheid.

Glocalization as a global mosaic. – Geographic scale can be considered as a product of spatialized social and economic processes, rather than as a pre-given category (Smith 1992). Consistent with this approach, some authors have argued that globalization processes are associated with the production of new scales within the political (Leitner 1996; MacLeod 2001), economic (Swyngedouw 1997; Brenner 2004b), and scientific spaces (Brockman 1995, Sui 2004a).

Development in particular places is more the result of a dialectic relationship between global and local forces (Pacione 2001/2005; Taylor 2004b) and could be much better expressed through the combined effects of two intertwined sets of vertical processes. The first one relates to re-localization or re-territorialization, whereby global influences interact with and are reshaped within local contexts; the second relates to de-localization or de-territorialization, as local elements are disseminated and integrated into larger global trends (Robertson 1995). The first set proceeds downward – what happens in each place is the local version of processes operating at larger scales. Examples are the menus of McDonald's restaurants offering local items in markets like China or India; another one is the creation of small virtual spaces within the World Wide Web where individuals find niches for personal interests, chat regularly, get local images and services, or use global technology for small business activities (Wellman 2002). The second set proceeds upward. It can be exemplified by the numerous imitations of locally succeeded models, like prettifying historic heritage, creating ethnic and fashion districts, or promoting multicultural festivals to increase the number of tourists and local patrons; in the same line it may include the global expansion of some initially local-oriented companies like Wal-Mart and Benetton, and the copying of well-succeeded local policies like the introduction of light-transit networks in many large cities (Kelly 2005).

According to Eric Swyngedouw (1997, 2004) real processes occur within a multiplicity of scales, from local all the way up to global. Scalar configurations, either as regulatory orders or as networks, result from socio-spatial dynamics. Human activities are constantly "re-scaled" as processes originated at one scale are shifted to other scales in ways that change social power geometries. The scales of economic flows and networks and of territorial governance go through a process of 'glocalization' when they are transferred to (re-scaled at) lower levels. Especially relevant are the reconfigurations of processes at the supra-national and sub-national scales, in the current context of weakening the nation-state.

The prominence of analyses at the global scale has marginalized socio-spatial struggles in which the reconfiguration of spatial scales is the key arena, often ignoring resistance to de-territorialization or re-territorialization processes (Swyngedouw 2004). Scale configurations, generally arenas of cooperation or competition, change along with shifts in power, both in terms of their interrelations with processes operating at other scales and their spatial extent.

Glocalization as local polarization. – The major idea behind this approach is the assumption that globalization is an incomplete set of processes, because it primarily involves modern economic sectors, large corporations and local elites; or, put in a friendlier way, is only global in the sense Castells (1996/2000) used to define the global economy as just the most dynamic, but relatively small, portion of the world economy. It is global because it reaches places all over the world, but it is not global because only involves some social groups, leaving aside a vast majority (Massey 1996; Veseth 2005). Following this line, it is necessary to explore two complementary sides of polarization: one that maximizes time-space compression between strategic players, and another that increases social polarization within the major centers (Kelly 1999; Capel 2003; Smith 2005).

The new digital economy is primarily an urban economy, a network where the key nodes are a few large urban centers (Scholz 2000; Scott 2001); or, to be more accurate, the cores of some centers provided with higher-quality infrastructural connections (Graham and Marvin 2001).

The new space of flows is also limited by physical barriers; people, food and material goods cannot be moved in the same way as information. But the new economy has been able to create "infrastructure networks that support distant linkages… [that] may actually provide tunnel effects which bring valued spaces and places 'together' whilst simultaneously pushing physically adjacent areas further apart" (Graham and Marvin 1996). These tunnel linkages operate primarily between logistic enclaves, forcing corporations to secure "economies of conjunction', the efficiencies resulting from seamlessly inter-connected premium network spaces (Rodrigue 1999; Graham and Marvin 2001). In this sense, these processes reach their more extreme proportions in the larger cities, which are the primary beneficiaries of expensive and up-to-date infrastructure like new financial enclaves and data centers (Obitsu and Nagae 1998; Graham and Smith 2001), security systems (Lyon 2002), and even boutique airports for business travelers (Flint 2007). Being a major node in the new optic fiber 'hard networks' maximizes linkages and guarantees the instant transmission of enormous amounts of information (Malecki 2002).

The space of flows could be compared to a thin roof built over the space of places, which is only touched through selected processes. For John Agnew (2001), some places are temporarily organized for consumption, some for production and some ignored – agent contemporary liberalism is selective; in one sense he compares the global economy to a new type of 'empire,' because it is a global structure of power; but "contemporary liberalism is all about stimulating consumption in already developed regions, with selected poorer regions largely servicing their manufacturing needs and others literally dropping back off the world-economic map."

One of the most understated processes of glocalization took place in the financial system after the breaking of the Bretton Woods agreement (Swyngedouw 1996). As sites of production and consumption have been located in different currency zones, a re-configuration of the patterns of uneven development has emerged as corporations take advantage of the fast and often significant exchange-rate fluctuations.

Globalization does not operate at every scale; in the largest urban regions it leads to a differentiation between globalized sectors at the top, which are similar and well-connected everywhere, and a variety of local groups that are not significantly affected and remain isolated from both economic globalization and from other places (Graham and Marvin 2001). In this case, glocalization is a locally-differentiated process. For Ash Amin (2002), actor networks of varying length and duration and the world of practices are the central components of a "topographical" understanding of globalization. Some local actors participate in horizontal networks at the global stage, while other actors are restricted by their connections to more limited local scales.

But there is also space for hope. New technologies can be used as a vehicle to surmount economic and social fragmentation at the local level, as exemplified by community television, electronic public spaces and virtual cities projects (Graham 1999). And in a more general sense, many geographic schools of thought (Sauer 1952; Hägerstrand 1953/1968; Agnew 1979) have showed through empirical evidence that the diffusion of innovations are biased and highly discriminatory in earlier stages, before reaching more widespread levels of adoption (but never homogeneity).

A city-based globalization

Some historical narratives dealing with economic processes at the world scale have equated some major periods with a leading city, the place where power, culture and innovation were concentrated at the time (Hoyt 1941; Mumford 1961; Braudel 1966/1984). Peter Hall (1966) work, by advancing the concept of world city, was a milestone in the field and focused the debate.

Directly or implicitly, cities have had a major role in every theoretical approach to globalization. Some theoretical approaches are based either on the primary role of technostructures, like the rational world aimed by Weber (Bottomore 1985), or created by technocracies, like the global village of McLuhan (Ianni 1996) and the information society of Bell and Castells (Beninger 1986). The large cities may not be directly expressed in some cases, but they are the only type of place that simultaneously concentrates the human resources, capital and infrastructure required to support and coordinate such technostructures. Other approaches, built around concepts of dialectical or interdependent relationships, acknowledge that urban based elements are either the dominant or more relevant elements; that is the case of the general capital absorbing local capital (Ianni 1996), the developed core controlling the resources of a large periphery advanced by Braudel and Wallerstein (Camilleri and Falk 1992), the expanding financial capital breaking away from the control of national governments (Porter 2005), or the relevance of the political and economic subsystems in a world of interdependent units (Modelski 1987).

Cities have been ‘rediscovered’ as the powerhouses of the globalized economy; contemporary urban life is founded on the heterogeneity of economic, social, cultural and institutional assets (Amin and Graham 1997).

The biggest challenge to relate globalization and urban research has arguably been the availability of comparable data sets – empirical data to support theoretical proposals. There is plenty of data on city/region/nation attributes, but virtually none on inter-regional flows of capital and information. Some authors have been using network analysis to conceptualize cities and urban regions as nodes of networks of flows, developing measures based on centrality and structural equivalence between cities (Smith and Timberlake 2002). Other authors have tried to develop new data sets based on specific attributes, such as networks of offices of major firms in specialized service areas (Taylor *et al.* 2001; Taylor *et al.* 2002b). There is a wealth of comparative studies focusing on the concentration of corporate headquarters (Holloway and Wheeler 1991; Atkinson and Gottlieb 2001) and trends in the amount of office space consumed in larger urban areas (Sui and Wheeler 1993).

Two main directions for academic research have characterized the field of global urban areas. On the one hand, there are more theoretically-driven discussions addressing the fragmentation of the state (Scott and Storper 2003; Scholz 2000) and the role of new technologies, especially those related to telecommunications and information (Brooker-Gross 1980; Castells 1985, 1993; Graham and Marvin 1996; Graham 1999) in urban restructuring and the reshaping global hierarchies. On the other, alternative theoretical approaches to urban systems based on the location of activities and the structure of markets and supplying networks (Smith 1971/1981; Berry and Parr 1988) have given place to wider and more holistic approaches, incorporating various sectors and other types of explanatory variables, such as comparative advantages, competition and innovation (Nijkamp 1990; Mills and MacDonald 1992; Brotchie *et al*. 1995).

Empirical evidence, despite its fragmentation, reinforces the idea that urban areas, and especially the largest, have been commanding economic and demographic growth worldwide. Global metropolises are getting larger, growing faster, and concentrating large shares of their region's population and economy. The following are some examples:

- the population of global cities has been growing faster than their own countries, even in cases of little or no growth, like Japan, Russia and the U.K.:
    - the Tokyo region (Kanto) posted a positive growth rate of 2.6% in the inter-census period of 2000-2005, while the rest of Japan had a negative growth of -0.3% (Statistics Bureau, Management and Coordination Agency of Japan, quoted in van der Heyden 2007);
    - the Moscow region (city and oblast) was estimated to have a positive growth rate of 0.2% in the period 2002-2005, in contrast to the negative rate of -0.6% in the rest of Russia (State Committee of the Russian Federation on Statistics, quoted in van der Heyden 2007);
    - London plus the eight Thames basin surrounding counties were estimated to post a positive growth rate of 2.4%, significantly higher than the positive rate of 1.6% for the rest of the country (Office for National Statistics of the UK, quoted in van der Heyden 2007;)
- the Shanghai Stock Exchange, created in 1990, is already comparable to Hong Kong's in stock market capitalization; recently, its market index tripled in just the 12 months following April, 2006; the Shanghai region (the city and two adjoining provinces), accounts for 30% of China's foreign exports and attracts 25% of all foreign investment into the country, while the region's GDP alone is $450 billion, equivalent to half the size of the economy of India (Schifferes 2007b, 2007c); in year 2000, New York's GDP was $829 billion, and London's $239 billion (Koolhaas *et al*. 2001; since figures are in current dollars, they are not directly comparable);
- Dubai has been one of the fastest growing cities in the world; in 2004, its economy grew by almost 17%, four times faster than that of the U.S. and twice as fast as China's (Hennessy 2005);

- in Texas, the seven counties with largest aggregate personal income (Bexar, Collin, Dallas, Denton, Harris, Tarrant and Travis) accounted for 3% of the state area in 2003-2004, but also for 49% of the population, 53% of the property value, 58% of personal income, and 68% of wages, and these proportions have been increasing over time (DMN 2006).

According to Richard Florida (2006): "…the global economy takes shape around perhaps 20 Mega[citie]s… These regions are home to just 10 percent of total world population, 660 million people, but produce half of all economic activity, two thirds of world-class scientific activity and three quarters of global innovations." In other words, the 'space of flows' cannot be understood without reference to the 'space of places' to which it connects (Zook 2003).

Some unanswered questions

There have been endless debates about what globalization is about. The term has been used to describe recent events at the global scale, to explain some new and widespread processes, to elaborate on the possibilities of new technologies, even to envision what the future will be about. So much has been written that the term is almost meaningless. And consequently, it generated more questions than answers. The following are representative of some of the most polemic issues.

The obvious first question has to be what globalization is and what it is not. It has been easy to explain many new situations as an expression of globalization. If it is a set of processes led by new technologies, as posted by Castells, it should be more related to innovation and dissemination of information technologies (IT) than with transnational corporation power. In this sense it becomes difficult to argue why the operation of some sectors, for instance accounting and law, have been affected more deeply by IT than the movie industry, engineering or higher education. But the IT approach has an intrinsic contradiction, because high tech, due to its nature, has to be associated with a few selected locations and technological leadership than with global convergence (perhaps its ultimate goal, but not its actual practice). Is global the right scale to deal with globalization?

A second question relates to the boundaries of the topic and the nature of data. Most studies have focused on a few issues, generally linked to wealthier sectors of the economy, and dealing with official data. But there is growing evidence that the size of invisible economic flows is too large to be ignored; to what extent do the informal economy, illegal labor markets, or money laundering play a part in globalization? And some difficult-to-measure subjects – like the expanding networks of Gujarati or Cantonese low-cost stores, or rings of prostitution or arms-dealing – should these now be classified now as global processes? It becomes tempting to ask the reverse question: considering the dimensions of the entity, what actually is *not* globalization?

There has been significant literature linking globalization with the spread of western capitalism, the elimination of borders and the opening of markets. But are there in the world any more open (to foreign corporations) and globalized (first through colonization, now through debt) economies than those in Africa? In this case, it is obvious that global trade has led to many things, but not to prosperity. How deeply and honestly have past experiences been analyzed, and how much is simply rhetoric?

On the same line it is possible to ask which fair terms of global competition and market freedom are. Third world countries cannot subsidize their fledgling industries because that would be considered a distorting subsidy, but in the developed world large public participation in research and development is accepted. Actually, would the IT revolution have been possible without very sizeable direct and indirect subsidies? If public distortions (either by subsidies or by political pressure) are removed from the idea of globalization, is there much left? Are we moving towards a global village or a constellation of global ghettos?

Last but not least, is the idea of globalization and market efficiency really sound? This may seem an absurd question, but if IT expands to all sectors of the economy, making them capital intensive and more efficient, what would happen to the millions of workers liberated of (or expelled from) their traditional activities? And would that be compatible with the economic dogma that economic growth is not possible without population growth?

2.3 World cities, global cities and global regions

Globalization has renewed interest in the location and role of cities in the international system (Alderson and Beckfield 2004), as people is becoming increasingly aware of the relationship between the fate of cities and their relative position (and connections) in international flows of investment and trade.

This interest has led to the creation of new ontological constructs addressing the role of cities and their relationships in the context of an increasingly integrated global economy. Early attempts to identify some relationships between the cities within a geographical area can be traced back to Jefferson (1939), who advanced the concept of primate city to relate to single and dominant urban centers concentrating most of the power and resources of its country. He also found a mathematical relationship between the size of the three largest cities in several countries, where the population of the second and third largest amounted to about 1/3 and 1/5 of the population of the largest city.

Following research on the topic moved from the identification of mathematical relationships in comparing city sizes, generally through their population, to identifying regularities in the distribution of urban centers across space.

The rank-size rule, the central place theory and other urban systems

The first systematic attempt to identify some order in the relationships between cities was proposed by Zipf (1949/1969). A comparative analysis of the population size of cities within national states led him to develop the rank-size rule – if cities are placed in a descending order based on their population, the size of the place of rank *n* would be about 1/*n* of the size of the largest city. Empirical studies have provided evidence that in many countries and regions, especially those with more isolated economies, city sizes are relatively consistent with this rule (Stewart 1958, Browning and Gibbs 1961).

Following the regularity of city sizes it was found that urban settlements were also regularly spaced. A comprehensive theory, better known as the central place theory, was developed by Walter Christaller (1933/1966) and then confirmed through his empirical studies in southern Germany. It assumed the existence of a general hierarchy, where for each central place of a higher order there was a fixed number of directly dependent central places of the next lower order. The theory also proposed the expected population of places in each category, their connections, and the hexagonal shape and the size of their market areas. Interestingly enough, the theory was conceived addressing the form, but most of its applications focused on functions.

One of the flaws in Christaller’s theoretical model related to the absence of lower level centers along routes connecting major centers, an assumption contradicted by most empirical evidence. This problem was solved by Lösch (1939/1954) also in Germany, by incorporating elements of von Thünen’s theory of agricultural location, Weber’s theory of industrial location and transportation principles into the central place theory. By rotating the original hexagonal market areas deducted by Christaller, Lösch could establish a hierarchy of transport lines irradiating from any central city.

One of the shortcomings of Christaller's and Lösch's work is the relatively static nature of their constructs, since they did not provide any explanation about how some centers emerged as dominant, or which processes could lead to changes in the order over time. Further empirical work by Pred (1976) and Berry and Parr (1988) found that major interdependences were self-reinforced and tended to persist over time, but change was still possible.

Berry and Parr (1988) also proposed three alternative ways for change to occur: choices made in the initial establishment of a place (leading to chains of top-down or bottom-up effects); changes in the way specific functions are supplied, such as those related to new efficiencies and technological innovations; and structural changes in the number of levels or the number of centers at a specific level. Hall (1999) has argued that the two bottom-levels of the Christaller hierarchy are tending to disappear in contemporary economic conditions, a situation also linked to the development of major highways and the growing importance of air connections.

The term 'urban system' has been historically associated in geography to the classification of sets of urban centers in some hierarchical framework. The most common approach is to use criteria based on one or several economic functions generally provided by cities to other cities or to their hinterland. Cities function as interdependent nodes, and their fortunes reflect each one's position within larger systems, and change as the structures of those systems evolve over time (Bourne 1974, Berry 1976, Pred 1977). Each metropolitan area competes with each other to enlarge its zone of influence and expand the set of functions it performs (Bourne *et al.* 1984, Brotchie *et al.* 1995, Geyer and Kontuly 1996). At the same time, rural areas become essential for the urban systems associated with them, as larger metropolitan areas function as gateways between their hinterland and the world economy (Claval 1993/1998, Bourne 2002).

Some attempts have been made to link the central place theory to a General System Theory. In a study of the hierarchy of American cities since 1790, Alan Pred (1977) found that initial advantages tend to remain over time, especially due the primary role of access to specialized information. Berry and Parr (1988) acknowledged that even if central place systems tend to persist, they remain a part of an even larger system, one with many other subsystems and more complex aspects not incorporated in the central place constructs.

Urban systems at the global scale

The concept of world cities was first advanced by Anthony Geddes (1915) to refer to the few urban places that concentrated a disproportionate portion of the world's business activities. This idea was further elaborated by Peter Hall (1966), who attempted to make list of the places qualifying for such definition. The essentially descriptive nature of the concept remained unaltered for several decades, until it was related to work done on globalization and world systems analysis.

A general theory of urban systems applied to the global scale was first advanced by John Friedmann (1972), where urban regions were considered as unique, spatially organized entities. The processes of global economic integration, generally designated by globalization, also emphasized the diminishing relevance of national boundaries over history (de Vries 1984) and, consequently, the increasing relevance of the global scale.

A later work by Manuel Castells and Peter Hall (1994) stressed the fundamental role that new technology complexes were having in reshaping the new industrial regions across the world.

World cities and global cities

A new interest on the characteristics of major metropolises started in the early 1980s in the context of globalization. A major article by John Friedman and Goetz Wolff (1982) focused on the emergence of a few selected cities as points for the concentration of global capital, the new emerging hierarchy of primary cities, and the consequences of reorganization as the global urban cities bypass national borders. The article was followed four years later by a formalized ‘world city hypothesis’ (Friedmann 1986), where he stressed the importance of the new international division of labor to explain the new urban functions of major cities, their control role in the flows of global capital, and their structural changes.

In that period other authors analyzed specific aspects of world cities such as peripheral urbanization (Walton 1982), the peripheralization of labor (Ross and Trachte 1983), reorganization of city cores (Sassen 1984), and specialization within a world system (Rodriguez and Feagin 1986).

Research on world cities got a major stimulus with the publication of several important books. In *The Informational City*, Manuel Castells (1989) suggested that the current globalization process is creating a space of flows that is revamping traditional political and economic powers. Anthony King (1990), while analyzing the case of London in his *Global Cities*, showed that former capitals of large colonial empires were still at the leading edge of the globalization process. And Saskia Sassen (1991/2001) in her *The Global City* stressed the role of creating control capacities as a key to success in the new world economy.

Over time, a clear distinction arose between the concepts of ‘world city’ and ‘global city,’ frequently used as interchangeable. The former relates to cities that were or are major centers of political and economic power, the cosmopolitan centers of potent states (Hall 1966; Braudel 1984,) while the latter relates to the dynamic centers where the current processes of globalization of capital and information are taking place (Abu-Lughod 1999; Short and Kim 1999; Poon 2003). As acutely argued by Jan Nijman (1996), Miami could be considered as a global city, but it could never qualify for world city status.

The distinction was necessary due to some limitations of the world city hypothesis, where the emphasis is on local attributes and existing state boundaries rather than on processes, networks and external flows. It is implicit in the notion of global city that the focus is on relative conditions and dynamics: the location of specific processes and links with other cities and the hinterland. But there are problems with the global city approach; some authors have pointed out that most studies have tended to overlook vertical connections, especially within nations and regions (Bourne 2002), internal factors of urban economic development (Logan and Swanstrom 1990), and the role of peripheral areas such as Africa and the Middle East (Simon 1995).

An interesting aspect of research on global cities (or, more appropriately, global regions) is the little attention given to the reinforcing links between these cities and their hinterlands. This fact is surprising since all the highest-ranked global cities – New York, Tokyo, London, and Paris – are the major business centers of the large capitalist economies, a clear indication that size of the hinterland matters. And similar relationships can be found both in regions of the semi-periphery and periphery, and at other levels of the hierarchy, which suggests that there is a clear relationship between the size of each regional market and the hierarchical position of its global city.

The main elements of the global city model

Several core elements were identified in the emerging global city model (Sassen 1991/2001). The more relevant ones follow:

- the spatial dispersion of activities, bolstered by the creation of large business conglomerates and the increasing role of subcontracting operations, is a key factor supporting the relevance of central corporate functions to coordinate a wide array of functions at multiple locations;
- firms involved in the provision of complex specialized services in global markets are subject to agglomeration economies, since in the largest centers they can better access a larger and more diverse pool of clients;

- the increasing complexity of central functions has led global firms to outsource highly specialized services such as accounting, finance, law, public relations, advertising, marketing, programming and telecommunications; and
- outsourcing has been freeing corporate headquarters from some agglomeration economies, allowing firms to more freely choose locations away from financial districts, as well as to physically separate their units.

At the same time, several additional elements have been gaining recognition (Sassen *idem*):

- firms providing specialized services for global corporations increasingly need a global network of offices or affiliates;
- the increasing role of high-profit service firms in selected locations, and their reliance on top level professionals, has led to the growth of social and economic inequalities within and between cities; and
- the reallocation of portions of production and distribution to the informal economy is increasingly a strategy of survival under the current globalization conditions.

Many of the capabilities required in globalized economic activities are not hypermobile. In fact they are deeply embedded in specific places such as world cities, global urban regions, and exporting processing zones. A focus on the production, operation, coordination, and control of these capabilities, highly dependent on new information technologies, has shifted the emphasis of research on urban systems to the practices of economic globalization and global competition.

Global cities in the context of world systems

The idea of global cities can be integrated within the wider framework of world systems theory. This theory, developed from the 1970s by Immanuel Wallerstein (1974) and based on concepts of dependence and historical materialism, identified three major types of societies, each one characterized by modes of production of their own. The two most complex types, the pre-capitalist world empires and the capitalist world economies, operated at the world scale and consequently have been designated as world systems.

Wallerstein further argued that the density of links between world states could be used to establish a hierarchy of power, the most powerful countries being those benefiting from more and more diversified linkages. This concept of hierarchy was used to reclassify national states as core and peripheral states in a context of uneven development; an additional class, the semi-periphery, was later added to include areas going through deeper processes of economic restructuring (Wallerstein 1984).

Global cities could be considered as the gravity points in this system of world dominance (Geyer 2002), since the largest concentrations of economic, social, political and cultural networks are based on the primate urban centers of the richest and most developed countries. Within the context of the world systems theory it would be possible to differentiate cities belonging to the global ‘core,’ ‘semi-periphery’ and ‘periphery,’ each with different functions in the global system.

The global city/urban region could be considered as part of a new set of concepts created to deal with the current phase of capitalist expansion. But it is not the first time in history that urban systems were used to characterize new and broader levels of organization within societies – the city-states of classical Greece, the Hanseatic League, the coastal centers of western colonial empires, and the new metropolises of the industrial revolution are just a few examples. Giovanni Arrighi (1994) emphasized this recurrence of some organizational patterns over time, corresponding to larger cycles in the economy and the reorganization of capital, and stressing that each phase shows a higher level of complexity and a wider scope.

The decreasing relevance of nation-states

A significant contribution has been recently made by Peter Taylor (2000b, 2001b) emphasizing the decreasing relevance of national boundaries, and the trend of the old mosaic of nation-states being progressively replaced by a new network of urban centers, which has been redefined as a global space of flows. The relevance of trans-state processes and importance of monopolies in the current phase of capitalism accumulation is based on the notion advanced by Fernand Braudel (1966/1984) that capitalism is inherently anti-regulated markets. As capital searches for power configurations that enable a lesser dependence on markets and the achievement of higher profits in temporary monopolies, it can take advantage of the regionally-specific knowledge complexes characteristic of contemporary global cities (Taylor 2000b). In this context, the new urban hierarchy assumes that cities with different sized hinterworlds – the fluid (and overlapping) equivalent of hinterland in the new world of flows – provide different levels of services (Taylor 2001b).

Most of the work on global cities and regions has pointed to the weakening of national units and the progressive erosion of traditional territorial boundaries. Neil Brenner (1998) argued that most of these conclusions are the result of incorrect assumptions based on a zero-sum approach – if the global scale is being reinforced, it is at the cost of the national scale. Actually, from a Braudelian point of view, the persistence of the state (glocal states) is necessary for post-Fordist global capital as a guaranty of the persistence of economic disparities between regions that could be used for capital accumulation. Like cities and regions, national (and regional) states are also going through restructuring processes of their own, and in some aspects their traditional roles may have been reinforced.

Brenner (1998) also pointed out that several individual global cities and regions have been actively promoted by their own nation states as preferential nodes for the investment of transnational capital. The reinforcement of the centrality of places like London, Paris or the Dutch Randstad has been actively pursued through public policies (such as the creation of new business districts at Canary Wharf, La Défense and Schiphol). And the political support of the German government to the location of the European Central Bank in Frankfurt can also be better understood in this context.

Global regions

The earliest reference to an urbanized region with global relevance goes back to the comprehensive study made by Jean Gottman (1961) of the Northeast Coast American megalopolis. Gottman emphasized not just the form (a continuously urbanized area) but also its poly-nuclear nature (incorporating more than one large metropolitan area). Since then, other comparable regions have been identified in Japan, north-west Europe and along the Great Lakes (Gottman 1977/1999).

More recently, the intensified regionalization of production overlaid by a global division of labor has led to the argument, formulated by Allen J. Scott (1996), that the current reorganization of capitalism is both creating a global economic system as well as promoting its spatial disaggregation into a network of regional production complexes. In this perspective, globalization means a system of regions, not cities, where some regions are organized around a primate city and other regions may include several relevant cities of comparable size. Scott has also identified three broad economic sectors – high-technology manufacturing, fabrication of design-intensive consumer goods, and business and financial services – as most relevant in attracting other producers and creating regional super-clusters of industries and services. This trend toward super-clusters has been reinforced by economies of scale linked to higher-quality physical infrastructures and public services. This recomposition of urban areas, leading to multi-scale polycentric regions such as Los Angeles, Tokyo-Nagoya and Hong Kong-Guangdong has also been discussed by

Castells (1996/2000). Directly tied to the new international division of labor, globalization is not leading to the homogenization of urban spaces but rather to a deeper differentiation from region to region (Scott and Storper 2003).

Some unanswered questions

Plenty of literature has been produced on world and global cities over the last two decades, but a good number of fundamental issues still remain insufficiently researched and discussed. First and foremost, the difference between 'world city' and 'global city' (or 'international city') requires further clarification and empirical verification. If most of the rosters of global and world cities that have been advanced are similar, it is possible to argue that there is no need for two categories.

A second important issue relates to the nature of power. While there is some agreement in considering global cities as places from where the global economy is controlled, the actors and processes directly related to such control need to be better examined. In her global city hypothesis Saskia Sassen locates the heart of such control in the 'command' functions provided by advanced transnational services. But it is also logical to argue that the most important decisions are still made by corporate boards and executive managers, the ones that decide (among many other issues) which advanced service providers to hire and which services are going to be asked and/or pursued. It remains to be empirically proven if it is the availability of advanced services in selected cities that brings transnational corporation activity to such cities, or conversely if it is the existence of a larger pool of potential clients in the largest and most accessible cities of advanced economies that encourages services companies to open offices there. The fact that Wal-Mart, in 2004 the company with the largest sales volume in the world (Fortune 2005b) is still based in Bentonville, Arkansas, relying on an accountancy firm from Rogers, AR, a registrar and transfer agent from Providence, RI, and a bank from Dallas, TX (Wal-Mart 2007) is a good illustration that large transnational corporations do not need to be located in top global services centers, nor rely on their advanced service providers. Similar arguments could be made about the relocation of the Bank of America from San Francisco to Charlotte, and of Exxon Mobil from New York to Dallas.

Another important issue relates to the sectors considered as markers of global cities. These sectors were identified through theoretical arguments, and especially in Sassen's global city hypothesis. But so far, their presence in a finalized list was neither justified empirically nor their relative importance demonstrated empirically. Some research showed that the linkages of London-based accounting firms are especially relevant with cities in the British Commonwealth but much less significant with places in other countries (Taylor *et al.* 2004), making it possible to argue that the role of accounting firms may have been overstated. As well, some analyses of the international financial sector in Mexico City and Santiago of Chile (Parnreiter 2002; Parnreiter *et al.* 2004) found a very significant presence of Spanish banks that are both among the largest in the world and have been recently expanding in Latin America through acquisitions. But in most empirical studies such banks are ignored, and smaller ones based in the United Kingdom, Germany or Switzerland taken as more relevant. In fact, the way lists of advanced service providers used in empirical studies were elaborated, why some segments were considered relevant, and which and how many companies of each made the final list are major issues insufficiently explained. Much of this work has been done by British researchers using a disproportionate number of British companies and, conversely, a small number of companies based outside the Anglo-Saxon and German worlds. Some empirical research done using other lists (Short *et al.* 1996; Short 2004) has shown that the role of places like Paris, Amsterdam and Madrid are far more relevant than generally has been assumed.

A fourth question relates to the relevance of links within companies. There is a wealth of empirical work based on the location of offices of major companies that assumes the presence of a company as sufficient evidence of significant inter-office linkages, generally treated as horizontal and symmetrical. It remains to be demonstrated that the nature of the flows between a head office located, for example in New York, and two second-level field offices in Singapore and Milan is horizontal and symmetrical, as well as the existence of relevant flows between Singapore and Milan. Corporations have a hierarchical organization that has been insufficiently accounted in global city research; many linkages are very likely more vertical and asymmetrical than horizontal, and the existence of nodes within a corporation can not be taken as guarantee of significant linkages.

2.4 Analyzing and comparing cities in the new economy

Four broader empirical lines of research have been pursued to identify urban typologies in the context of economic globalization. The first follows the identification by Saskia Sassen (1984; 1991/2001; 1994/2006) of advanced business services as the most significant marker of urban specialization; the second is directly linked to the work of Manuel Castells (1989, 1996/2000, 2002) on the informational city and network society and has focused primarily on internet connectivity or high-tech activities; the third tried to achieve more comprehensive analyses by using data sets representing all economic sectors (Short *et al.* 1996; Alderson and Beckfield 2004); and the fourth, accepting globalization as a complex, heterogeneous and ongoing set of processes, focuses on the relevance of the roles played by different cities (Markuse and van Kempen 2000; Krätke 2004).

Advanced global services over the world

Most of the empirical work on the first line of research has been done in Britain, under the umbrella of the GaWC (Globalization and World Cities Study Group and Network), an international team of researchers centered at the department of geography of Loughborough University, U.K., and led by Peter J. Taylor and Jonathan V. Beaverstock (GaWC 2006).

The GaWC has been collecting data on the office location of international advanced services corporations (Accounting, Advertising, Banking, Insurance, Law, and Management Consulting Media). Global corporations were empirically defined as those having a minimum of 15 offices, and at least one in North America, one in Europe and one in the Asia-Pacific region. The offices of each company were then classified from 1 (headquarter) to 5 (local office) according to their spatial reach, range of activities, and pattern of reporting. With this data it was possible to create a comprehensive matrix of corporations by cities; cell values were either zero (no office of the corporation *x* in city *y*) or between 1 and 5 (office relevance). This matrix could be further used to calculate overall global connectivity indexes for sets of cities.

In 1999 Jonathan V. Beaverstock and fellow researchers, working with GaWC data, came up with a "roster" of world cities, in which 55 places were allocated to three categories (Beaverstock *et al.* 1999). Several American cities were classified: New York, Los Angeles and Chicago were in the top category (Alpha world cities); San Francisco was a Beta world city; and at the third level, Dallas and Houston were, like Atlanta, Boston, Miami, Minneapolis and Washington, considered as Gamma world cities. More recently Peter J. Taylor and Robert E. Lang (2005) applied a similar methodology to an expanded matrix and identified four vertical strata, from I at the top and to IV at the bottom. New York was the sole city in Stratum I, followed by Chicago and Los Angeles in Stratum II; San Francisco, Miami, Atlanta and Washington made up Stratum III, while both Dallas and Houston were in Stratum IV, with Boston and Seattle. This study also found that in general U.S. coastal cities had relatively higher global connectivity indexes than their non-coastal counterparts.

Over time the emphasis of world and global cities started switching from single measurements to studies of city typologies with the aim of producing overall measures of hierarchy. Peter J. Taylor and fellow researchers (Taylor *et al.* 2002a), used GaWC data on potential types of linkages (vertical and horizontal) between office cities to assess "power through the network", and proposed a city classification with eight classes, with the possibility of overlap (cities with multiple roles, thus belonging to several categories). In a summarized way, American metropolises were classified as follows:

- San Francisco was both a *highly connected world center* due to the high number of office connections, and an *international financial center* due to its high overall office connectivity in banking and finance;
- Atlanta, Boston, Detroit, Indianapolis, Miami, San Francisco and Washington as minor *dominant office centers* because of the proportion of headquarters and regional offices;
- Boston, Cleveland, Dallas, Minneapolis, Philadelphia, San Francisco and Washington as *global command centers* because of the concentration of international corporation headquarters;
- New York, Miami and Washington as *regional command centers* because of the high proportion of regional (continental) field offices;
- Atlanta and Miami as *major gateways* because of their concentration of offices without command functions;
- Houston as an *emerging center*, with a small number of offices and a still undefined typology (or one of its own); and
- New York, Chicago and Los Angeles, were *highly connected world centers, international financial centers*, *dominant office centers*, and *global command centers*.

Ben Derudder and Frank Wilcox (2004) applied a fuzzy cluster analysis to a similar GaWC matrix and identified 22 groups of "urban arenas" with comparable linkages, which they classified from A (highest connectivity) to V (lowest connectivity). New York was allocated to cluster A, Chicago to cluster C; Dallas was in cluster F (average connectivity of 0.401 out of 1), along with Atlanta, Boston and Washington; Miami was in cluster J; Houston was found in cluster O (average connectivity of 0.193 out of 1), with other 27 American cities (including places like Philadelphia, Denver and Hartford).

In another relevant work Peter J. Taylor and fellow researchers (2002b) applied a principal component analysis to GaWC data to propose another world city typology. They placed both Dallas and Houston in a component called as "inner-wannabes," made up of secondary cities in western economies; both Texan cities also had similar loadings, but Dallas' loading became increasingly relevant as additional components were considered.

These studies have been criticized as lacking a firm theoretical basis from a network-analytical perspective, as the composition of samples remains arbitrary, internal attributes are used as a proxy (and as a rough estimate) for structural values, and full and multidirectional intra-firm linkages are assumed (Short *et al.* 1996; Nordlund 2004). The likeness of world cities within the same category is far from proven (Slater 2004).

The leading role of new technologies

Empirical work under the second line has been far less copious. In part this was the result of work being pursued by dispersed independent researchers lacking a comprehensive centralized data base, but this disadvantage has also contributed to more variety.

Mitchell L. Moss and Anthony M. Townsend (2000) analyzed the capacity of internet backbone networks of American cities to identify urban hierarchies and recent temporal trends. Their analysis showed the progressive emergence of a set of six cities – Washington, Dallas, San Francisco, Chicago, Atlanta and New York – clearly at the top of the hierarchy. When compared to hierarchies based on advanced services, these new layers of backbone nodes showed one major difference – the accepted triad of top American global cities was not dominant. The interconnections between San Francisco, Dallas and the duo Washington-New York were also of much lesser relevance than some intra-regional links, showing the emergence of three regional clusters of different size – New York was the top linkage from Chicago and Washington (and Washington the top linkage from Atlanta), San Francisco was the top linkage from Los Angeles and Salt Lake City, and Dallas was the top linkage from Houston.

A similar study of international linkages was published by Anthony M. Townsend the following year (2001a) and brought different findings. In this case New York was, and by far, the city with the largest backbone capacity, about four times larger than the next two cities (Washington and San Francisco). A few peripheral cities, in particular Seattle, Miami and Los

Angeles, benefited from their location, being more relevant gateways than larger nodes situated inland, like Dallas, Chicago and Atlanta. In short, while central locations had a major advantage for domestic connectivity, they were at a disadvantage for international linkages.

Townsend expanded his analysis in another article (2001b) were he used three variables – backbone capacity, number of domains registered locally, and registered domains per capita – to identify both new network cities and information blackholes. He also arranged new network cities in hierarchical tiers, topped by San Francisco and Washington in Tier 1, and with Dallas, Atlanta, Houston, Boston and Seattle in Tier 2.

When applying the same methodology to an updated dataset for the period 1997-2000 Edward J. Malecki (2002) confirmed most of the findings by Moss and Townsend, but also found that relative changes in the ranking of the six major U.S. nodes were quite frequent – by year 2000 New York and Chicago had moved to the top of the rankings. He also found that a group of smaller cities, including Austin and San Antonio, had become very successful in attracting the collocation industry (facilitation of alternative internet linkages, which is independent from public access points and traditional telecommunication patterns).

More recently Karen Chapple and colleagues (Chapple *et al.* 2004) developed a definition of high-tech activities and proceeded to rank cities based on their relevance in local employment. At the top of the hierarchy they found seven metropolitan areas –five out of the six cities singled by Moss and Townsend in 2000 (all but Atlanta), plus Boston and Philadelphia. They also identified a set of smaller but highly attractive locations for high-tech specialization which included Austin, and to a lesser extent San Antonio.

Other empirical work has tried to use alternative types of surrogate measures including analyses of foreign banks representation (Moss 1987), frequency and type of business news in major papers (Taylor 1997), the relevance of skilled international labor (Beaverstock 1994, 1996), and global air links (Smith and Timberlake 1995, 2001).

The limitations of this second approach are similar to those raised in the previous section. If globalization, per definition, involves the whole world economy, the use of some more dynamic economic segments as proxies for global trends and/or data flows between spatial units is not acceptable. At most this approach can identify the degree of penetration of new technologies through space and time, but the quick adoption and dissemination of key innovations does not ensure economic command.

Searching for more comprehensive methods

The third line of empirical research is a consequence of the impossible agreement on which segments and types of processes have been more representative of economic globalization, which ones have been the most dynamic and innovative, and which ones have been forced to react to external and stronger trends.

The first comprehensive approaches, based more on theoretical discussions than empirical datasets, introduced the concept of world city (Hall 1966; Braudel 1966/1984). The idea was novel and encompassing at the time, but could only assist in identifying cities at the top, the most cosmopolitan and powerful at the world scale. There was little room for other and more wide-ranging typologies.

In a work that quickly became the point of reference for world city empirical research, John Friedmann (1986) advanced a classification of cities, where Houston, Miami, San Francisco and Toronto were considered as secondary North American centers within the world city core, immediately below a top group made up by New York, Los Angeles and Chicago. His results were synthesized in a map, but the original data and his methodology were not presented. Later he argued that his original purpose, more than proposing a new world hierarchy, was to advance a new research agenda, and with the map and associated table he simply intended to initiate a debate (Friedmann 2001).

The difficulty to find comprehensive (and representative) data sets led John R. Short and colleagues (1996) to choose a new approach – if there was not one single overreaching variable, why not deal with a variety of them? They elaborated different city rankings (and in some cases showed temporal variations) based on the head office location of largest banks, major stock exchanges measured by trade volume and listed companies, head offices of the top 50 foreign banks operating in the U.S., headquarters of Fortune's Top 500 corporations, international passengers in larger airports, and even the location of global events (like the Olympics and Rolling Stones concerts). They did not attempt to create a single consolidated measure, but their analysis showed hierarchies were far more complex; they also found that Tokyo and Paris were more relevant than assumed in previous studies, and a slowly growing presence of Dallas at the middle or bottom of some lists.

The city GDP, perhaps the most comprehensive single variable to be found, was used by Rémy Prud'homme (1996a, 1996b) to compare large urban areas. He also proposed the complementary idea of labor superproductivity, measured as the difference between the city productivity (the ratio between value added outside agriculture and labor outside agriculture) and the overall productivity. As expected he found major mismatches between urban size and economic productivity, both between cities in developed and developing countries, but also between cities in advanced economies – in these the largest cities consistently showed higher superproductivity. Unfortunately Prud'homme only examined the top 10 cities by GDP, which included five American cities (New York, Los Angeles, Chicago, San Francisco and Boston), and his work had no continuity.

Arthur S. Alderson and Jason Beckfield (2004) used an earlier discussion on linkage relevance and relative position in social networks (Freeman 1979) to propose four types of centrality (outdegree, closeness, betweenness, indegree). They used the 500 largest corporations (of any industry) identified by Fortune magazine in 2000, and analyzed the location of their headquarters and subsidiary offices. Their conclusions found Dallas and Houston with similar scores for closeness (reflecting the average number of links to all other cities) and indegree (reflecting the number of ties received from other cities); but Dallas scored much better for outdegree (reflecting the number of ties sent by each city) and betweenness (reflecting the nodal role linking pairs of other cities).

Empirical work under this third line has faced the same criticisms of the previous two. It is debatable to what extent each dataset is just a surrogate of a more complex reality, and to what extent is representative of the full economy, of key segments, or the main processes in the ongoing economic globalization. Allocation to hierarchical groups or typologies had to be made in very general terms, primarily measuring one or a few surrogate variables, often expressed by vague indexes of limited use beyond the rankings they were made for, key assumptions have been asserted but not empirically confirmed, and priority was given to rank-building over identifying and explaining key processes.

Multiple and different roles

Once New York, Tokyo and London were identified as the cities at the top of the hierarchy (Friedmann and Wolff 1982,) it did not take long to use the degree of similarity each other city had with this trio as a measure of its relevance in the processes of globalization; cities higher in the hierarchy were expected to be more alike (Marcotullio 2003). At one point Saskia Sassen considered that "any city representing a post-industrial economy would surely be like the leading sectors of New York, London, and increasingly Tokyo" (1991/2001: 9).

Against this type of reductionism some authors have been presenting three parallel types of arguments: firstly, since globalization is an ongoing set of processes there are no cities 100% globalized but globalizing cities all over the world, each one at a distinct stage; secondly, if globalization is considered as the combination of multiple and different processes, with some degree of interdependence but also with specific dynamics their own, the role of each city would depend on its economic composition and connections; and thirdly, once a city becomes a “global city”, what would its future role be since economic processes will not stop?

The first argument was developed by Peter Marcuse and Ronald van Kempen (2000). Globalization is not a status but a continuum, a process that has been (and will be) affecting all cities in the world and not just the cities at the top of some hierarchy. This is consistent with the proposal made by Stefan Krätke (2004) to replace the construct of “global” cities and regions by the more flexible of “globalizing” cities and regions. Research in Third World cities like that of Hans-Georg Hofmeister (2002) and Christof Parnreiter (2002) on Mexico City, and Fred Scholz on Dhaka (2001) and Karachi (2003) has proved that globalizing process have been deeply transforming the physical and socio-economic structures of urban areas of developing countries.

Using a principal component analysis they could identify six main components, each articulated from one or two major cities, and having more relevance in a few world regions (further details are presented in Chapter IV). Leaving aside considerations about the composition of the dataset, focusing on pre-selected industries and dominated by British companies, and their potential impact on the results, three major conclusions must be emphasized. First, there are some forms of specialization in every component related to regional, scale, and even historical factors. Second, each component was articulated from a different area of the traditional core, but also having different relevance in peripheral areas. And third, the roles and relevance of major cities do not overlap; actually they clearly show specialization in very specific activities.

More recently Eric Slater (2004) reminded that, even in the highly interconnected world of financial markets, the major global cities occupy a distinct niche, as New York is the primary equities market, London the major center of currency exchange, and Tokyo the leader in international banking.

These findings challenge assumptions on the homogeneity of global capital, its pattern of expansion, and simple typologies on the role of global cities. But they are also consistent with statements made early by John Friedmann (1986) on expected differences as a consequence of the "specific ways… urban regions are becoming integrated with the global system of economic relations".

And as Manuel Castells (2002) later stated:

> … The global city… is a network of financial spaces when the global city is defined in terms of financial networks. It is a network of the advertising or media industry when it is defined in those terms. It is a network of high-tech spaces – along with Silicon Valley, Helsinki and Munich – when defined in those terms. So, there are many global cities. But the many global cities are not London, Zurich, New York and Frankfurt, etc. There are many different dimensions of globalization, of urban activities, which are connected functionally… (p. 554).

This leaves ample room to re-examine the role of Texas cities and the TUT from alternative perspectives.

Some unanswered questions

Comparing complex entities like contemporary cities can not be an easy task. Within a framework of multiple globalizations (and globalizing cities) the obvious problem is how to differentiate what is really comparable and what is not. It is apparent that factors that are extremely important in some places can have no significance elsewhere. Any answer forcibly entails some notion of relevance within a broad context, which requires wider theoretical constructions. In an emerging field of high variety and complexity, and especially with no clear foreseen direction, every empirical study carries a strong contextual component difficult to evaluate. How to identify what is relevant without falling in an exceptionalist trap?

One of the points where there is virtual agreement in globalization debates is the acceleration in the rate of change. New technologies and products are penetrating every field, and become obsolete in relatively little time. As change plays such a prominent role in the current processes, it is perplexing that so many contributions to the topic of city typologies/hierarchies are static analyses of one point in time. Is there any evidence that, in the contemporary dynamic environment characterized by continuous change, cities will retain the same roles and ranks? Why has the time component been so neglected over two decades of studies of global cities' economies?

A tremendous problem is the separation of new and old dynamics in urban economic processes. In spite of the difficulty of finding good data sets, it is fundamental to identify what relates to the continuation of older processes, the weight of pre-existing structures, and role of local factors. Certainly old and new elements are intertwined and often are difficult to separate; but in the hypothetical absence of these new technologies, changes would certainly occur that are related to historical processes. For instance, in a sector like banking how much is new and how much relates to evolving traditions? The easy answer is to identify the more dynamic sectors and then either deal with their entirety, or treat specific elements as examples of overall transformations. But what and how much in change is the consequence of new processes and technologies, and their internalization?

A fourth question relates to the choice of points of reference when performing comparisons. If New York, Tokyo, London and Paris were very much at the top of the world urban hierarchy before the IT, if the list of secondary global centers still contains the next largest cities of the developed economies, if advanced services had existed in larger urban centers for a long time, what new elements are behind the concept of global cities? It became a hot topic, like globalization, and lots of studies have used the concept to the point that is becoming synonymous of world cities (as defined by Hall), international cities, megacities, cosmopolitan cities, large metropolises. In a narrow sense, which elements of urban economies should be the basis for comparisons? And should this set of elements remain the same, or be more flexible considering that globalization processes are neither homogeneous nor linear? Without some answers, how is possible to explain the matching of old and new urban hierarchies, and where readjustments are occurring? Perhaps there is a need for more flexible and diverse global cities typologies.

2.5 Air transportation and time-space in geography

The last century witnessed the first powered air flight, but also the emergence of air transportation and its transformation into a huge industry which by 2006 was moving about 2.3 billion passengers (Flint 2007). Technological developments allowed planes to fly faster and farther, progressively replacing the train and the car for longer land distances, and the ship for transoceanic connections. Its effects in reduction travel time were selective and very significant.

Air transportation in geography

Initially with far fewer passengers and cargo than land and water alternatives, air transportation was for a long time a minor research area within Transportation Geography. The first articles dealing specifically with aviation were descriptive works about the achievements and potential of a new and fascinating vehicle, both for passengers (Light 1935) and merchandises (Pollog 1937). Technological developments and the major role of aviation during World War II, allied to the significant growth in commercial air transportation, increased the attention of transportation geographers; some descriptive overviews of both a new research field and expanding type of transportation (Renner 1942; Van Zandt 1944) were written at the time.

The quantitative revolution initiated in the 1950s moved the geographical focus to linkages and networks (Pearcy and Alexander 1951), along with some analyses of the industry growth (Sealy 1957/1966; Taaffe 1956, 1959). It was during this period that Edward Taaffe (1962) published his first work relating air passenger traffic to urban hierarchies, using a gravitational model inspired in previous work on bus transportation and the notions of interaction, hierarchy and dominance. Using a data set for the period 1940-1955 he mapped the commanding role of New York within the network, but also the emergence of a few regional sub-units around Chicago, California and Texas, and to a lesser extent Atlanta and the Pacific Northwest. In an earlier article (1959) he had dealt with airfare variation and mapped flight costs, and introduced the concept of traffic shadow to explain the disproportionate traffic share of the major center within a region.

There was also pioneering research on the relationship between air transportation and economic growth. For instance, Anthony Hoare (1974) discussed the economic growth generated by an international airport by studying the case of Heathrow within the growth pole framework, John G. Adams (1971) considered the consequences of the development of alternative airports within the same urban area, and Jan Brueckner (1985) tried to correlate airline traffic with elements of metropolitan economies.

Among other work produced until the 1970s were new types of cartographic representation (Boggs 1941; Warntz 1968), the characteristics of airport locations (Sealy 1967), physical constraints to transoceanic flights (Warntz 1961), historical works (Higham 1960; Kelly 1963), and the aesthetical impact of airports (Blake 1969).

The big changes of post-deregulation

The introduction of the Airline Deregulation Act of 1978 in the United States provoked a deep reorganization in the industry. The effects of this piece of legislation deeply analyzed within geography, with special focus on major airlines, low-cost airlines, competition in primary markets, and the development of niches for smaller companies (Bailey *et al*. 1985; Goetz and Sutton 1997, Goetz 2002); deregulation in other parts of the world was also examined, especially in East Asia, where some flag carriers subsisted (Bowen and Leinbach 1995; Bowen 2002). The effect of public decision has been important, as recently exemplified by the decreed merger of Air India and Indian Airlines, in order to create a large and more competitive carrier (Flint 2007).

One of the major consequences of deregulation was increasing relevance of airline hubs, which taking advantage of a locally dominant position could negotiate better gate rates, reorganize regional flights and have some control of prices and entrance to the hub. Some empirical studies analyzed the hub distribution across the country, their relationship with passenger traffic, and its transformations over time (Ivy 1993; Drezner and Drezner 2001); other authors dealt with air fares changes resulting from hub-and-spoke effects and cases of airline dominance (Borenstein 1989; Goetz 1994). Case studies were less frequent, and Atlanta (Song 2006) and Osaka (Matsumoto 2005) serve as illustration. More recently, Ben Derudder and colleagues (2007) published a comprehensive study of international hubs; among the findings was the presence of Dallas and Houston among the top ten hubs worldwide by passenger traffic, second in the U.S. only to Chicago and Atlanta; in the two Texas cities the proportion of transients varied between 38 and 35% of the overall traffic, significantly less than Atlanta (45%), but more then Chicago (31%).

Directly related to hub reinforcement were studies of hub network design in a context of maximizing efficiency. The team led by Morton O'Kelly at Ohio State University was especially productive on hub location theory and hub-and-spoke systems analysis (O'Kelly and Miller 1994; O'Kelly *et al*. 1996; O'Kelly 1998; Horner and O'Kelly 2001). Other work discussed network theory in policy contexts (Button and Stough 2000), developed specific software (Mayer and Wagner 2002), and analyzed hub design in an empirical context (Kuby and Gray 1993). In a more empirical direction, there were studies of U.S. (Shaw 1993) and European (Burghouwt *et al*. 2003) hub networks, on the effects of airline mergers on existing networks (Shaw and Ivy 1994), and on the competition between hub-and-spoke and point-to-point systems (Alderighi *et al*. 2005).

A second major consequence of deregulation was the multiplication and specialization of low-fare carriers. Among relevant topics were their effect on traffic density (Sorensen 1991), on fares (Vowles 2000), their expansion in Europe (De Groote 2005), and a discussion on the trends in the sector (Francis *et al*. 2006). Another relevant subject has been the emergence of strategic alliances between carriers (Debbage 1994) and their effects on hubs (Matthiessen 2004).

The tradition of studying spatial patterns diversified, dealing with regional coverage (Ward 1989), their relation with prices (Goetz 1994), the importance of regional and historical factors (Zook and Brunn 2005), and more recently the relevance of distance and positionality to explain the existence of well-connected ‘wormholes’ (Zook and Brunn 2006). The trend was similar in studies relating airline traffic and economic development, especially in the U.S. (Goetz 1992; O’Connor 1995), but also in Asia (Bowen 2000); a collateral and interesting development was the relationship between hubs and high-tech activities (Button *et al*. 1999).

A research area in expansion has been the analysis of competition within regions served by several airports. In such areas the combination of multiple factors, including fare differentials, time, efficiency, and personal convenience lead to different combinations of driving and flying, where a relatively distant airport (and airline) can appear as an attractive alternative (Pels *et al*. 2000; Fuelhart 2003). In regional markets, barriers to airline entrance are also a factor of increasing relevance (Pels *et al*. 2003; Fournier *et al*. 2005).

Among the most interesting recent subjects are studies linking air travel to health and security issues. The effects on demand of the September 11, 2001 attack (Lai and Whei-Li 2005), and the relationship between air networks and the spread of diseases (Grais *et al.* 2003a, 2003b) illustrate this wide and promising area. Good discussions on the limitations of airline data, from data omissions to excessive aggregation, were presented recently (Derudder and Wilcox 2005a, 2005b).

The balance of almost three decades of post-deregulation is controversial. The industry grew substantially, and offer more diversified products. But according to Andrew Goetz, one of the leading scholars in the field, the ‘[c]urrent problems in the US airline industry such as increasing industry consolidation, fortress hub dominance, predatory behavior, and high fare ‘pockets of pain’ have their roots in the flaws of the theories that supported airline deregulation in 1978. Contrary to pre-deregulation expectations, the industry is characterized by large economies of scale, large barriers to entry, and a lack of contestability in airline markets; mergers/acquisitions only make this worse” (Goetz 2002).

Air transportation and global hierarchies

In the 1990s discussions about the relationship between world-city hierarchies and air travel became relatively frequent, in part because some offer more easily available and comprehensive relational datasets from a global (Keeling 1995; Simon 1995) or continental (Kunzmann 1998) context. In a complementary direction Peter Rimmer (1998) used passenger and freight traffic to identify major centers, and examined changes in the volume of freight between pairs of major cities in the period 1984-1992.

In one of the most influential articles in this field, David Smith and Michael Timberlake (2001) analyzed world city hierarchies using a set of matrices of international air passenger traffic between 100 cities for the period 1977-1997. Network analysis software was used to extract measures of coherence (groupings of key elements) and especially equivalence, used to analyze changes in the rankings over the study period. Four cities consistently remained at the top of the hierarchy (London, New York, Paris and Frankfurt) and the most noticeable changes were the moving up of some East Asian cities like Seoul and Beijing, and the moving down of major South American centers.

Kevin O'Connor (2003) discussed the major factors reshaping the hierarchy of global air destinations. He identified as highly relevant changes in the demand (like the increasing importance of business travelers and charter operators,) improvements in aircraft technology allowing cutting costs and reaching more distant places, and post-deregulation trends like the creation of airline alliances. In his opinion most of these factors contributed to reinforce the role of cities at the top of the hierarchy, but congestion and high prices at the top may also benefit second layer cities in the future.

The availability and sophistication of new data has allowed a diversification of topics. By applying the concept of positionality, a construct related to power relations, their persistence and potential for change (Sheppard 2002), to a comprehensive set of hubs worldwide Matthew Zook and Stanley Brunn (2006) were able to demonstrate how the global air network benefits nodes situated in developed countries, and especially in Europe and North America, the primary beneficiaries of existing wormholes, and places in relative disadvantage peripheral nodes in Africa and Oceania. This bottom side of the hierarchies, the 'pockets of pain,' was also the focus of some studies (Goetz 2002; Lee and Yeoh 2004) both in the American and global contexts. The evolution of flight networks in the "Global South" has been showing growing intra-regional integration, especially in East Asia, but not in Africa or most of Latin America and Middle East (Taylor *et al*. 2006). The "pain" is going down for some, but remains high for many.

The most populous and affluent cities, offering a large market and substantial economies of agglomeration, were able to build the large airports required for high-capacity planes; they have emerged as the primary links in the air transportation network. No matter the methodology or the list, every major global city is currently served by a top international airport. In this sense, global cities are also global gateways (Short *et al*. 2000; Priemus and Zonneveld 2004).

By being able to serve distant places faster than any other type of transportation, air flights have contributed to 'shrink' our world, to make places closer than ever. With the current technologies it is possible to cover the 8,200 miles from New York to Hong Kong in about 17 hours without need for refueling in intermediary stops (Norris and Wagner 2005). More than any other technology, air transportation has maximized time-space compression along selected routes. But like every expensive technology, it is selective, and only the larger and more affluent urban markets can benefit most directly, and the myriad of places flown over are bypassed (Graham and Marvin 1996; 2001). In this sense, the routes of higher traffic or connected by faster planes also create tunnel effects, and can be compared to wormholes. As Douglas Eldridge and John Paul Jones (1991) argued more than a decade ago, distance decay (and time-space compression) is creating a warped world.

Time and space interaction

The nature of space and time and their relationship have been present in practically every theoretical debate within contemporary geography (Schaefer 1953; Bunge 1962; Johnston 1971/1997; Haggettt 2001). In traditional approaches, both were considered as independent variables, each one providing a different frame to position events and actors within a particular continuum, where to situate their relationships. The spatial-science paradigm that replaced descriptive human geography in the 1950s also kept time and space separated, while giving the latter most relevance.

Some attempts to build explanatory and especially predictive models in geography exposed the need of giving time a more prominent role, and even of integrating space and time (Janelle 1968). The idea of a time-space geography followed these analytical needs, and was directly expressed in efforts to anticipate diffusion processes through space and their impacts in landscapes, as well as in models attempting to simulate complex societal processes like land use sequences, migration behavior and the relationship between settlements and emerging transportation networks.

The idea was further advanced with the introduction of the concepts of time-space convergence and divergence by Donald Janelle (1968, 1969), as well as the work of Swedish geographer Torsten Hägerstrand in time geography, later translated into English (1953/1968, 1973, 1975). The work of Hägerstrand and his team at the University of Lund inspired the publication of several compilations of work in time-geography where he often was a major contributor (Chorley 1973; Carlstein *et al.* 1978; Buttimer 1983).

Over time new constructs followed. Especially relevant were the parallel concepts of time-space compression (Harvey 1989, 1990) and time-space distanciation (Giddens 1981, 1984), and the idea of human extensibility in time-space (Janelle 1973), incorporating elements of theories of structuration, critical science, and capitalism.

The field has been reinvigorated in the last decades, especially due to the emergence of Geographic Information Systems (GIS). New developments in dynamic cartography (DiBiase *et al*. 1992; Monmonier 1992; MacEachren and Kraak 1997) and the visualization of graphs and maps (Bertin 1967/1983; Kosslyn 1985; Langran 1992; Dykes 1997) allowed the embedding of a dynamic temporal component in mapping.

Absolute views of space and time

Space and time as two independent dimensions have their modern origin in the work of Immanuel Kant, a leading 18th century German philosopher. According to Kant nature can be approached in two alternative ways – logical, where elements are allocated to categories based on similar characteristics, and physical, where objects are related based on time or space relationships (Hartshorne 1939). His approach led to the traditional differentiation between history and geography, where the former is a narrative of phenomena happening through a time continuum and the latter is a primarily a description of phenomena closely located in a space continuum. Kantian views had been extremely influential, and had a major impact in the establishment of the traditional branches of knowledge in the 19th century (Capel 1981).

The persistence of a Kantian approach has been rooted in practical reasons, since it often becomes easier to deal separately with space and time to measure and bound phenomena (Janelle 2001) than having to deal with simultaneous changes in two major (and related) dimensions. Such approach frequently led to sets of descriptions of reduced significance, irrelevant if removed from the unique context for which were created. To overcome this type of problem, geographers attempted some alternative ways. In some cases places were analyzed in different points in time in order to identify major spatial changes that allow the establishing of trends of historic significance; in other cases time is subdivided based on pre-established criteria, and variations in selected phenomena then analyzed within each box. One example of the former is the approach taken by Christaller (1933/1966) to develop his central place theory. Examples of the latter are analyses based on census data (Ingram and Carroll 1981; Fuguitt 1985; Ma and Cui 1987; Gibson 1998), when changes can only be tracked over periods of 10 years due to the data collection schedule.

Mixed approaches are also common, like in the case of the model of demographic transition from pre-industrial to industrial societies (Becker *et al*. 1990; Kirk 1996; Galor and Weil 2000), where stages are not based on comparable time periods but on the relevance of some social changes or the diffusion of new technologies.

Early in the past century the concepts of absolute space and absolute time were challenged by developments in the relativity theory, which introduced the idea of a four-dimensional continuum of space-time (Mead 1932/2002). Material objects, actors or events simultaneously occupy positions both in time and in space, which change continually when they move. But even though the relativity theory was developed in the first quarter of the 20th century, only late in the same century did it start to influence geographical work.

The origins of time-spatial approaches

The idea of time-space geography can be linked to attempts to reformulate geography as a nomothetic science that paralleled the quantitative revolution of the 1950s and 1960s. If geography intended to have a practical social value it needed to develop a predictive perspective with a stronger theoretical content (Schaeffer 1953; Bunge 1962). This required abandoning the traditional focus on the description of unique traits of unique regions, and moving towards forecasting the future developments of spatial actions. The shift away from description and explanation led to a growing interest in identifying and understanding processes, especially in the areas of human spatial behavior, diffusion processes and regional economics.

Early discussions on diffusion processes and the role of barriers can be traced to the work of Carl Sauer (1952), but it was the innovative work of Torsten Hägerstrand (1953/1968) on innovation diffusion and the importance of simulation processes that initiated contemporary studies in time-space geography (Leigh 1954). Hägerstrand introduced the idea of a mean information field influencing the way information circulates through regional systems which include both physical features and individuals offering different degrees of resistance; ultimately information may be transformed in innovation and emerge onto an adoption surface (Haggett *et al*. 1977). Hägerstrand (1976) also proposed a model of time-geography of society where he tried to graphically represent people's movement and actions over a sequence of space and time locations, and used this method to identify cycles during a typical day or a lifetime.

The web model proposed by Hägerstrand was based on four basic propositions: 1) space and time are resources where individuals and groups have to represent their projects; 2) any project is framed by three types of constraints, related to the capability of individuals (capability constraints), their capacity of coupling with other individuals or objects (coupling constraints), and the conditions for accessing and acting within time-space domains (authority constraints); 3) constraints are interactive and define the potential boundaries for each project; and 4) competition between projects to open (or less-restricted) space-times is generally the central problem that should be analyzed (Hägerstrand 1973).

The work of Hägerstrand has been considered as an attempt to approach human geography as a form of human ecology equated to a methodical reconstruction of time-space events within a physical landscape, and more broadly as an effort of connecting it to contextual theory (Gregory 1981/2000). Contrary to the Kantian approach of considering time and space as external coordinates used to frame actions, Hägerstrand sees both as resources that must be drawn upon the conduct of social life. He contends that processes can not unfold without restraints, since they have to develop within a context of existing pressures and opportunities where space and time are embedded (Hägerstrand 1976). His research influenced later work based on structuration theory like Alan Pred's (1986, 1990) analysis of change in rural and urban societies in Sweden, and Nigel Thrift's (1983) study on the rationale for social action. Göran Hoppe and John Langton (1994) proposed a way to combine individuals, society and milieu in longer processes operating at larger scales in such a way that people's life could be summarized as a sequence of changes in livelihood positions.

The approaches of Hägerstrand and his followers had significant limitations to deal with diffusion processes, unable to explain how social processes can selectively give meaning to different types of information flows (Blaut 1977), the emergence, behavior and achievements of better informed actors (Buttimer 1976). These shortcomings, the reliance on stochastic processes and the treatment of space as a homogeneous Euclidean media led some authors to take more analytical approaches, a trend that was strengthened with the crisis of the positivist paradigm in the last quarter of the 20th century.

Janelle's work in time-space convergence and extensibility

A second key contribution to time-space geography was the work of Donald Janelle on time-space convergence, first presented in an article of *The Professional Geographer* (1968). Building on material from his PhD dissertation, and inspired by previous work by James Blaut (1961) on the nature of real-world structures, and P.W. Bridgman (1963/2002) on the relationships between locations, directions and velocities, Janelle argued that technological innovations, especially in transportation, were leading to a decreasing relevance of distance. The travel time required to move between specific places had been decreasing over time, and was exemplified by the shorter and shorter trips from Edinburgh to London thanks to improvements in stage-coach services, and then the introduction of railroads, automobiles and airplanes. The reduction in time-distance led Janelle to propose the concept of "time-space convergence," as places were getting closer, not in physical distance but in the time needed to overcome their distance.

Time-space convergence between two points could de defined as the average rate of decline over time in the time required to travel from one to another (Janelle 1968). It could be represented by a jagged convergence curve with major changes of direction in periods following the introduction of major transportation innovations. One of the most original elements in Janelle's work was his novel treatment of space. In his approach space is no longer the homogeneous Euclidean setting where movement occurs, but a plastic setting presenting discontinuous attrition to movement that could also vary over time. When functional measures are applied then places on earth are like points all in relative motion in regard to other points. Consequently space is equated to a permanent flux shaped by advances and regressions linked to changes or availability of technology (Forer 1978). In other words, space is no longer considered as a neutral framework but as an active component of movements and spatial processes.

Time-space convergence could be compared to velocity as defined in physics, like a constant flux of varying intensity. But it is an abstract concept, since it can only be perceived after defining a form of measurement. The natural counterpoint to the concept of time-space compression would be time-space divergence, the result of an increased attrition and longer times to overcome a distance (Janelle 2001). Examples of this situation are cases of traffic congestion, decaying infrastructure and suspension (or reduction) of services.

Time-space convergence (or divergence) has a social origin, as it is the result of innovation processes occurring within. It is part of a reciprocal process where on the one hand specific investments are a direct response to innovations reinforcing time-space compression, and on the other hand the existing spatial structure of a society affects new patterns of investment in order to support specific time-space convergence processes (Forer 1974).

One aspect that is particularly relevant to this dissertation is the recognition that variations in time-space convergence are also a product of the hierarchy of urban areas, since larger centers tend to take greater advantage of technological improvements than smaller centers (Janelle 1968;

Forer 1974,) and benefit from tunnel and wormhole effects. This is explained by differences in the levels of investment, since more expensive transportation and communication infrastructure is generally installed in major markets, and will only trickle down to smaller areas if costs decrease over time. As a direct consequence larger areas tend to converge more rapidly, while bypassed areas may diverge. Allan Pred (1973) widened the discussion by adding political and economic components as he showed how public information used by newspapers in the United States over a 50-year period was moving at contrasted speeds related to hierarchical relationships between urban centers. Over time time-space convergence may play a major role in the reorganization of urban systems, since good accessibility and up-to-date information and technology are basic advantages in the attraction of external investment and the creation of new economic opportunities.

The idea of cost-convergence was developed along with similar arguments applied to distance. The reduction of the friction of distance has been accompanied by a reduction of the corresponding costs (Abler 1971, 1991; Wolf 2002).

Further work by Janelle (1973) added the concept of human extensibility, an idea that relates with the capacity that individuals or groups have to extend their influence to distant locations. This concept was further elaborated by Adams (1995), and stresses inequalities faced by different media to overcome significant spatio-temporal barriers. Empirical examples can be provided, such as the ability of large corporations to manage vast networks of distant resources and subsidiaries, or the maintenance of family ties over long distances taking advantage of the mail, and later of the telephone and now the internet.

Important work on the parallel concept of time-space distanciation was done by Anthony Giddens (1984) in the context of structuration theory. Time-space distanciation deals with the relations with actors that are not physically present in time and/or space but, along with time-space routinization, contribute to the emergence of modes of regionalization that condition social life.

Harvey and the idea of time-space compression

Early research on time-space geography showed the relativity of relations across time-space, as different actors have different capacity to reach beyond their locations and interact with or influence actors and processes elsewhere. The difficulty to bound spaces and processes involving multiple interactions strengthened the need to deal with the social and dynamic nature of human processes. Work by David Harvey (1990,) inspired in political economy, led to the concept of time-space compression.

Time space compression relates to social processes that force people to change the way they represent their own world. Harvey (1990) advanced a persuasive rationale to justify attaching social content and an experimental meaning to actions based on the goal, inherent to capitalist societies, of maximizing the extraction of surplus per unit of time. Harvey's use of the word compression relates to the acceleration of events needed to increase the turnover of capital, constantly disrupting existent forms of social life, which ends by adding enormous amounts of stress to human lives. Even though the idea of annihilation of space through time share some elements with time–space convergence, its consequences are far more difficult to measure.

Harvey clearly added a political dimension, since the production (and benefit) of surplus in contemporary capitalism implies specific forms of political organization, class relations and class struggles. According to Harvey, the ascendancy of short-term global capital goals over local (or individual) agendas implies the shortening of time horizons and the ability to eliminate distance as a barrier to achieve a some types of exchanges, and ultimately to social and economic dominance. At first glance the idea of time-space compression may be related to the decreasing relevance of the local scale in contemporary societies, explained by the ability of capital to easily move resources from place to place with no regard for the consequences at the local scale. But this process is dialectic since global capital is able to eliminate local barriers (compressing space) while creating and taking advantage of other local differences (distanciating space) to generate better conditions to increase the extraction of surpluses. With this constant acceleration and shift of processes it becomes more and more difficult to grasp the time-space dimensions of modern societies.

Daniel Bell (1978) used a similar rationale to discuss the compression of an 'aesthetic distance' associated with cultural formations in a society, as cultural information is also disseminated and replaced over shorter periods of time due to new transportation systems within the context of modernism. The increase in immediacy and instability leads to crises of representation which Harvey related to basal crises of capital accumulation and to new rounds of compression generated by the dynamics of flexible accumulation (Gregory 1994).

Several major criticisms of Harvey's approach have been made over the last decade (Gregory 1981/2000). First, it seems simplistic to link time-space compression to the logic of flexible accumulation under modern capitalism since the concept is equally valid to explain the emergence of forms of colonialism and imperialism (O'Tuathail 1996, 2000; Sparke 2003; Raley 2004). Second, processes of time-space compression have different intensity for different social groups, leading to what Doreen Massey (1993) called a power-geometry of time-space compression (Massey 1999; Morley 2000; Mawhinney 2004). Third, technological advances also lead to changes in social relations, an aspect underestimated by Harvey, especially in issues like the occupation of ‘lived space’ by ‘abstract’ forms of space and the importance of interpersonal contacts in the varying success of compression processes (Thrift 1997; Amin 2002). And finally, in the concept of time-space compression the former is treated as a passive element.

Some unanswered questions

Time-space compression is an area that requires more empirical work. Most debates have been on its positive side, compressing space by reducing and consequently bringing distant places together. But the more sophisticated is the technology contributing to this convergence, fewer and more selective are the wormholes and tunnel effects. Distant and smaller places tend to be bypassed, and in some cases even affected by processes of time-space expansion, especially when old transportation technologies can not remain competitive and local services to isolated services are eliminated. Thus, to what extent does time-space compression reinforce existing urban hierarchies and increases the gap between the top and the bottom?

Most theoretical and empirical work has been concentrated in major links, those where new technologies are affordable. But time-space compression is not ubiquitous. Consequently, what are the effects of concepts like relational proximity (e.g. Amin 1999) and positionality (e.g. Zook and Brunn 2006). How selective, and which factors are more relevant to explain spatial differences in time-space compression and expansion?

Empirical evidence shows that even in e-commerce most of the business is local (Graham 2004), which means that, at least to certain extent, cities retained a hinterland, partially intra-urban. Taking in consideration the new elements resulting of new technologies, what form are contemporary hinterlands taking, and which are the main factors affecting their shape? What are the new hinterlands of a large business center, or a major air gateway? How far can they reach?

ICT has a major force behind the reorganization of parcel transportation. Companies like DHL, FedEx, UPS and USPS are able to deliver products in very short periods of time, and to do so create their own networks of air and land connections. Is the operation of parcel transportation comparable to passenger airlines? How are their hubs organized, what is the interface between air and land stages, and what are the economic impacts in their hubs?

The majority of studies of airline networks and related time-space compression have dealt with counting and measuring (time, distance, and flows) of linkages, approaches that do not provide any information about the nature of the linkage. Most empirical research on global cities has been focused on aggregate measures of 'globality', convergence, or comparability between cities, by assuming that relationships (frequently of unknown type) exist. The identification of hierarchies implies some degree of convergence, at least within the same level; even though the position of each city results from the aggregation of both horizontal and vertical flows, these are seldom identified. In this context, and accepting that cities are globalizing at different paces and ways and have preferential linkages of their own, aggregate measures are a simplification of little use. Considering the types of relationships between city pairs, which are less frequent or express some degree of specialization, which are asymmetrical and denote some degree of hierarchy, which are direct or proceed through hubs? Perhaps taking the concept of hinterworlds of Peter Taylor (2001b) to another level, by replacing aggregate intensity of linkages by type and intensity we will be able to have a better idea about where cities compete, and where they complement their neighbors.

2.6 Summary

This chapter, aiming to present an overview of relevant literature produced in recent decades, starts with a presentation of the concept of economic globalization in order to provide a framework for following analyses. Several theoretical explanations of the ongoing globalization processes are briefly discussed and then contrasted, along with some empirical evidence, to the alternative concept of multiple globalizations. To better understand the latter is presented the idea of glocalization, which deals with the interaction of global and local processes, and discussed from two divergent points of view, one built around the diversity of results from place to place, the other a pattern of vertical segregation between global and non-global elements appearing at every place.

The following section presents the concepts of world city, global city and global region, by discussing their emergence and evolution, and their contribution to explain the urban systems that are at the core of economic globalization. Special relevance is given to the idea that cities at the global scale are no longer single administrative units, but large urban regions with a larger city at the core, surrounded by a myriad of places of contrasted sizes over distances that can reach one hundred miles.

Next, a section discusses the problem of how to compare, and eventually rank, cities in the context of the new economic trends. Four major alternative approaches are presented, based respectively on the concentration of advanced business services, the local relevance of high-tech activities, inclusive measures representing the whole urban economy, and the identification of the diverse roles of each city and their relevance in a global scale.

The last section discusses air transportation as one of the most useful subfields to empirically analyze global linkages, with the additional advantage of being expressed in relational data. Recent studies have used figures on flights and travelers to analyze the industry in a global city context. Differences in flight supply and passenger counts allow identifying major routes and hubs, where time-space compression is maximized. This is complemented with an overview of major concepts in time-space geography, which can be used to explain contrasting patterns in cities relationships.

CHAPTER III

THE TEXAS URBAN TRIANGLE

For the sake of a single rose,
the gardener becomes servant to a thousand thorns.

Traditional Moroccan proverb

3.1 Introduction

The state of Texas covers an extensive territory and hosts a large human population. Among the 48 contiguous states of the United States it is the first in area and second to California in population (USBC 2006c). It is also a sub-national entity that has evolved in a unique way, the result of both being the only U.S. state that was an independent nation before joining the union and being at the intersection of varied historical and cultural influences (Meinig 1969).

3.2 The individualization of Texas

Using Donald W. Meinig's own words, Texas "evolved as a distinctive culture area and an autonomous functional region," but one also containing unique sub-regional patterns (Meinig *idem*: 7-8). The interaction of cultural and environmental factors over time resulted in a "cluster of subcultures held together with conscious effort, around symbols, dreams, and a sense of destiny" (*idem*: 8). According to Meinig's argument, such areas were kept together by a higher sense of destiny which he called the 'imperial dream of Texans.'

According to Meinig, the sources of these sub-regional cultures can be traced back to the four major in-migration routes that reached the area before 1860. The older one followed colonial roads linking Mexico to one of its northern frontiers, and consolidated the position of the former *presidio* of San Antonio as both an administrative center of a vast area and a gateway between Mexico and the great American plains. This route was always a weak link between a few little-populated missions and Mexico's heartland, its role further lessened by the political separation of Texas from the rest of Mexico. The other three routes gained relevance over the decades 1830-1860. In this period waves of Anglo-Saxon migrants started converging in Texas and played a major role in the processes of independence from Mexico (1836), and joining the United States (1845). The northernmost and middle stream routes proceeded overland through the Mississippi basin, and brought to northern and eastern Texas long-distance migrants from the Mid-Atlantic, Virginia and the Carolinas. The last route proceeded by water, entered the state through the ports in the Gulf of Mexico, from which settlers spread through the center of the state. Each route brought different types of migrants and strengthened links with source geographical areas, leading over time to the cultural and economic differentiation of Southern, Northern, Eastern and Central Texas.

By 1850, in the first enumeration after the integration in the United States, Texas had a mere 212,592 inhabitants, ranking 25th in a Union of 31 states (McGregor 1936). At that time the new state was not much more than a vast, distant and sparsely populated frontier. But in just one decade the population increased almost three fold, surpassing 600,000 in 1860. And by 1880 the state's population was over 1.5 million, and Texas ranked 11th within the 38 states federated at the time.

Texas sub-regional entities were strengthened by the expansion of the American railways (McGregor 1936). Capitalizing on their control of the emergent railway network, first Houston (the focus of five lines by 1860) and later Dallas (reached by several national lines before the end of the 19th century) reinforced their position as the two major sub-regional centers (Meinig *idem*). In 1881 The International & Great Northern Railway (I&GN) connected Saint Louis to the Mexican border through San Antonio (NBHRMS 2006). also reinforcing this city's position as the main gateway to Mexico and communications hub in South Texas.

By the last quarter of the 19th century the 'Burke's Texas Almanac for 1879' (Burke 1878), a comprehensive publication summarizing traits and figures about the state, gave major emphasis to public administration and agriculture, at that time the main economic sector. 'Orange Culture,' 'The Vineyard,' 'Small Fruit Culture,' 'Phenomena of Vegetable Life' and even the 'Texas Horticultural Association' figured among the 33 sections. The almanac, published in Houston, had one single section related to non-rural economic issues, a 20 page-description of the leading 'Business Men of Houston.' The largest proportion of the 26 entries in this section was related to farming (cotton being particularly relevant), construction and railroads. As the most relevant industries in Houston the book cited "ten bakers, ten black-smiths, two blank book manufacturers, four machinist and boiler makers, one bone dust manufactory, seventeen boot and shoe factories, two breweries, some dozen house builders, six manufactories of carriage and wagons, three coopers, three cotton compresses, dour dryers, one large flouring mill, two ice factories, twenty-three butchers, five planning mills and manufacturers of sash, doors and blinds, four soap manufacturers, three soda water factories…" (*idem*: 112). A significant proportion of the industrial activity was oriented to supplying the growing local market with basic consumption goods.

Along with Houston the 1879 Burke's Almanac singled out only three other cities in the state – Dallas, Galveston, and Waco. Waco was described as the center of a prosper cotton-producing area well located in the interior of the state, while Galveston was the main port for shipping cotton, making extra revenue by selling sand but having problems with the retention of fresh water. Dallas, a mere settlement of less than 500 people three decades earlier, was already referred to as 'the metropolis of North Texas' and 'the "Chicago" of Texas' (*idem*: 17), capitalizing on its location in the wheat belt of the state and the arrival of major railroads. By then Dallas had "in operation two cotton compresses, two grain elevators, a mammoth cotton seed oil factory, a number of capacious planning mills, a woolen factory, six flouring mills, supplied with all modern machinery, several foundries and machine shops…; a cement factory, an artificial stone factory, quite a number of brick kilns, a large broom factory, carriage and wagon manufactories, and is the headquarters for Texas for farm and mill machinery – perhaps doing more business in that line than all other towns combined.." (*idem*: 17-18). From very early Dallas emerged not just as the major trade center in the northern part of Texas, but also as the large city with the most diversified economy.

The growth of the oil industry, following a successful wildcat drill in the Beaumont area in 1901, did not change the sub-regional breakdown. It both initiated a heavy inflow of capital from Eastern states and generated great wealth, controlled by locals who frequently reinvested locally. As Meinig stressed "[o]il… created a new rich class, a new style of life, and a new degree of financial independence for Texas as a whole, and thus brought a new manifestation of cultural self-consciousness and commercial imperialism" (Meinig 1969: 78-79). With the growth of its economy the influence of the state, and especially of its largest cities, kept extending across state boundaries, reasserting old imperialist feelings to lands formerly part of Texas but over time integrated in other states (*idem*: 63). As the economic influence of Texas reached well beyond the state boundaries, the major economic and trading areas served by its cities now include sizeable portions of New Mexico, Oklahoma, Arkansas and Louisiana (FCC

1994, 1997). In this sense, each of the sub-regional centers not just articulated peripheral parts of the state with its core, but also Texas with the rest of the country.

The emergence of a triad of large cities, each one dominating a peripheral sub-region within the state, led Meinig (1969) to advance the idea of the Core area of Texas:

> … we may well begin to think of a Central Texas defined not so much by its internal cultural character as by the great cities near its corners. If we see it as a great triangle whose sides are the traffic ways uniting the metropolitan areas of its three points, the functional centrality of this region… is greatly magnified… [E]ach of these cities is the focus of more than one peripheral region and it is through them that the parts of Texas are articulated with one another.… [T]ake this triangle to be the Core area of Texas in the usual sense of that term: the seat of political and economic power, the focus of circulation, the area of most concentrated development and most characteristic culture patterns. The rest of Texas is bound to that Core through the mediating functions of Houston, San Antonio and Dallas-Fort Worth. (p. 110-111)

This triangular area did not fit the generic concept of a core since it was rather hollow and most of the resources and power were at the vertices, not at the center, as Meinig acknowledged himself. Even considering that Austin, the state capital, is located within the triangle, it seemed a relatively weak center notwithstanding its major political role. And the vertices were performing different roles, being Houston the largest and richest city, San Antonio the most historically famous, and Dallas the best known and the real gateway between Texas and the nation (and also an intermediate point between California and the Southeast, or Chicago and Mexico). The Texan core was an abstract construction, a functional concept, not a continuous feature observable on the ground.

Meinig identified and characterized the spatial arrangement and developed the concept but the expression the 'Texas Urban Triangle' (TUT) is a more recent creation. In the late 1990s Texan academics dealing with urban issues started referring to the trio of large cities in the state as the TUT, and especially in the contexts of sustainability (Ellis *et al.* 1999; Rogers and Ellis 2001; Ellis 2002) and urban growth (Neuman 2000; Sui 2003).

Contemporary urban growth and the formation of large polycentric urban forms in different parts of the world have received increasing attention in geography (Pred 1977;

Kloosterman and Musterd 2001; Krätke 2001; Parr 2004). The way some researchers, both inside and outside the academia, have approached the idea of a megalopolis taking shape in Texas (Gilmer 2004a, 2004b; Lang 2004, 2005) can be linked to this general trend. If this is the case, the TUT would be a new type of urban form – a molecular megalopolis – large and discontinuous, where most population and activities are concentrated in a few peripheral nodes, like the atoms of a small molecule, but separated by large empty spaces. But a hollow (urban) triangle was an odd concept in traditional human geography, where urban units have been identified by their physical continuity.

The megalopolitan area, an alternative concept to tackle the formation of urban regions in Texas and the nation, was recently proposed by Robert E. Lang and Dawn Dhavale (2005), and further expanded by Lang and Arthur C. Nelson (2006). Their work is an attempt to extend Jean Gottman's (1961) research on the Megalopolis of the northeastern United States to other parts of the country in a contemporary context. Strongly influenced by work done in Europe and the U. S. (Faludi 2002; Yaro *et al*. 2004; Carbonell and Yaro 2005), their major aim is to identify clusters of continuous metropolitan areas with a projected population of 10 million or more by 2040 (revised in 2006 to 5 million). These units were described as the new emerging urban forms within a globalizing economy.

Even though Lang and Dhavale claim that the "… Megapolitan concept… suggests a new geography to show which regional economies are linked…" (*idem, ibidem*: 2) the main criteria used are physical – city size, county boundaries, and spatial continuity. The largest Texan metropolitan areas were allocated to two different regions: the interior of the state to the elongated 'I-35 Corridor megapolitan area,' an almost contiguous string of places along Interstate 35 from San Antonio to Dallas, Oklahoma City and Kansas City; and the coastal areas of the state to a second corridor, the 'Gulf Coast megapolitan area,' another string of places by the Gulf of Mexico coast, all the way from Brownsville to Houston, New Orleans and Pensacola, and partially based on Interstate 10.

The separation of Texas into two different urban regions contradicts empirical evidence showing that Dallas (in the I-35 Corridor) and Houston (in the Gulf Coast) are far more interconnected than any pairing of one of them with any other city, within or outside Texas (Malecki 2002). To other authors the four large Texan metropolitan areas even operate as a large economic unit (Gilmer 2003, 2004a, 2004b). Therefore, in the context of this dissertation, the TUT is considered as the functional construct that reflects the regional dynamics.

The TUT can be broadly defined as all the urban areas and rural counties totally or partially situated within the triangle having the cities of Dallas, Houston and San Antonio as vertices. Interstate highways 10 (linking Houston to San Antonio), 35 (linking Dallas and Forth Worth to Austin and San Antonio), and 45 (linking Dallas and Houston), should be considered as its major land communication axes. The area defined in this way is quite diverse and can be further broken down into three major subdivisions using counties and the U.S. Bureau of Census (USBC) metropolitan areas as reference units (see Figure 3.1).

The most significant element of the TUT has to be, per definition, the set of large metropolitan areas situated at the vertices of the triangle; the metropolitan area of Austin should be added to them due to both its size, comparable to San Antonio's, and the process of coalescence occurring between these two cities (which will be discussed further). These four major metropolitan areas – Dallas-Fort Worth, Houston, San Antonio and Austin – can be further subdivided into two contrasted portions, one made up by their urban cores, which can be broadly defined as Dallas, Tarrant, Harris, Bexar and Travis counties, and the other by the extensive suburban and exurban areas which have developed around them.

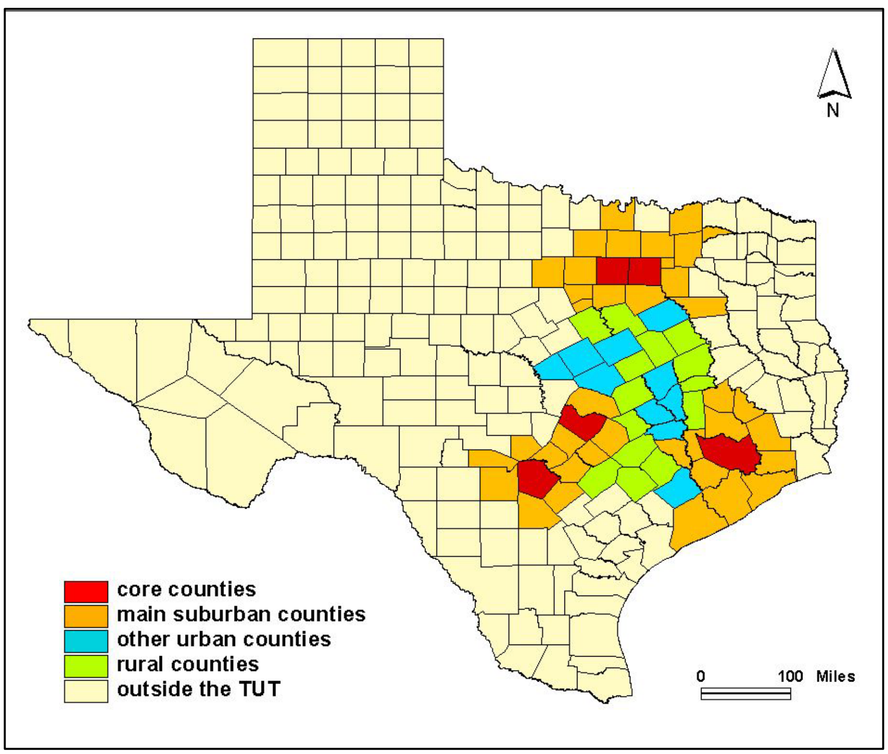


Figure 3.1. The Texas Urban Triangle in 2007

The second sub-division of the TUT comprises six secondary urban areas, much smaller than Austin's but large enough to have official recognition by the USBC; they are centered in the cities of Killeen and Temple (both close to Forth Hood), College Station and Bryan (the location of Texas A&M University), Waco, Brenham, Corsicana and El Campo. And finally, the third sub-division includes the remaining (and predominantly) rural counties.

The following sections will discuss the growing demographic and economic relevance of the TUT within Texas, and relate its development with some major trends in contemporary processes of economic globalization.

3.3 Demographic growth in Texas

The population of Texas has been growing consistently fast, and in every inter-census period posting growth rates well above the national average (DMN 2006). The growth rate was especially high during the decades from 1850 to 1880, when population was small and in-migration had a relatively large impact. It has remained consistently above 15% (see Table 3.1), with the sole exception of 1940-1950, a period related with World War II.

Texas' population surpassed 1 million in the 1870s, 5 million in the 1920s, 10 million in the 1960s, and 20 million in the 1990s. Between the last two censuses, 1990 and 2000, the state population grew by 23%, ten points above the national average of 13% (USBC 2006c).

Table 3.1. The population of Texas, 1850-2000

Census	*Population*	*change*	*Census*	*Population*	*change*
1850	**212,592**	-	1930	**5,824,715**	*25 %*
1860	**604,215**	*184 %*	1940	**6,414,824**	*10 %*
1870	**818,579**	*35 %*	1950	**7,711,194**	*20 %*
1880	**1,591,749**	*94 %*	1960	**9,579,677**	*24 %*
1890	**2,235,527**	*40 %*	1970	**11,198,655**	*17 %*
1900	**3,048,710**	*36 %*	1980	**14,225,513**	*27 %*
1910	**3,896,542**	*28 %*	1990	**16,986,510**	*19 %*
1920	**4,663,228**	*20 %*	2000	**20,851,820**	*23 %*

Source: United States Bureau of Census and McGregor (1936).

Texas has been outperforming the nation due to its higher birth rates and a strong and continuous in-flow of migrants (Sharp 1993). According to the state's Comptroller office, net migration since 1950 explained more than one third of the net population growth, and Hispanic net migration amounted to more than one half of legal migrants (*idem*, *ibidem*: 20-22). Even though the population of the state is increasingly older, consistent with national trends, Texas has a relatively young population and one of the lowest median ages in the nation, well below the national average and second only to Utah (USBC 2002).

Despite the consistently high population growth in Texas over the last 150 years, there have been major regional differences across the state. In 1850 Texas was a little and very sparsely populated area, the largest settlement being the coastal town of Galveston, with just over 4,000 inhabitants; Austin, the state capital, just surpassed 600 (McGregor 1936). Since then the state population increased almost 100 times over a period of 150 years, but this growth was very unevenly distributed.

From the examination of Figure 3.2, representing population density by county in 1900, 1950 and 2000, it is apparent that density did not increase significantly in the majority of counties of Texas (see exhibit 3.1 in the Appendix for figures; population of counties created after 1900 were estimated case by case based in the population and growth trends of source counties).

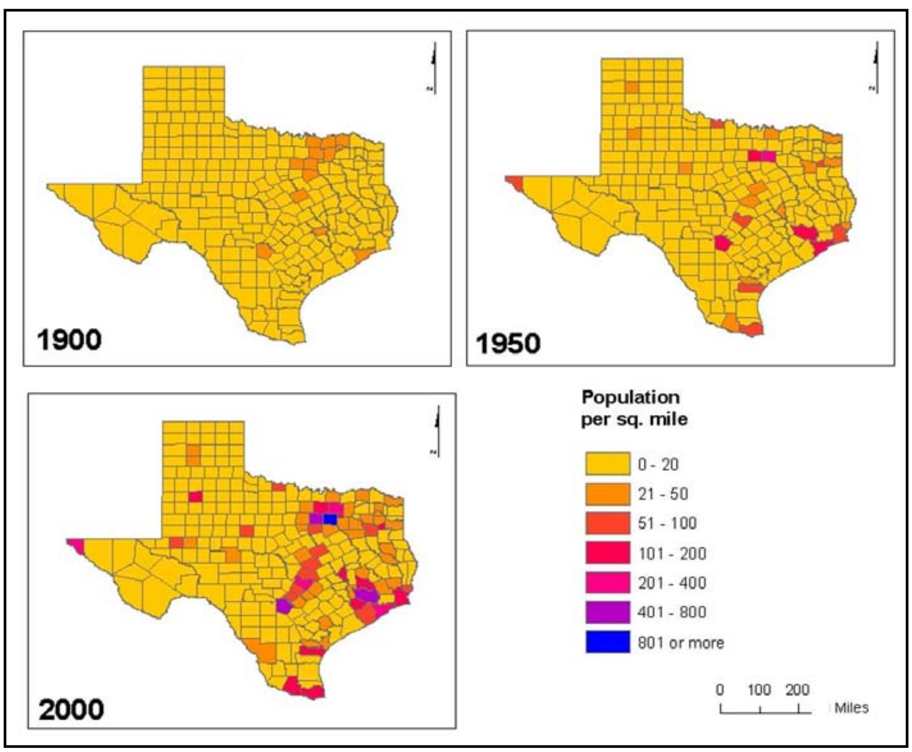


Figure 3.2. Population density in Texas by county, 1900, 1950, 2000

By 1900 every county had a population density below 50 persons per square mile; in only 14 counties the density was greater than 20, and the majority of these were concentrated in around of and northeast from Dallas, up to the Red River valley. By 1950 five counties, those containing the urban settlements of Fort Worth, Dallas, San Antonio, Houston and Galveston, had surpassed the density of 100 persons per square mile, and counties containing larger towns had shown substantial density increases; but the large majority of the counties remained with density below 20. By year 2000 this trend had been reinforced, with the counties having the largest cities having densities over 400 persons per square mile, followed by counties with suburban areas and other regional centers. In rural Texas densities remained low.

Two other aspects also deserve special mention. Firstly, the highest density found in any county went up from 42.7 persons per square mile in 1900 to 269.9 in 1950 and to 974.0 in 2000, while the lowest densities remained below 0.2 persons per square mile for the whole period; consequently, the difference between highest- and low-density counties has been increasing enormously over time. And secondly, by year 2000 suburban counties around Dallas, Houston, Austin and San Antonio were also showing significant density gains.

Another surprising fact is that many counties in Texas have actually been losing population, some of them over a relatively long period. Figure 3.3 shows in which census county populations peaked over the period 1900-2000 (see exhibit 3.1 in Appendix for complete set of figures). Through analysis, it is possible to roughly subdivide the state in two halves: the northwest, where most counties had reached their highest populations several decades ago, the few exceptions being counties with urban centers or by the Mexican border; and the southeast, counties closer to Dallas, Houston, San Antonio and Austin (as well as those around Corpus Christi and in the lower portion of the Rio Grande valley) that reached their peak population very recently, while other rural counties had reached their peak several decades ago.

And somehow surprisingly, the population of most counties within the geographic core of the TUT but farther from the urban vertices peaked before World War II, some even in the last census of the 19th century. Being within the emerging Texan triangular megalopolis has not been a big advantage. It is evident that the demographic trends around the vertices of the TUT and elsewhere in triangle or the state have been much contrasted.

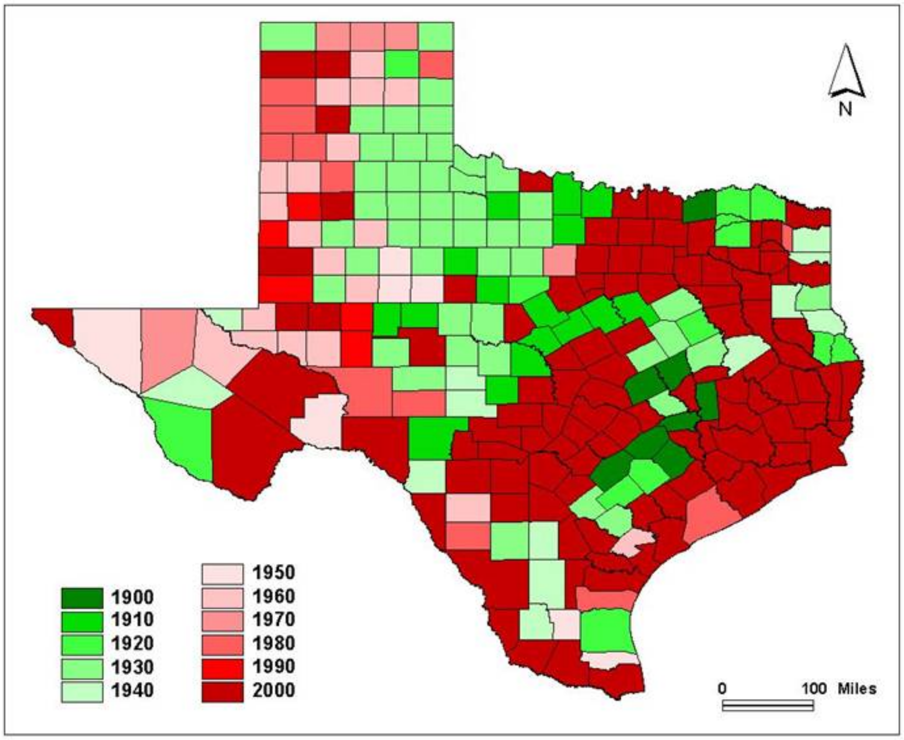


Figure 3.3. Population peaks in the Texas counties, 1900 - 2000

3.4 Urban growth and suburbanization

The previous section emphasized the contrasted demographic fortunes of two sides of Texas – on the one hand growing urban Texas, and on the other hand declining rural Texas. But this is only the first layer of the story because the TUT, the triangular area identified by Meinig and following researchers, has concentrated the lion's share of the state's population growth (Figure 3.4). The Lower Rio Grande, the other area where population peaked in the last census, has comparatively posted more modest net gains.

Until 1950 the TUT accounted for close to one half of the state population. In the 1950 census it amounted to 52% (almost 4.0 million out of a total of 7.7 million). But since then its share has grown regularly, having surpassed 60% before 1970, and reaching 68% in the last census. By year 2000 the population of the TUT had reached 14.2 out of a state population of 20.8 million. In other words, from 1950 to 2000 the net population increase for the TUT was over 10 million, while for the rest of the Texas, including the Lower Rio Grande, the net gain was almost 3 million. Since 1950 more than 75% of new Texans were living in the TUT.

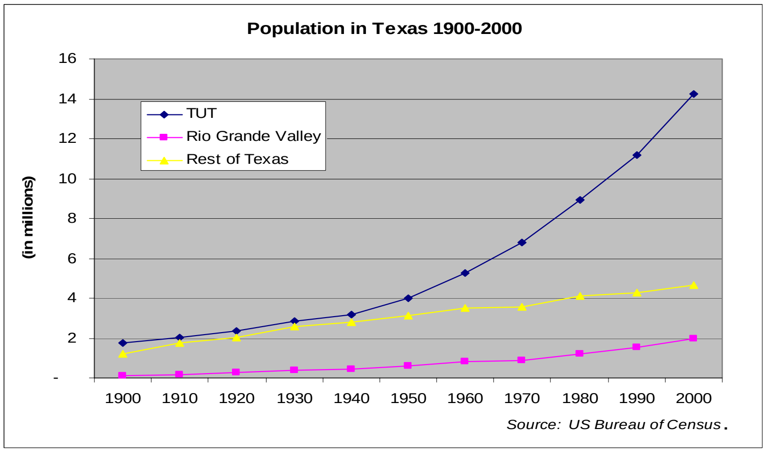


Figure 3.4. Population growth in Texas, 1900 - 2000

Within the TUT the main trend has been similar to what happens in the state as a whole, with the population growing much faster in the largest urban areas. This becomes clear in Figure 3.5, which shows how the proportion of the population in the different components of the TUT evolved over time (the current metropolitan boundaries were considered over the whole period, so the areas did not change). It is immediately apparent that the share of the TUT population living in the four large metropolitan areas has increased steadily from close to 60% in 1950 to more than 90% in 2000. The remaining components of the triangle as a whole (including secondary metropolitan areas) accounted for a little less than 10% of the total by the last census.

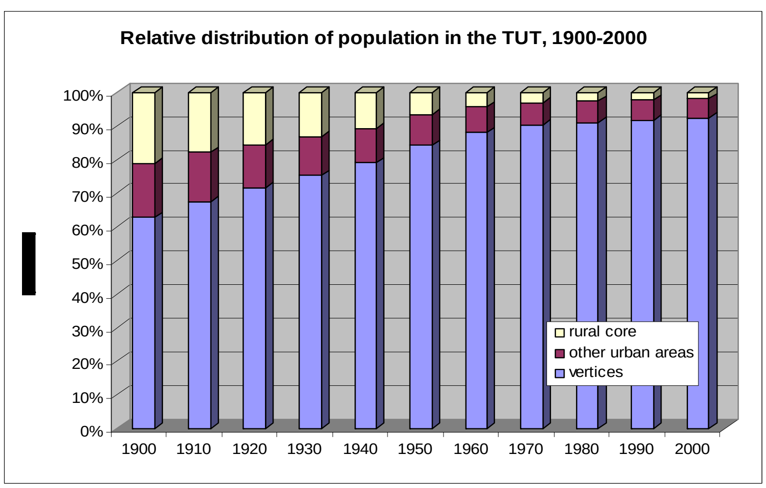


Figure 3.5. Relative distribution of population in the Texas Urban Triangle

Considering the rapid population growth of the TUT over the last five decades (and as the TUT is by definition an array of the largest urban areas in Texas), it should be no surprise to observe high population growth in the central cities. In fact, all five largest cities in the TUT posted very significant net population gains (Table 3.2). In the fifty years between 1950 and 2000 the population in Austin increased by 359%, in Houston by 209%, in San Antonio by 175%, in Dallas by 150%, and in Fort Worth by 76%.

Table 3.2. Population of selected cities in Texas, 1950-2000

Cities	1950	1960	1970	1980	1990	2000
Austin	132.5	186.5	251.8	345.5	465.6	608.1
Dallas	434.4	679.7	844.4	904.1	1.006.9	1,085.6
Fort Worth	278.8	356.3	393.5	385.2	447.6	489.3
Houston	596.2	938.2	1,232.8	1,594.1	1,630.6	1,841.1
San Antonio	408.4	587.7	654.2	785.4	935.9	1,123.6

Note: population shown in thousands.

Source: United States Bureau of Census.

These figures are impressive but also a bit misleading. Table 3.3 displays the variation in the area of the same cities, and shows that each has also incorporated new territory at rates significantly higher than their population growth. Over the same five decades Austin's area increased by 705%, San Antonio's by 493%, Houston's by 276%, Dallas' by 244%, Fort Worth's by 219%. In Texas home rule cities can annex adjacent territory within their extraterritorial jurisdiction (land 5 miles beyond the boundary for a large city) with relatively ease, a direct consequence of a state constitutional amendment approved in 1912. The annexation process was further regulated by the Municipal Annexation Act, passed by the Texas Legislature in 1963, which restricted annexations to up to 10% of the existing city area per year (Sharp 1993) in order to avoid major seizures of non-urbanized land like those that took place in the 1950s, which led to massive land speculation.

Texas cities have taken full advantage of these provisions in the past, but most recently there is a noticeable trend for a slowing down in annexation rates. One of the major reasons has been the progressive incorporation of suburbs as independent cities which become physical barriers to the area expansion of the central city, a process that is especially noticeable around Dallas and, to a lesser extent, southeast of Houston. As a direct consequence of annexation, population density in the largest TUT cities has been decreasing over the same period – at rates varying from 18% in Houston, not surprising the lowest rate since it was the city with the largest area in 1950, up to 54% in San Antonio. This is also clear evidence of growing urban sprawl.

Table 3.3. Area of selected cities in Texas, 1950-2000

Cities	*1950*	*1960*	*1970*	*1980*	*1990*	*2000*
Austin	32.1	49.4	72.1	116.0	217.8	258.4
Dallas	112.0	279.9	265.6	333.0	342.4	385.0
Fort Worth	93.7	140.5	205.0	240.2	281.1	298.9
Houston	160.0	328.1	433.9	556.4	578.5	601.7
San Antonio	69.5	160.5	184.0	262.7	333.0	412.1

Note: area shown in square miles; both land and water portions included.
Sources: United States Bureau of Census, Sharp (1993) and Gibson (1998).

All together the combined population of the five largest cities of the TUT increased from 1.9 million in 1950 to 5.2 million in 2000. But even though this is a substantial increase, their share of the TUT's total population fell from 46% in 1950 to 36% in 2000. The aggressive annexation policies in Dallas, Houston and San Antonio during the 1950s allowed this share of the total population to raise 52% in 1960, but since then it has been falling steadily.

The declining share of the combined population of central cities, in spite of significant net gains, is the result of strong suburbanization processes in the TUT over the last decades. The TUT cities have been growing quickly, but their suburbs have been growing even faster. Like in most American cities in the last quarter of the 20th century an increasing proportion of the population is living in suburbs, a process that has been particularly noticeable in the Sunbelt (Abbott 1981; Jackson 1985; Garreau 1991).

Before discussing population changes at the metropolitan level three important issues must be clarified, the first related to typologies, the second to designations, and the third to boundaries. The Metropolitan Statistical Area (MSA), later also called Standard Metropolitan Statistical Area (SMSA), the initial concept introduced in 1950 by the Bureau of Census, presumed the existence of one central city surrounded by suburbs (USBC 2005). But as closer metropolitan areas were coalescing and becoming more complex functional units a second concept was created in 1981, the Consolidated Standard Metropolitan Statistical Area (CSMSA), was made up of two or more Primary Metropolitan Statistical Areas (PMSAs). Houston-Galveston became the first in Texas (1981), renamed as Houston-Galveston-Brazoria in the 1983 revision, when Dallas-Forth Worth also became a CSMSA. A major revision was carried out in

2003, introducing a third type of unit, the smaller Micropolitan Statistical Areas; at the same time the CSMSAs were replaced by Combined Statistical Areas (CSAs), which were made up of two or more metropolitan and/or micropolitan statistical areas (USBC 2006b). Austin and San Antonio remained single-unit metropolitan areas during the whole period. By 2003 the CSA of Houston-Baytown-Huntsville had one metropolitan area (Houston-Baytown-Sugar Land) and two micropolitan areas (Bay City and Huntsville), while the CSA of Dallas-Forth Worth had one metropolitan area (Dallas- Forth Worth-Arlington) and four micropolitan areas (Athens, Gainesville, Granbury and Mineral Wells); in 2004 the micropolitan area of Bonham was added to Dallas-Forth Worth CSA. In the context of this dissertation, where most discussions are placed at the global, national and/or sub-national scales, the highest category will be used when referring to each metropolitan unit.

The official designations of several metropolitan areas have changed over time and often became composed, like Austin becoming Austin-San Marcos in 1993, or Fort Worth becoming Forth Worth-Arlington in 1981 (USBC 2005). Since 2003 the designations of the CSA or metropolitan areas with a population of over a million are Austin-Round Rock, Dallas-Fort Worth, Houston-Baytown-Huntsville and San Antonio. This process reflects sprawl and the growing demographic weight of suburbs within metropolitan areas. But in the context of this dissertation and to simplify designations each metropolitan unit will be referred by the name of the main central city.

All four metropolitan largest areas occupied one single county in 1950, but became multi-county areas over time. Metro Austin started with Travis in 1950 and later incorporated four new counties (Hays in 1973, Williamson in 1981, and Bastrop and Caldwell in 1993). Metro Houston started with Harris, and absorbed nine new counties (Brazoria, Fort Bend, Liberty and Montgomery in 1971, Waller in 1981, Chambers in 1993, and finally Austin, Galveston and San Jacinto in 2003); Brazoria and Galveston were PMSAs from 1981 to 2003. Metro San Antonio started as Bexar, and seven other counties were added later (Guadalupe in 1963, Comal in 1981, Wilson in 1993, and Atascosa, Bandera, Kendall and Medina in 2003). The case of Dallas is far more complex: to Dallas county were added thirteen counties (Collin, Denton and Ellis in 1960, Kaufman and Rockwall in 1971, the whole Fort Worth metropolitan area with Hood, Johnston, Parker, Tarrant and Wise in 1973, Henderson and Hunt in 1993, and Delta counties 2003); but Wise was excluded in the 1983 revision, to be added again in 2003, while Hood was excluded in

1983, added again in 1993, and became part of the micropolitan area of Granbury in 2003, and Henderson become part of the micropolitan area of Athens in 2003 (USBC 2005, 2006b).

The total population of the four largest metropolitan areas in Texas is shown in Table 3.4. It is important to note that figures in this table relate to the official highest-level metropolitan boundaries existing at the time of each census, and some of the inter-census increases are due to the addition of new counties to each metropolitan area.

These figures, even though they relate to changing areas and are not completely comparable, are relevant because they represent the population living in the urbanized areas at the time of each census. Over the five-decade period metropolitan growth rates were extremely high, from 272% in San Antonio, to 497% in Houston, 676% in Austin, and 775% in Dallas. Since in every case metropolitan growth rates are significantly higher than the respective central city growth rates (in spite of successive land annexations), the proportion of the metropolitan population living in the central city has been decreasing over time, as shown in Figure 3.5. All four cities had values above 70% in 1950, but by year 2000 some were as low as 20.% in Dallas and 38% in Houston.

Table 3.4. Population in selected metropolitan areas, 1950-2000

Metro	*1950*	*1960*	*1970*	*1980*	*1990*	*2000*
Austin	161	212	296	460	782	1,250
Dallas	615	1,084	1,517	2,975	3,885	5,222
Houston	807	1.243	1,742	2,886	3,494	4,670
San Antonio	500	687	864	1,036	1,302	1,592

Note: Population in thousands.

Sources: United States Bureau of Census.

The most important point to be extracted from this discussion is that central cities are increasingly diluted within larger metropolitan units, and consequently it makes more sense now to use metropolitan areas as the basic urban unit at the regional, national, and even perhaps global scales.

The TUT metropolitan areas, and especially the case of Dallas, also provide good examples of two new trends observable in urban America. The first relates to the emergence of "edge cities," relatively recent concentrations of office and retail space around suburban highway intersections, increasingly significant in contemporary metropolises (Garreau 1991; Lang and LeFurgy 2003). In the Dallas metropolitan area a good number of them have been identified, like Arlington, Irvington, Plano and Grapevine; but recently other parts of the TUT have been showing similar trends, apparent in areas like The Woodlands north of Houston, and Round Rock north of Austin (Lewis 2002). The second trend relates to 'boomburbs,' a term coined by Robert Lang and Patrick E. Simmons (2001) for fast-growing suburban communities whose population has been increasing at double-digit growth rates. Both concepts are useful to understand the urban growth in Texas metropolitan areas, since edge cities and boomburbs are found in fast-growing suburbs north of Dallas, north and west of Houston, and north of Austin.

Table 3.5. City population as a percent of their metropolitan population, 1950-2000

Cities	*1950*	*1960*	*1970*	*1980*	*1990*	*2000*
Austin	82 %	88 %	85 %	60 %	49 %	49 %
Dallas	71 %	63 %	56 %	26 %	21 %	20 %
Houston	74 %	75 %	71 %	47 %	39 %	38 %
San Antonio	82 %	86 %	76 %	72 %	71 %	66 %

Source: United States Bureau of Census.

Metropolitan units extending outwards to over 60 or even 100 miles better represent the contemporary "spatially integrated economic and social systems" (Friedmann and Wolff 1982) and the life space of their inhabitants, like John Friedmann and John Miller forecasted when advancing the idea of the "urban field" (1965) and Deyan Sudjic argued as the emergent model of urban life (1992). In the case of the Texan metropolises this outward expansion is remarkable, as the officially defined Metro Dallas already reached places like Cooper, 81 miles away, and Metro Houston reached Bay City, 83 miles away; but even Metro Austin already reached San Marcos, 30 miles away, and Metro San Antonio reached Bandera, 50 miles away.

This outward suburbanization, it must be emphasized, has not been proceeding similarly in every direction, like an oil stain. The pattern of growth varies from one metropolitan area to another. Figure 3.6 shows the net population increases in each Texan county between 1950 and 2000. It is apparent that net population increases were larger on the northern side of the metropolitan area of Dallas and the western side of Houston's, and conversely smaller to the southeast of the former and east of the latter. In the case of Metro Austin and Metro San Antonio larger increases were observed in counties situated to the north of these cities and along Interstate 35, and smaller away from this highway.

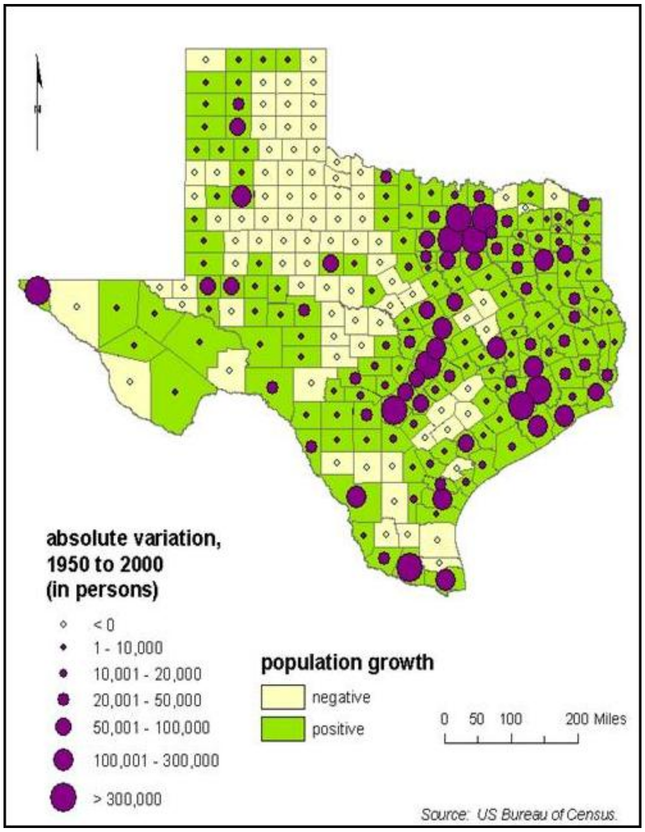


Figure 3.6. Population increase in Texas counties, 1950 - 2000

The map also shows that there is only one area in the TUT with a clear trend for axial coalescence, and this is Interstate 35 from San Antonio to Austin and Killeen-Temple. Waco, just 40 miles north of Temple, has been growing very slowly, well below the state average; it does not seem to gain much advantage from its location on the major link between Dallas and Austin-San Antonio. Similarly, there is no trend for coalescence between Dallas and Houston, nor between either of those cities and the Austin-San Antonio area, and even less along the megapolitan axes proposed by Lang and Dhavale (2005).

In physical terms it is certain that overall of the metropolises of the TUT are not showing a trend for coalescence. While distances between the cities are not too large, there is no clear trend showing significant urbanization along their built-up gaps, with the exception of the corridor Austin-San Antonio. Having no evidence that the TUT is evolving toward a recognizable single physical form, it remains to be addressed if it can be identified as a functional unit.

3.5 Recent changes in the economy of Texas and its cities

The economy of Texas moved from subsistence agriculture to the production of cotton, primarily produced for export, by the 1860s (Fehrenbach 1983). After the Civil War a second major wave of economic development was driven by the cattle industry, which quickly developed by taking advantage of the new railroads and the needs of northern markets (Yemma 1987). Cotton and cattle, and to a lesser extent lumber, all primarily oriented to the needs of the industrialized northern American states, remained the pillars of the Texas economy until the discovery of oil. After the successful Spindletop oil dig in 1901 not only the state economy but its very position within the United States economy were changed in a most significant way (Wright 1990; Sharp 1993).

The role of Texas as a supplier of raw materials to the rest of the country started changing with World War II, with the creation of aircraft plants close to Dallas and petrochemical industries in the Gulf Coast, both industries linked to military needs and benefiting from large federal government investments matched by private funding. After the war, the popularity of cars and new uses for plastics and synthetic rubber boosted the growth of petroleum-linked industries (Pratt 1980). But the war effort also supported the development of local specialized metal and construction industries which, ultimately, allowed Texas companies to break the monopoly of Standard Oil in the oil industry, and the rise of The Texas Fuel Oil Company (later Texaco) and J.M. Guffey Petroleum Company (later Gulf Oil) (Williamson *et al.* 1963).

After World War II the economy of Texas kept growing at rates higher than the national average and becoming increasingly diversified (Sharp 1993). Even recently, the gross state product grew four-fold over the last 25 years, and posted increases higher than 50% over the 5-year periods of 1980-1985 and 1995-2000 (see Table 3.6).

Table 3.6. The Texas gross product, 1980-2005

year	*GSP (2005 $)*	*growth rate*
1980	228.58	-
1985	347.96	52.2 %
1990	485.99	39.7 %
1995	502.08	3.3 %
2000	759.08	51.2 %
2005	886.15	16.7 %

Notes: GSP in billion of real $ of 2005; 2005 figures are estimates.
Sources: Texas Comptroller of Public Accounts, U.S. Bureau of Economic Analysis and U.S. Bureau of Energy.

As a direct consequence of growth rates above the national average, Texas' share of the United States GDP kept increasing over time (see Figure 3.7). By 2004 Texas' share was approaching 8%, the third largest state share in the nation after California and New York.

Texas' share had peaked in the early 1980s, a result of the oil boom of the 1970s, and receded in the second half of this decade, following the fortunes of the oil industry (Sharp 1993). But in the 1990s Texas' share grew again, finally reaching pre-recession levels by 2004; if the current trend persists it will become the second largest GDP contributor before the end of this decade, surpassing New York. But it is also important to notice that since 1977, and relatively to Texas, the net share gains of California and Florida have been larger.

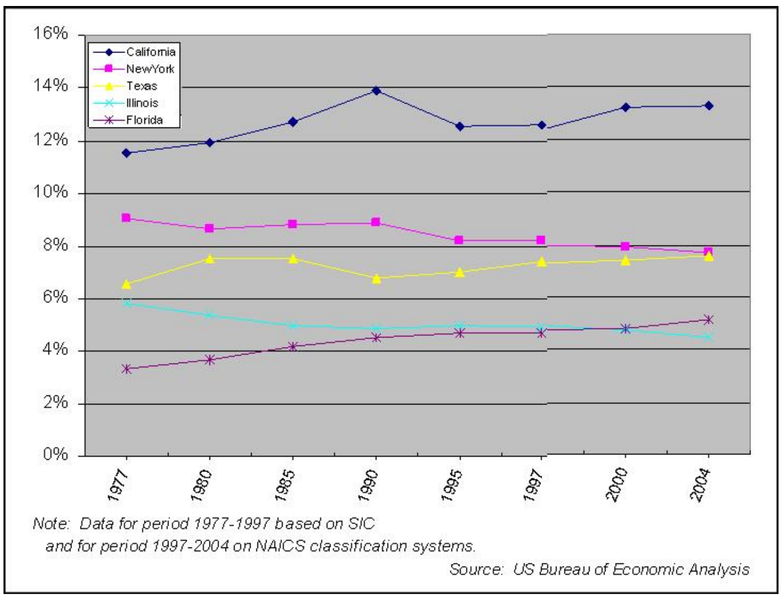


Figure 3.7. State GDP as a percent of national GDP in selected states, 1977-2004

Along with the enormous growth of the last decades the economy of Texas went through significant internal transformations. In 1980 the services sector ranked 5th out of the nine main sectors identified by the Texas Comptroller of Public Accounts (TCPA), accounting for 11.2% of the GSP; by 1990 it had become the largest contributor, and in 2003 accounted for 20.5% of the GSP. The share of Transportation & Utilities, Wholesale & Retail Trade, Finance, Insurance & Real Estate, and Government also grew, slowly but steadily. Manufacturing and Mining, the top two contributors in the early 1980s, suffered significant share reductions over the same period, from 19.3% and 15.2% in 1980 to 11.4% and 6.5%, respectively. The relative importance of agriculture continued to decline, following a long term trend (see Table 3.7).

Table 3.7. Share of Texas gross product by sector, 1980-2003

Sector	*1980*	*1985*	*1990*	*1995*	*2000*	*2003*
Agriculture	2.0	1.9	2.0	1.4	1.3	1.4
Mining	15.2	12.4	7.0	6.8	6.2	6.5
Construction	6.3	5.4	4.2	4.3	4.9	5.1
Manufacturing	19.3	15.6	16.6	16.4	13.0	11.4
Transportation & Utilities	9.8	10.3	11.2	10.8	11.2	11.1
W. & Retail Trade	15.1	16.0	15.3	16.1	17.4	17.2
F., I. & R.E.	11.9	14.8	14.7	14.4	15.1	15.4
Services	11.2	13.6	17.7	17.8	19.8	20.5
Government	9.2	10.1	11.3	12.0	11.1	11.5

Notes: 2003 figures are estimates; ‘W. & Retail Trade’ for ‘Wholesale and Retail Trade,’ ‘F., I. and R.E.’ for ‘Finance, Insurance and Real Estate’; figures for ‘Government’ include local, state and federal administration.

Sources: Texas Comptroller of Public Accounts and U.S. Bureau of Economic Analysis.

In the context of Texas’ fast-growing economy, it is important to stress that sectors with a declining share of the GSP actually kept growing, their relative decline simply an indication of growth rates below the state average. Mining is one example; the sector went from an industry product of $34.7 billion in 1980 to $47.1 billion in 2000 in constant 2005 dollars, while its share of the GSP plummeted from 15.2% to 6.5%.

The Texas economy has becoming increasingly similar to the economy of the rest of the country, less dependent on agriculture and more on services, with most sectors having comparable shares of both the GSP and the national GDP (Sharp 1993). But in this process of convergence there was one fundamental exception – mining, largely related to oil and gas – ,whose relative importance in Texas remained much higher. In 1950 the share of mining in the gross product of Texas was 3.4 times larger than its share of the nation GDP; this location quotient increased to 4.0 in 1990, and to 5.1 in 2004 (when the sector was responsible for 5.7% of the GSP, but only for 1.1% of the national GDP) (USBEA 2006a).

The oil industry has been affected by expansions and recessions not always related to trends in the overall economy. Following significant oil price hikes in OPEC countries in the second quarter of the 1970s, there was a general boost of oil exploration and production in which Texas-based corporations took part. Houston, which according to Richard C. Hill and Joe R.

Feagin had “become the center of a world oil and petrochemical production system” (1989: 167), where 34 out 35 largest American oil companies had major facilities, could take full advantage of this situation. As Hill and Feagin stated;

> … Houston has grown because of cheaper production costs (e.g. weaker unions, lower wages), weaker physical and structural barriers to new development (e.g. no ageing industrial foundation) and tremendous federal expenditures on infrastructure (e.g. highways) and high-technology defense industries. (p. 168)

Taking advantage of short-term oil price increases both oil corporations and regional banking became less interested in economic diversification and continued giving higher priority to oil exploration and digging. But later Houston paid the price of its high sectoral specialization; it suffered employment losses above the national average and record bankruptcies during the recession of 1982-1987 (Hill and Feagin 1989).

By the last decades of the twentieth century the high-tech industry gained prominence in the state economy, to a point that some authors even argued that a fourth development wave was under way, following the previous waves based on agriculture, ranching, and oil (Yemma 1987). This sector, initially linked to the aerospace industry clustered around Dallas and Fort Worth during World War II, started diversifying in the 1960s, when branch assembly plants of top-tier corporations were installed in the Austin area, and got a boost with the relocation of Microelectronics and Computer Technology Corporation (MCC) in 1983, and the creation of Dell Computers in 1984, both in the Austin area (Tu 2004).

Changes in the major economic sectors shares in the state GSP and the national GDP between 1997 and 2004 are presented in exhibit 3.2 of the Appendix. Data shows that in spite of general convergence between the state and national economies of previous decades, most sectors based on natural resources and its primary transformation and distribution were still more relevant in Texas than in the nation as a whole. At the same time, most sectors generally linked to economic globalization, like Finance and Insurance, Real Estate, Professional and Technical Services, and Management of Companies were relatively less relevant in Texas. In 1997 information was the major exception, being responsible for a 4.6% share of the GST, well above its 4.2% share of the national GDP. But after the high-tech boom and while the country entered a recession in the early 2000s, Texas' information sector growth has lagged behind other states, and by 2004 Texas' share had fallen below the national average.

The two columns in the right side of exhibit 3.2 of the Appendix show two measures which compare changes in the share of each sector in the state and national economies. The second column from the right represents the shift-share variation (*Is*), the difference between the state projected share (the expected share of a sector if its growth rate from 1997 to 2004 had been the same in Texas and in the nation) and the actual state share in 2004. A positive value indicates that a sector grew faster in Texas than in the rest of the nation, while a negative value indicates a slower growth. Shift-share values are useful to compare relative growth rates, but from their analysis it is not possible to know if a sector is growing more quickly (or more slowly) than the nation is moving closer or away from the national average.

Shift-shares were complemented by an index of sectoral convergence (*Ic*) between the Texan and the national economies (in the first column from the right in the same appendix exhibit). This index expresses directional changes in the ratio between state and national shares following the formula

$$Ic_{i,j} = 100 * \left(\frac{(S_i - N_i)^2}{N_i} - \frac{(S_j - N_j)^2}{N_j} \right)$$

where the index of convergence Ic is linked to changes in the ratios between the state share (*S*) and the national share (*N*) of an economic sector from year *i to* year *j*. Positive values of the index indicate convergence, i.e. when the share of a sector in the Texas GSP is converging to the corresponding national share, and conversely negative values indicate divergence from the national share over the period.

The combination of shift-share variations (gaining/losing share) and directions of the index of convergence (convergence/diverging) leads to four possible pairings: share gain with convergence, share gain with divergence, share loss with convergence, and share loss with divergence. By identifying the economic sectors that fall within each pair (see Table 3.8), it is possible to better understand the economic trends in Texas from 1997 to 2004. An analysis of the figures shows surprising trends, in some cases contradicting the prevalent convergence towards national averages of previous decades.

The most consequential trends are perhaps those taking place in sectors related to primary and secondary transformation of natural resources. The Texan economy is leading once again toward a higher reliance on Mining and Utilities, and in spite of its cheap-labor and "good business climate" is losing ground in manufacturing (as well as in Health Care & Social Assistance, which also has negative impacts on labor productivity).

Table 3.8. Absolute and relative changes in the GST share of Texan economic sectors in regard to national averages, 1997-2004

	converging	*diverging*
gaining share	Agriculture & related Finance & Insurance Management of Companies Government	Mining Utilities Wholesale Trade
losing share	Retail Trade Information Administration & Waste Services	Manufacturing Health Care & Social Assistance

In 2001 the four major metropolitan areas of the TUT concentrated 62% of the state population, 68% of the salaried jobs, and 71% of the personal income. But their economic composition was relatively different, with each city having some areas of specialization. Robert W. Gilmer (2004b) identified the export sectors of each city by analyzing the location quotients for 60 economic sectors, or industries, using 2001 SIC data on wages, salaries and employer-paid benefits. According to his method, industries with a location quotient higher than 1.15, which means the industry has a share of locally earned income at least 15% larger than the industry's national share, were considered as export industries. Six export industries were identified in Austin, fourteen in Dallas, fifteen in Houston, and nineteen in San Antonio. For each city the following industries showed location quotients higher than 2 (industries listed in more than one city are shown in italics):

- Austin – industrial machinery and equipment (3.69), *electronic and other electrical equipment* (3.32), state government (2.27);
- Dallas – *oil and gas extraction* (4.82), transportation by air (2.49), *electronic and other electrical equipment* (2.47), *transportation services* (2.12);
- Houston – *oil and gas extraction* (13.81), pipelines, except natural gas (6.78), petroleum and coal products (4.97), *electric, gas and sanitary services* (3.69), water transportation (3.38), *transportation services* (3.32), heavy construction (3.03), chemical and allied products (2.43), holding and other investment offices (2.10);
- San Antonio – military (4.70), *electric, gas and sanitary services* (3.13), *transportation services* (2.85), insurance carriers (2.35).

From this listing it is possible to conclude that Houston was clearly the most specialized city, having location quotients extremely high in industries directly related to oil and gas, and Dallas the least specialized with only one industry not listed in any other city. Austin had its major strength in manufacturing equipment, Dallas in transportation, Houston in oil and gas, and San Antonio in services. But there were also some overlapping areas, such as oil and gas extraction in both Houston and Dallas, transportation services in Houston, San Antonio and Dallas, or electronic and other electrical equipment in Austin and Dallas.

At first glance, none of the cities showed a clear specialization in sectors identified in specialized literature as key for global cities, and/or in processes of economic globalization. According to Gilmer's (2004b) data, Dallas was the city showing most diversification in these sectors, having high location quotients in communications (1.82), real estate (1.54), business services (1.35), depositary and nondepository institutions (1.16), insurance agents, brokers and services (1.16) and holding and other investment offices (1.16). Austin showed some specialization in business services (1.47), Houston in engineering and management services (1.40), legal services (1.34) and real estate (1.27), and San Antonio in insurance carriers (2.35), communications (1.96) and holding and other investment offices (1.72). But these figures represent only a snapshot - what the situation was in year 2001 - and neither are able to show ongoing trends nor to compare Texas cities (and the TUT) with other urban areas in the country (differences in data collection and classification systems make international comparisons virtually impossible).

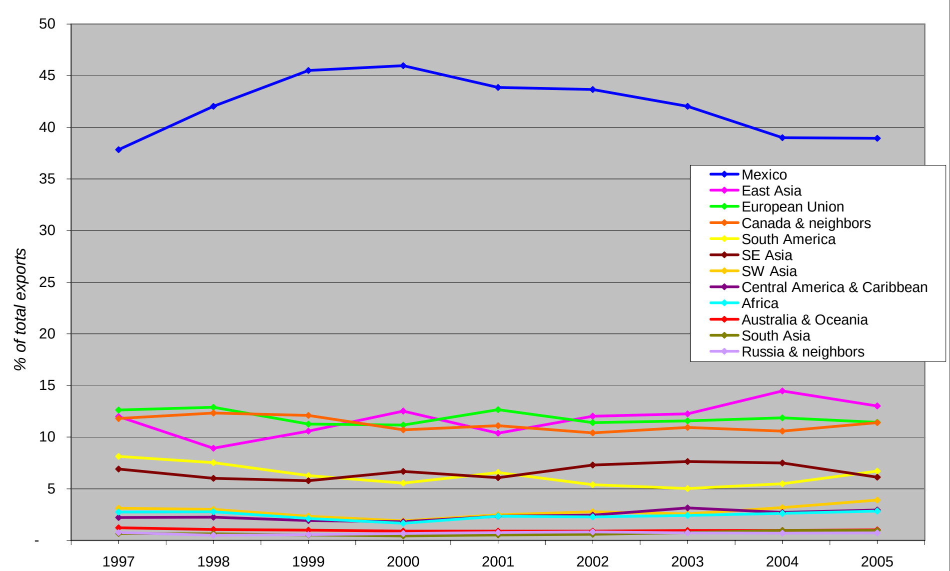
The raising oil prices that followed the 2001 economic recession seem to be recreating the short-term boom scenario of the 1970s, when re-capitalization of oil-related activities was done at the expense of medium- and long-term growing investments like information. The obvious questions, beyond the scope of this dissertation, are how well prepared is the state's economy to face the end of another oil boom, and how the global role of Texas cities will be affected in the aftermath. A big portion of the answer will certainly lie in their degree of diversity, capacity to readjust, and global connections of the cities of the Texas Urban Triangle.

<u>3.6 Texas, its metropolises and the global economy</u>

Previous sections covered the demographic and economic growth of Texas. This section discusses some aspects of the state economy in an international context, how the main cities of the TUT operate as corporate centers, and how they are linked to the rest of the world.

Texas has been one of the most important export-oriented state, and after surpassing California in 2002 it become the top exporting in the United States (WISERTrade 2006a). exhibit 3.3 in the Appendix shows total value of exports, ranking, and share of total export for all states plus the District of Columbia in 1997-2005. During this period Texas was the only state to increase its share of national exports by more than one point, rising from 12.4% in 1997 to 15.3% in 2005, a net gain of 2.9%; this figure was larger than the whole share of 42 states (Pennsylvania, ranking 9th in 2005 by value of exports, had a share of just 2.7%). Texas' share gain was unique by its size, but did not follow any regional pattern, since there are states gaining or losing shares all over the country.

The destination of Texas international exports over the period 1997-2005 (WISERTrade 2006c) is represented in Figure 3.8. Overall exports within the North American Free Trade Agreement (NAFTA) area have accounted for about one half of the state exports. Mexico has been clearly the top destination, with a share of the total value to 40%; this share peaked in year 2000, when it reached 46%, but has been slowly declining since then. Far from Mexico there is a group of three regions with shares between 10 and 15%, East Asia, European Union and Canada & neighbors, the former showing a clearer trend for share increase. South America and Southeast Asia had shares between 5 and 10%, and all other regions below 5%.



Notes: Canada & neighbors includes Greenland and St-Pierre; European Union includes full and associated members, and countries negotiating admission; Russia & neighbors includes other former Soviet republics in Eastern Europe and Central Asia.

Sources: WISERTrade and U.S. Census Bureau, Foreign Trade Division.

Figure 3.8. Destination of Texas exports by region, 1997 - 2005

Texas exports have been primarily based in five sectors: computer and electronic products (24.2% of the total value in 2005), chemicals (19.2%), machinery except electrical (12.8%), transportation equipment (10.8%), and petroleum and coal products (6.9%). In aggregate these sectors accounted for 74% of the state exports (detailed figures in exhibit 3.4 of the Appendix). But the most recent figures (1997-2005) showed increases in the shares of chemicals, and petroleum and coal products (net gains of 2.9% and 3.1% from 1997 to 2005), and declines in the share of computer and electronic products, machinery except electrical, and transportation equipment (net losses of 0.9%, 2.0% and 0.5%, respectively).

To place these figures in a broader context it is necessary to stress that, in spite of the significant increase of Texas exports, the relative importance of exports in the state economy is decreasing. Based on figures from USBEA and WISERTrade, it is apparent that the value of exports amounted to 12.7% of the Texas GSP in 1997, but falling to 10.9% in 2000, and 9.4% in 2005 (USBEA 2006b and WISERTrade 2006b). In spite of its leading role in international exports, the economy of Texas is becoming increasingly oriented to the national economy.

Previous figures represented the state economy and economic sectors in aggregate, independently of corporate size and location. A good grasp of the relevance of large corporations, a recognized driven force in the processes of economic globalization, as discussed in the literature review, is provided by data on the number, ranking, location of headquarters and activity of Texas corporations available in the top 500 lists published by Fortune and Forbes. These economic magazines are specifically oriented to the private corporate sector, each which publishes comprehensive annual rankings of the largest corporations in the United States and the world. For this exercise, corporations analyzed have made the top 500 American by sales in the 1985, 1995 and 2005 issues are analyzed (data always refer to the previous fiscal year). Lists from both magazines were consolidated, and in cases of major discrepancies selected the figure more consistent with performances in the previous and next year. Aggregate sales, even though was not the best variable, was used because it provided the only data set covering the whole period. Using American top 500 of Global top 500 made no major difference since domestic and international sales are not discriminated, the former list only having a larger number of Texas companies.

The number of Texas-based corporations listed among the top 500 in the country in 1985, 1995 and 2005 is shown in Table 3.9. Both the increase in their number (with a net gain of 12, an increase of 33.3% between 1995 and 2005), and their progressive progress towards the top of the ranking are noticeable. In 1985 the largest corporation in Texas (Shell Oil) ranked 18th in the nation, but in 1995 the largest (Exxon) ranked 3rd, and in 2005 the largest corporation in Texas and the nation was the same (Exxon Mobil).

Table 3.9. Number of Texas-based corporations in the top 500 largest U.S. companies

rankings	*1985*	*1995*	*2005*
Top 10	-	1	2
Top 20	1	1	2
Top 50	3	3	6
Top 100	6	6	10
Top 200	16	13	19
Top 500	39	36	48

Notes: Rankings were based in sales as reported to Fortune and Forbes.

Sources: Fortune and Forbes magazines.

The headquarters of these Texan corporations are listed in exhibits 3.5a through 3.5c of the Appendix, and from their analysis, major conclusions are apparent. Firstly, there were very few corporations located outside the TUT in 1985, and none in 2005. Secondly, the number of corporations based in Dallas and Houston did not change much from 1985 to 2005 (18 to 19 and 17 to 21, respectively, even though both with a setback in 1995). Thirdly, there is an increasing relevance of San Antonio and Austin, both in the number of corporations from 1985 to 2005 (0 to 3 and 2 to 5, respectively) and at the top of the rankings: in 2005 one corporation from Austin and two from San Antonio were in the top 50. There was also a trend for suburban locations, already noticeable in 1995 around Dallas (especially to Irving and Plano), and in lesser extent in Houston (The Woodlands).

An industry to industry comparison is made difficult by the constant changes in the classification systems used by both magazines. But it was possible to identify three major trends. First, consistent with state trends, there is an increasing relevance of corporations related to oil and natural gas, and to a lesser extent to electronics and information.

The second major trend relates to banking. Texas-based banking corporations disappeared from the lists (from five banks in 1985 to none in 2005), evidence of a progressive absorption by corporations based outside the state. There have been other signs that the financial sector has weakened, namely the dramatic reduction of the assets of all insured commercial banks in the leading financial counties. Total assets in the state peaked between 1985 and 1997, and have been declining since then, a trend due to reductions in the Texas-based assets of national banks (DMN 1987, 1992, 1998, 2002, 2006). Total assets in Dallas County went from $75.3 to $13.6 billion in 1996-2004, in Harris County from $48.7 to $ 18.5 billion in 1984-2004, in Bexar County from $31.1 to $12.5 billion in 2000-2004, and in Travis County from $6.8 to $0.2 billion in 1984-2004.

Finally, when comparing manufacturing in Dallas and Houston, there has been a consistent trend for specialization in consumer-oriented products in the former, and in industry-oriented products in the latter. This can be explained by the higher diversification of Dallas' economy and the larger size of its economic and trading areas (FCC 1994, 1997), and by the large seaport and the high specialization on oil and gas-oriented sectors in Houston.

The previous discussion leads to a first impression that cities of the TUT do not exhibit the traits identified as typical of world or global cities, and therefore would neither play an influential role in the ongoing processes of economic globalization, nor have strong links with major international urban centers. Some work on the linkages between Dallas and Houston and other major business cities worldwide has been done by Peter J. Taylor (2001b, 2003) in the context of his work on hinterworlds. He coined the concept to refer to the spread of a city's hinterland across the world, leading to spatially discontinuous patterns of inter-relations in the provision of advanced producer services, more aptly defined by the strength of the linkages than by spatial extent or distance.

Having measured the connectivity between every pair in a set of 123 major cities through the presence of local offices of selected advanced services providers, Taylor proposed that all linkages of a city could be evaluated based on an average calculated through a regression process. For each city connectivities with the other 122 cities were regressed against their global network connectivity (2004), and the resulting positive residuals would identify stronger linkages (overlinkages) and negative residuals weaker linkages (underlinkages). The hinterworld of Dallas and Houston in 2000 as mapped by Taylor (2004) is represented in Figures 3.9 and 3.10 (see exhibit 3.6 in the Appendix for key to city abbreviations); for each city overlinkages and underlinkages were identified, as well as the top 10 and top 30 connections within each group.

In both maps the most noticeable common trait was the much stronger connections both cities have with other American cities (9 of the top 10 for Dallas, and 10 of the top 10 for

Houston) than with the rest of the world. This finding is completely consistent with empirical evidence and the major trends identified in the Texas economy.

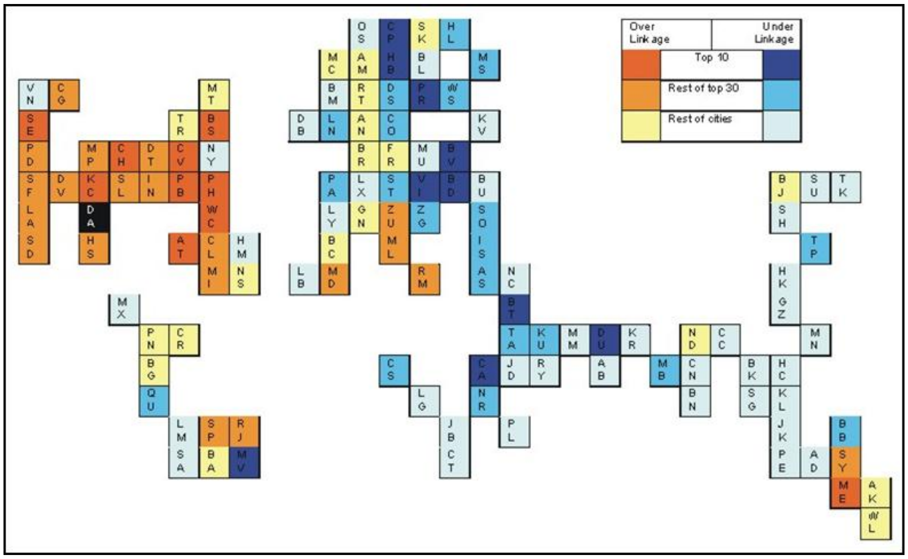


Figure 3.9. The hinterworld of Dallas (from Taylor 2004, Atlas of Hinterworlds)

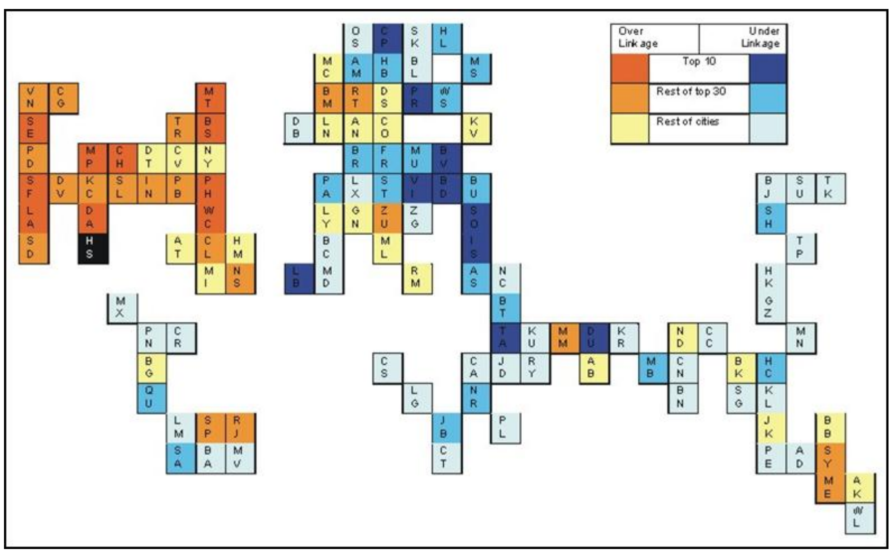


Figure 3.10. The hinterworld of Houston (from Taylor 2004, Atlas of Hinterworlds)

Interestingly both cities also had relatively weak links with New York, and very strong links with Washington and Philadelphia. But that is the end of similarity. Within North America, Dallas had relatively stronger links with cities in the Great Lakes and Southeast, while Houston has stronger links with the Pacific Coast, New England and Canada.

But arguably the most interesting (and intriguing) trait of Dallas and Houston hinterworlds was the relatively weak linkages of both cities to New York, London, Paris and Tokyo, the places generally identified as the world and global cities of highest order, and comparatively much stronger linkages with other cities in the same parts of the world.

Both cities also have significant overseas connections, but showing contrasted patterns. There are a good number of common traits, especially overlinkages with Brazil, Australia (Melbourne was even one of the top 10 overlinkages for Dallas), and Zurich, and underlinkages with Central and Eastern Europe, Africa, South Asia and Japan. With regards to major differences, Dallas was relatively better connected to Latin America, Southern Europe and China, and Houston to Northern Europe, the Middle East and Southeast Asia.

From the hinterworld maps it was not possible to argue whether the two Texas cities were bypassing or being bypassed by the dominant global city hierarchal processes, or even both. Identifying which global role is actually performed by Dallas and Houston is not an easy task.

3.7 Research questions

In a global context, the economy of Texas is large, surpassed in terms of gross domestic product by just eight nation states other than the United States: Japan, Germany, United Kingdom, France, China, Italy, Spain and Canada (World Bank 2006 and USBEA 2006b). But this relevance is not reflected in the relative position allocated to Texan cities in studies of global cities hierarchy, such as those published by prominent authors like John Friedmann, Saskia Sassen, Peter Hall, Jonathan V. Beaverstock and Peter J. Taylor. Friedmann (1986) considered Houston a secondary city within the world economic core, while Sassen (1994/2000) and Hall (1999) did not include Texas cities in their lists of most relevant global centers. For Beaverstock *et al.* (1999) both Dallas and Houston were identified as “Gamma World Cities”, the third hierarchical level of their classification system. And Taylor *et al.* (2002b) elaborated a map (see exhibit 3.7 in the Appendix) using a composite index based on the office location patterns of upper business services, where the two largest Texas cities showed lower connectivity than about fifty cities, including Montreal, Budapest, Kuala Lumpur and Auckland.

This mismatch between a city-based and a strong and specialized state economy trading above the American average with other parts of the world leads to the first research question:

1) Are the key sectors of the Texas economy little or less relevant in the processes of economic globalization that have been observed over the last decades? And consequently, is the role of the major cities of the Texas Urban Triangle of little relevance in these processes?

A good number of American cities also appear at higher or comparable position in world and global city rankings. Beaverstock *et al.* (1999) classified New York, Los Angeles and Chicago as Alpha world cities, San Francisco as a Beta world city, and Atlanta, Boston, Miami and Washington, like Dallas and Houston, Gamma world cities. The latter four cities also presented connectivities, as measured by Taylor *et al.* (2002b), comparable to Dallas and Houston. Thus at the national level Texan cities also rank lower than the relative size of their state's economy. This second mismatch leads to a second question:

2) Are the economic sectors considered as most significant in the processes of economic globalization underrepresented in the TUT metropolises (and the TUT as a whole) when compared to American global cities like New York, Los Angeles and Chicago, and to major urban regions like the Northeast Atlantic and California?

Most empirical discussions on global city status have been based on lists of field offices of major corporations offering upper business services. It may be the case that for many large corporations having offices in more than one Texas city would lead to some redundancy, since at the global scale intra-state distances are relatively small. Actually evidence shows that units of polycentric urban regions treated separately in empirical studies tend to score lower than primate cities. The cases of the Rhine-Ruhr in Germany, Randstad in The Netherlands, and Northern Italy as treated by Beaverstock *et al.* (1999) and Taylor *et al.* (2002d) provide good illustration.

If the Texas Urban Triangle operates like a large functional region, it seems logical that its components would show relatively lower levels of connectivity with other major cities worldwide if the major criterion is the existence of specialized field offices. The need to address the internal connectivity within the TUT leads to the last question:

3) Are the connections between the vertices of the TUT equally or less relevant than their connections to other American global metropolises?

CHAPTER IV

RESEARCH METHODOLOGY

Prediction is very difficult,
especially about the future.

Nils Bohr, Physician

4.1 Introduction

The research questions to be tackled in this dissertation are centered in two major issues: one deals with the relevance of Texas metropolises in the ongoing processes of economic globalization, the other with how to define the Texas Urban Triangle, i.e. either a group of cities that history placed within common administrative boundaries or a group of cities operating as a functional unit at the global scale.

One the major problems faced by every author discussing globalization processes is the lack of relational data, forcing most analyses to rely on attribute data (Short *et al.* 1996; Hall 2002; Short 2004; Derudder and Wilcox 2004). Ideally a discussion of urban hierarchies should be addressed by analyzing flows between pairs of cities, but data is rarely collected in this way, and when existing data sets are generally confidential, fragmented and not standardized.

A major part of the problem derives from data collection priorities. Most statistical data within public access is collected by national organizations, funded by the respective national government, and thus tied to national boundaries, and following different goals, schedules and standards from country to country (Short *et al.* 1996). The most evident consequence of this system is that existing data is very seldom comparable. And, in the specific case of economic globalization, a process where transnational corporations are playing a primary role, most corporate data available to the public is rarely comprehensive.

4.2 Measuring global headquarters city roles

The first research question in this dissertation requires to analyze the relevance of different economic sectors in the process of globalization, in order to discuss which role the key economic sectors have in the TUT cities. For this purpose data from lists of the 500 largest transnational corporations in the world in selected years was extracted and analyzed.

Transnational corporations have been considered as the single most relevant element of the contemporary global economy (Hall 1966; Dicken 1986/1992, 1998/2002; Knox and Agnew 1994; Klier and Testa 2002). But this area of study still lacks a wide theoretical background, and keys issues like the different role of corporations acting in different economic sectors, the structure of corporate power and different roles performed by head offices and field offices have been insufficiently discussed; actually, far more has been asserted than demonstrated (Short *et al.* 1996).

The concentration of corporation headquarters as a key variable to discuss the importance (or ranking) of urban centers has a long tradition in geography (Hymer 1972; Heenan 1977; Cohen 1981; Friedmann 1986). More recently, and within this context of discussions on globalization, two major methodological approaches can be found in empirical literature: in one lists provide data to build numerical indexes expressing centrality, connectivity or interdependence (Meyer 1986; Beaverstock *et al.* 1999, 2000b; Taylor *et al.* 2002c; Taylor 2003), while in the other lists are used to provide figures like head office counts or aggregate business in order to establish simple rankings (Sassen 1994/2006; Short *et al.* 1996; Shin and Timberlake 2000). But this distinction is a little deceptive, since both approaches are solidly grounded in one of the oldest theories in contemporary geography, central place theory. One of the key assumptions of this theory states that there is a direct relationship between the hierarchical level of a city and the variety of functions and number of providers found there; in other words, cities higher in the hierarchy have more and more varied functions (Bradford and Kent 1977, Pacione 2001/2005).

Central place theory was advanced by German geographer Walter Christaller (1933/1966, 1950) to explain regularities in the relative location of urban centers and the extension of their market areas. A major shortcoming in his own and his followers work has been the relatively static nature of their constructs, almost comparable to a Paretian equilibrium, neither providing some explanation about how existing urban centers attained their hierarchical arrangement, nor discussing how such hierarchy could change over time. There was also an excessive focus in finding an ideal geometric equilibrium, and subdividing a two-dimensional territory in vertically organized and well-bound market areas, and little concern for horizontal relationships or processes bypassing borders or intermediate hierarchies (Abler *et al.* 1971; Pacione 2001/2005; Benko and Scott 2004).

Central place theory was very popular within the positivist paradigm of the third quarter of the twentieth century. Several authors addressed its lack of a temporal component, and found that major interdependences between cities were self-reinforced and tend to persist over time, but change in city orders was still possible (Parr (1973; Pred 1977; Berry and Parr 1988). The theory was also widely applied in regional planning, especially in Europe, were was used to decide the location of urban settlements in the new Dutch polders (van Hulton 1969), select the regional centers that should counteract the excessive influence of Paris over the whole France (Lajugie *et al.* 1986), or outline the new economic regions of England after World War II (McCrone 1969). But central place theory quickly lost popularity in geography as other approaches and qualitative methods gained momentum in the 1980s (Johnston 1971/1997; Benko and Scott 2004).

Globalization and the key role performed by a small group of large urban centers recovered the idea of urban hierarchies within a new context. The increasingly networked contemporary society discussed by authors like Manuel Castells (1989, 1996/2000) and David Harvey (1989) made the older hierarchical orders and rigid relationships outdated, but not completely unsuitable. Along this line, Peter Hall (2002) argued, as discussed in Chapter II, that the contemporary hierarchy of urban centers could fit relatively well in Christaller's old scheme if two major changes were considered: at the apex it is necessary to add at least two new categories, global and sub-global cities, to reflect contemporary processes at the world scale; and at the bottom, to readdress the need for the two lowest levels, which in contemporary economies do not seem to have any meaningful role. Ben Derudder and Frank Witlox (2004) went even further, arguing that world-city formation represents a qualitative shift requiring much deeper revisions of central place principles, and identified three main areas to be altered: first, the need to integrate the new information flows that are reshaping the global economy; second, to revise the concept of hinterland, which is no longer neither contiguous nor clearly bounded; and third, to clearly identify the areas where hierarchy and functional specialization do not necessarily overlap.

Saskia Sassen's analysis (1991/2001) of New York, London and Tokyo as (the) cities at the top of the global hierarchy and her theoretical approach of global city status based on the relevance of their advanced services (1994/2006) were quickly integrated in the mainstream of world city research. Sassen (1991/2001) used a variety of data to prove the high relevance of those three cities in advanced services provision as well as the whole economy; but considering they have been both the largest cities and financial centers of three of the largest and most advanced economies in the world for many decades, it would be very likely that almost any economic indicator unrelated to the primary sector, before or after the current wave of globalization, would have found these cities at the top of the hierarchy. This is consistent with existing empirical literature (Parr 1977; Berry and Parr 1988).

Even on the growing relevance of advanced services in modern economies, it remains to be determined to what extent this is part a long-term trend found in contemporary economies and marked by the increasing share and specialization of services, and which portion can be directly related to specific global(izing) economic processes. As Eric Slater (2004) correctly stressed, much empirical work on global cities has been based on widely accepted assumptions rather than on confirmed hypothesis. Insufficient discussion on fundamental differences in the roles of New York, London and Tokyo has also encouraged arguments based on reductionism and convergence – the more similarities other cities would have with these three centers, the more representative they would be of the emerging post-industrial economy, and thus closer to the top of the global city hierarchy (Sassen 1991/2001).

Answering the first question of this dissertation will contribute to fill some of the existing gaps in the literature. Temporal data on corporation business, little used in global cities research, will enable firstly to identify which segments of the world economy have been more influential in the ongoing globalization processes, and secondly to address the relevance of these segments in specific cities, including the metropolises of the TUT.

Data availability and its relevance

To identify the segments of the world economy having played a relevant role in the globalization processes five lists of the 500 largest corporations in the world were elaborated, one every five years, covering the twenty-year period from 1984 to 2004. Data was obtained from secondary sources, lists published by *Fortune* and *Forbes* magazines on an annual basis.

Even though there is some debate about the beginning of the ongoing wave of economic globalization, there is wide consensus that by the late 1980s it had emerged as the dominant set of processes in the world economy (Sassen 1994/2006, Holm and Sørensen 1995; Aslund 2002; Short 2004), especially after the collapse of the Soviet bloc in 1989. Foreign direct investment started rising sharply since 1986, led by a wave of cross-borders mergers and acquisitions (UNCTAD 2005a). Thus, data from 1984 can be used as reference, representative of a period prior to the intensification of these processes.

The empirical relevance of this group of 500 larger companies is unquestionable. By 2004, the total sales of the top-ranked corporation (Wal-Mart Stores) exceeded the GDP of all but the largest twenty national economies in the world, and the sales of the 500th ranked company still exceeded the GDP of more than eighty nations (refer to exhibits 4.1, 5.2a and 5.2b in the Appendix). Even more significantly, the aggregate sales of the top 500 companies were comparable to almost one third of the world economy, and this share has been growing. In 1984 the total sales of these companies was equivalent to 25% of the global GDP (measured by purchasing power parity), and since 1994 this figure has been above 30%. And, when comparing the same figures to the American GDP, the corresponding proportions were 118% in 1984 and 143% in 2004 (see Table 4.1). Detailed analyses must be taken with caution because the two variables (sales and GDP) have a different nature, sales is a variable with significant limitations to evaluate corporations, and there are alternative ways to calculate GDPs. The major point is that these figures show conclusively that the business generated by the top 500 corporations has been a very significant portion of the global economy.

Table 4.1. Global 500 corporations business compared to US and global GDP, 1984-2004

Year	*Top 500 sales*	*World GDP*	*US GDP*
1984	**6,830.0**	**27,082.4**	**5,813.6**
1989	**9,167.2**	**32,559.7**	**6,981.4**
1994	**11,408.9**	**36,302.2**	**7,835.5**
1999	**13,146.3**	**43,078.5**	**9,470.3**
2004	**15,397.2**	**51,273.1**	**10,755.7**

Note: Sales and GDP expressed in millions of 2000 chained US $.
Sources: United States Bureau of Economic Analysis, World Bank and Maddison (2003).

Using *Fortune* and *Forbes* lists as sources has obvious advantages, but also some limitations. Both publications have a solid reputation in the market, a world circulation of close to 1 million each (Fortune 2006a; FDD 2006), and target primarily large corporations and as well as a specialized niches in the financial area. A good position in these lists brings prestige and increases market awareness, while not appearing immediately raises questions among stockowners. Therefore it is in the best interest of every large corporation to answer the surveys with the required information; consequently, the lists are relatively comprehensive and reliable.

Conversely, *Fortune* and *Forbes* lists are no more than rankings of companies based on a few variables at a given point in time. *Fortune*'s rankings are based on the total volume of sales, even though other information is also reported; *Forbes* has used different criteria over time, but evolved to rankings now based on a combination of four variables (sales, profits, assets, and market value). From year to year companies can appear or disappear, move up or down from the lists based on the improvement or decline of their performances, but also due to one-time events like splits, mergers, acquisitions or even bankruptcies. Relevant changes in one list can happen without any variation in sales – for instance, if two top 500 companies merge they will leave one free slot for another company to move into the list; or a merge between companies ranked say 520 and 550 will bring the new company into the top 500 list and automatically exclude the bottom ranked one.

Overall, and due to their nature, *Fortune* and *Forbes* lists are representative of the economic activities typically carried out by the largest corporations, as earlier discussed considered as the most active actors in the process of economic globalization, but not representative of the whole economy. They are indicative of major trends and reorganizations happening at the top of the corporation rankings, but have a more limited value for detailed analyses on the overall performance of specific economic sectors or urban units.

Data availability also conditioned some research decisions. The size of the list was determined by the publishers' format, 500 being the number of firms traditionally reported by *Fortune* as early as 1955 (Short *et al*. 1996). Sales was the sole variable available both for the whole study period and all types of companies (including domestic and international), and consequently other relevant information like total assets, profits, stockholder appreciation and number of employees had to be disregarded. The size (number of companies reported) and organization of these lists varied over time, earlier with companies reported separately according to geography (American or foreign) and typology. For example, as recently as 1990 *Fortune* was publishing a consolidated list of the top 500 U.S. industrial corporations, and at the same time much shorter lists for foreign diversified services, commercial banking, diversified financial, savings, insurance, retailing, transportation companies and utilities. These changes in reporting made impossible going back on time farther than 1985, because earlier listings for some types of activities were not long enough to generate a comprehensive and reliable list with 500 corporations.

Data management

Data reported in the *Fortune* and *Forbes* lists generally refers to the previous fiscal year; in a few cases when is not available estimates or older data could be used. Data for 1984, 1989, 1994, 1999 and 2004 was found in issues published the following year. In both magazines lists of American companies are published by the end of the first quarter of the year, followed by lists of the largest global companies by mid-year, generally between June and August.

Fortune lists of global companies (Fortune 1985b, 1990b, 1995b, 2000b, 2005b) were selected as the primary source for this study, considering that they are based on total sales. But they were complemented by information collected from *Forbes* (Forbes 1985b, 1990b, 1995b, 2000b, 2005) and from lists of American companies also published in both magazines (Forbes 1985a, 1990a, 1995a, 2000a; Fortune 1985a, 1990a, 1995a, 2000a, 2005a). For instance, when a company with a significant volume of sales was found in another list but not reported in *Fortune*'s Global 500, it was added to the study list. In a few cases the amount of sales reported in *Fortune* and *Forbes* was different; in such instances, and when it was not possible to clarify the discrepancy, data reported in the former was retained. When the consolidation of the all lists was completed, companies were ranked by sales and only the top 500 kept for further analysis.

For each company sales data was complemented with the location of the head office and type of activity. When this information was not available, it was obtained (and confirmed) through searches in industry directories, both printed and online, namely Hoover's, Global Reports, ThomasNet, EDGAR (U.S. Securities and Exchange Commission Filings & Forms database) and CorporationInformation.com. In a few cases missing data was collected through internet searches. In those cases where a company was being renamed or expanding through acquisitions data was kept under the same record. Only in those cases were mergers originated a completely new company or the corporation headquarters moved to a different urban area data was entered under new records.

For the purpose of this study the location of regional and field offices was not considered. This is consistent with work done by leading authors (Friedmann 1986; Short *et al.* 1996; Sassen 1994/2006) where head office location was a major criterion to identify global urban hierarchies. This is even consistent with work on the location of offices of international advanced services firms where office hierarchy was most relevant and head office locations received the maximum weight (Beaverstock *et al.* 1999; Taylor *et al.* 2001; Taylor 2003).

The information collected on head offices included the city, country, and when available the zip/postal code, the latter to assist if several places with the same name were found in the same country. Each city was then located in a map and, case by case, verified if it is part of a larger urban region. Ideally, and concurring with Peter Hall (2001), urban regions should be defined in terms of internal linkages, a process practically impossible due to insufficient data on flows and a diversity of standards and formats. Thus, in the context of this study the term 'urban region' refers to an area larger than (and containing at least) a metropolitan area but smaller than a megalopolis, extending outside a major city over a radius of about 100 miles, and generally served by an international airport. This simple operational definition is consistent with discussions on the extent of modern urban units made by leading authors (Friedmann and Miller 1965; Hall 1966; Sudjic 1992), and even with empirical evidence like the discount air traffic routes serving London through Luton and Frankfurt through Hahn (O'Connor 2003). Short *et al.* (1996) also argued in favor of the aggregation of places within the same urban unit based on distance and contiguity, but were inconsistent in its empirical application, by performing aggregations for some American urban regions like San Francisco and Los Angeles while failing to identify places like Dearborn as a suburb of Detroit, or Courbevoie, Boulogne-Billancourt and Puteaux as suburbs of Paris. Using this definition through an exhaustive process of spatial aggregation, places generally included in recognized urban regions like the Rhine-Ruhr, Randstad Holland and Kansai (Beaverstock *et al.* 2000a; Kloosterman and Musterd 2001; Parr 2004) ended within the same urban region. For consistency with criteria already discussed for Texan metropolitan areas, each urban region will be referred by the name of its largest city or business center; for instance, San Francisco is used as a surrogate for the Bay Area or the San Jose-San Francisco-Oakland Consolidated Metropolitan Area, Amsterdam for Randstad Holland, Osaka for Kansai, and the like.

Criteria used by *Fortune* and *Forbes* to classify corporations and/or to allocate them to types of activities have changed widely over time. The general trend has led to an increasing number of categories, partly due to the growing of specialization in some industries, and partly to the emergence of new economic activities (especially those linked to new technologies and information). In order to compare data for the selected years but classified in varying ways, it was necessary to standardize this information and reduce a too long list of categories. This process involved a comprehensive listing of the types used in both magazines over time, and their consolidation in a fewer number of classes by analogy. To avoid conflicting terminologies in this text, the classes originally used by *Fortune* and *Forbes* will be referred as ‘categories,’ those resulting from the grouping of these categories will be referred as ‘types of activities,’ and the expression ‘economic segments’ will refer to subdivisions of the economy used by statistical organizations like the U.S. Bureau of Census or the U.S. Bureau of Economic Analysis.

The most common problem in the grouping process was the lack of a description for very general designations like ‘Consumer Products,’ ‘Materials’ and ‘Miscellaneous-Other;’ in such cases it was necessary to reassess the category by looking at the corporations it contained, and in even researching firm activity case by case. Frequently data obtained by crossing different lists provided valuable complementing information. Conversely, some complicated groupings involving categories like ‘Textiles’ and ‘Rubber & Plastic Products’ became unnecessary because none of their companies had enough sales volume to be included in the top 500 list.

The allocation of firms to types of activities was complicated by two reoccurring problems. Firstly, some corporations provided conflictive classifications of their activities from one year to another. In such cases the most recent answer was selected, unless it was completely inconsistent with the majority of the responses provided in previous years. And secondly, it was difficult to allocate large conglomerates covering multiple activities to one single type of activity. When the listed information for these companies was insufficient, their classification was decided through case by case research and finding which activity had the largest contribution to the total revenue. A detailed list of categories used by *Fortune* and *Forbes* during the study period and how they relate to the types of activities defined for this study is provided in exhibit 4.2 of the Appendix. Through this process the original list of 155 categories was consolidated into another one with 25 types of activities.

Once all the information was collected company counts and total sales volumes were calculated both by type of activity and urban area for each study year (1984, 1989, 1994, 1999 and 2004). Each figure was then compared with the total for the respective variable and year, and transformed into a share. The use of shares as an alternative to dollar figures presented the advantage of not requiring the transformation of current dollars, which can not be directly compared from year to year, into chained dollars. Temporal sequences of shares were analyzed in order to identify major trends, both in terms of sales volume by type of activity and concentration of head offices.

Most empirical literature previously quoted did not go beyond simple corporation counts, a process allowing very limited analyses because does not consider the contrasted sizes of corporations in the top and the bottom of the lists. For instance, in 1984 the top company had a sales volume 26 times larger than the one ranked 500th, and in 2004 it was 23 larger. Using total sales totals, a method used by Sassen (1991/2006) provides valuable insights on the both the relative importance of activities and corporative locations over time.

4.3 Comparing urban economies

The first question was tackled using a functionalist approach, first by identifying key economic segments, and then applying measures of frequency (number of headquarters, aggregate sales), and the relative significance of key types of activities in each city; in other words, the method emphasized differences and relevance to allocate relative positions to individual cities. But by identifying a significant degree of specialization all through global urban hierarchies does not automatically refute the possibility of some areas of convergence. Actually, any search for hierarchies or typologies implicitly recognizes that some areas of similarity must exist.

To complement the first question, the second deals with the fundamental issue – the role of Texas metropolises – by using a more empiricist methodology; having discussed the relevance of each type of activities in the ongoing economic globalization, comparing TUT cities with other major cities would allow identifying areas of convergence, and to what degree Texas cities are comparable or contrasted. The first problem here was, once more data; there is no international data set of any kind where data is collected at the urban level in comparable ways to analyze urban economies or urban employment. There is a wealth of data at the national level, and the amount decreases when descending to the following levels of administration, which seldom correspond to single urban areas. To complicate things, from country to country data tends to be collected in different ways and follow their own definitions. These data constraints limited here the scope of research to American metropolitan areas.

Comparisons with places outside Texas must focus on cities and regions already identified in the literature as global or world cities and regions. Several American cities have been present in every list of world or global cities found in the literature. And three cities, New York, Chicago and Los Angeles, have been regularly identified as being at the top the global urban hierarchy (Friedman 1986; Abu-Lughod 1995; Beaverstock *et al.* 1999; Taylor and Lang 2005;

Taylor *et al*. 2001, 2002a, 2002b, 2002d). These three centers, also the most populated metropolitan areas in the United States, have been found with the most relevant concentration of specialized business services.

Research using comprehensive variables has been scarce, and authors have tended to concentrate in specific sectors (Beaverstock *et al.* 1999; Taylor and Land 2005), or groups of variables purposely selected to be surrogates of the whole urban economy (Short *et al*. 1996), as discussed in the previous chapter. During the last decade two innovative pieces opened new research fronts: the first was the attempt to estimate urban GDPs, and associate them to the of labor superproductivity, areas where labor perform much better in specific areas (Prud'homme 1996a, 1996b); the second, the recognition that global cities may have multiple roles, opening the door to more flexible typologies (Taylor *et al*. 2002a). But so far limited work has been added in these directions.

A most interesting study was presented by Peter Taylor and colleagues in 2004, where the patterns of office location in a set of pre-selected companies of various sectors were measured and compared. The analysis involved the elaboration of a matrix of 123 cities by 100 companies, and then applying a principal component analysis to both the main and a rotated matrix. Through this method the authors could individualize six main components, each one characterized by a different arrangement of cities and activities. These six components can be summarized as follows:

- Component I, with a Pan-European emphasis, dominated by banking and law, articulated through Frankfurt and Munich, and to a lesser extent Berlin, London and Paris, and also having a significant presence in Eastern European;
- Component II, with a North-American emphasis, dominated by management consultancy, articulated through Chicago, and to a lesser degree Dallas, and also having a significant presence in Latin American;
- Component III, with a Pacific Asian emphasis, dominated by banking, articulated through Tokyo, and to a lesser extent Bangkok and Taipei, and also having some presence in South Asia and the Middle East;
- Component IV, with an emphasis on minor primate European cities, dominated by advertising, articulated through New York, and also having a significant presence in Eastern European;

- Component V, with a United States emphasis, dominated by law, articulated through New York and Washington, and to a lesser extent Los Angeles; and also having a significant presence in Pacific Asia; and
- Component VI, with a British Commonwealth emphasis, dominated by accounting, articulated through London.

It should be stressed that the initial selection of companies, by limiting the study to specific service sectors, obviously limits the results to that portion of the global economy. But the originality of this study was in the broader analysis of its empirical results, moving away from single measurements and rankings. The outcome reinforced the case of multiple globalization processes, by showing that the most relevant sectors have distinctive dynamics both spatially (different nodal cities and regional representation) and economically (their relationships with other sectors). Even the traditional trio of top global cities, had very contrasted roles, each being at the core of a different component (two in the case of New York) with different regional reach. New York was at the core of components based in advertising and law, reaching most significantly second-level European countries and Pacific Asia, respectively; Tokyo was at the core of a component based in banking and more relevant in Asia, including the Middle East; and London was at the core of a component based in accounting and more relevant in British Commonwealth countries.

The assumptions and data treatment found in this article were the base for the approach taken to answer the second question of this dissertation. It required comparing the relevance of key economic sectors in Texas' and other major American urban areas, and this was accomplished by dissecting and measuring up employment data per sector and urban unit, which then would be examined through a principal component analysis. By comparing the composition of local employment in Texas' and other American metropolises it will be possible to identify relevant contrasts and similarities at three levels: firstly, between the components of the TUT; secondly, between Texas and other American metropolises; and thirdly, between the TUT and other American urban regions.

Data availability and its relevance

Employment data at the metropolitan level has been compiled regularly by the U. S. Bureau of Census, discriminated by economic sector. This organization created an electronic database under the broad designation of CenStats (USBC 2006a) with annually updated information on employment counts and earnings. Until 1997 data were classified by the 4-digit Standard Industrial Classification (SIC), and disaggregated by state and county (1993-1997) and ZIP code (1994-1997). Since 1998, when the new North American Industry Classification System (NAICS) was adopted, data has been presented by state and county, ZIP code and metropolitan statistical area. This information has been published annually, with 2004 being the last dataset available.

Using CenStats data introduces some important limitations in the analysis. Firstly, both the SIC and NAICS are significantly different from the classification system used in section 4.1 to analyze Top 500 international corporations sales. In spite of this disadvantage, CenStats provides the most comprehensive and reliable datasets to tackle the second research question. And even though categories are not equivalent they still provide sufficient analogies to make broad comparisons and identify meaningful relationships.

Secondly, it was not possible to extend the analysis to the same 20-year period used in the previous section. The purpose of this study compelled the selection of metropolitan datasets, even though they were only available since 1998. Theoretically it would be possible to obtain metropolitan data for previous years by the aggregation of county data, but the earlier datasets were not comparable because of major structural differences between the SICS and NAICS classification systems. Data from both systems can not be compared due to both a large number of new categories created for the NAICS, and of SICS categories broken-down into segments further re-aggregated to different NAICS units (USBC 1998, 2001).

The CenStats datasets cover all the 361 metropolitan and 567 micropolitan statistical areas officially defined by the U.S. Office of Management and Budget (OMB) in 2004 (USBC 2006b). Using data for such a large number of units was considered as not meaningful in the context of this study for two major reasons: first, world and global city research relates to cities at the top of the urban hierarchy, which are fewer and generally large; and secondly, including a large number of small units would introduce an unnecessary amount of detail on places which are not players at the global scale, shifting results in their direction.

There is sufficient evidence that the largest cities concentrate more specialized and upper-level jobs, and this is clearly illustrated by the substantially higher average annual salaries found in metropolitan areas of higher ranking (see Table 4.2).

There is also a clear relationship between the relevance of different economic activities and the size of the metropolitan area where they are located (see exhibit 4.3 in the Appendix).

When analyzing 2004 employment data it is noticeable that a few NAICS sectors tend to be overrepresented in the largest metropolitan areas: Professional, Scientific, & Technical Services (37% above the all metro average), Information (24%), Educational Services (23%), Real Estate and Rental & Leasing (15%) and Wholesale Trade (13%). Finance and Insurance, Management of Companies & Enterprises, Administrative & Support and Waste Management & Remediation Services, and Arts, Entertainment, and Recreation also tend to concentrate in larger metropolitan areas, but do not show their highest share of employment in the top 5 centers. Transportation and Warehousing has a higher proportion of employment in medium-sized metropolitan areas. All other activities – Forestry, Fishing, Hunting, and Agriculture Support; Mining; Utilities; Construction; Manufacturing; Retail Trade; Health Care and Social Assistance; and Accommodation & Food Services – have employment shares above the average in smaller metropolitan areas.

Table 4.2. Salaries and establishment size per groups of metropolitan areas, 2004

metropolitan area population rankings	*employees per establishment*	*average annual salary*
1 – 5	15.8	$ 46,544
6 – 20	16.4	$ 40,638
21 – 50	17.1	$ 35,333
51 – 100	16.1	$ 32,374
101 – 305	14.6	$ 29,535
all metro areas	*16.0*	*$ 38,496*
all U.S.A.	15.6	$ 36,967
		Sources: U.S. Census Bureau, CenStats Databases.

This specialization of larger places is consistent with literature on world and global cities previously discussed. Consequently, from CenStats it was decided to extract only the data pertaining to the metropolitan areas with more than 1 million inhabitants – 53 according to the last population census. This reduced the number of spatial units substantially without excluding any major urban center, while keeping all four major components of the TUT.

CenStats data at the metropolitan level available includes the total number of establishments, mid-March employment, total first quarter and annual payroll, and number of establishments by employment-size classes by the first-two digits industry code. A sample showing the data and format of the datasets is shown in exhibit 4.4 of the Appendix.

Data management

Taking in consideration the twenty-year study period considered for this research (1984-2004), the methodological choice of using data for regularly spaced years (every five years from 1984 to 2004), and the reduced availability of NAICS data for the period 1998-2004, it was decided to focus the analysis on 2004.

In spite of its comprehensiveness, the CenStats datasets also presented some problems. The most important of them had to do with the need to keep the confidentiality of data in groups with very low frequency. As a result, information on segments with few establishments, irrespectively of their size, had to be totally concealed (when related to payroll a “0” was placed in the respective cell) or partially concealed (when related to the number of employees, ranges like “0-19”, “20-99”… and “100,000, or more” were placed in the respective cell). But this process also required the suppression of a few additional figures; otherwise the confidential information could be calculated by subtracting all other subtotals to the grand total. As illustration, out of the twenty NAICS two-digit classes, the 2004 information on payroll and number of employees was not provided for eight classes in Austin, two for Las Vegas, and zero (all data provided) for Chicago.

Concealed data was more frequent at both ends of the distribution, in sectors with very few small companies or very few large companies. In the case of concealed payroll figures, it is virtually impossible to come with reasonable estimates because all information is suppressed. But in the case of the partially concealed number of employees’ figures, it is possible to estimate the values for one city at a time by a combination of regression and algebraic systems of equations using the total “Number of Employees” (always provided) and the “Number of Establishments by Employment-size class”, which is disaggregated in 9 groups (0-4, 5-9, 10-19, 20-49, 50-99, 100-249, 250-499, 500-999, and 1000 or more). The total figures for each of the 20 NAICS two-digit classes in all metropolitan areas were used to determine best-fitting lines, one for each set of 9 points corresponding to an employment-size group.

Once having the average employment sizes within each group, overall and for each of the 20 classes, it was possible to multiply these figures by the number of establishments in the NAICS classes with concealed data and have a first set of estimates. Figures were progressively adjusted by reducing the thresholds of variation, taking in consideration the total Number of Employees and the number of establishments in each class. Preliminary estimates were made, one class at a time, starting with the class with the smallest range, and adjusting the other classes accordingly. Estimates were progressively readjusted until they all added up to the total Number of Employees in the city provided by CenStats.

This process allowed creating a matrix of 53 cities by 19 NAICS classes, after eliminating the last NAICS class, coded 99 and related to unclassified establishments, because there was no information on the nature of the activities. Once cleaned and completed, the data sets were ready to be analyzed by using a principal component analysis (PCA).

The selection of PCA for this step relates to three major reasons. Firstly, this technique provides a way to reduce extensive and complex matrices of potentially correlated variables into a small number of independent variables (the principal components), and consequently simplify its analysis. Secondly, the resulting dataset retains most of the variability of the original data. And thirdly, data processing is fully automated and easily performed by statistical packages, requiring minimal computational time (Joliffe 2002; Abdi and Valentin 2007).

PCA applies an iterative averaging procedure to identify one at a time the orthogonal direction of maximum variance in the original matrix, ensuring the solution is both statistically the most relevant and uncorrelated to every component previously identified (Bishop 1995; Abdi and Valentin 2007). PCA has been extensively used in geography, and especially to achieve four major general purposes (Johnston 1979): to reduce colinearity within data sets by eliminating redundant variables; to reduce the size of datasets by both keeping highly contrasted variables and eliminating some highly correlated ones; to identify common patterns by finding sets of inter-correlated variables; and to test alternative hypotheses by comparing the results obtained for slightly different datasets.

The technique has been widely applied in a diversity of urban-related topics and contexts. For instance, at the intra-city level, PCA was used to differentiate and classify smaller areas based on social characteristics (Townshend 1999), to recognize local variations in racial behavior (Dunn *et al.* 2006), or to identify significant changes in social life over time (Kitchen 2002). At the inter-city level, examples of research applications are the comparison between infrastructure provision in different cities (Arimah 2003), the comparison of cities' economic performances (Zhu 1998), and to find areas of interdependence within urban systems (Clayton 1980). At the intra-regional level, examples include the changing interactions between urban and rural areas (Lin 2001), characterization of migration patterns (Clayton 1977), and identification of newly urbanized areas (Liu and Lathrop 2002). At the inter-region level, PCA was applied to compare and find areas of interdependence between the economies of different spatial units (Gittel *et al.* 2000), analyze competition and specialization in a specific sector (Cuadrado-Roura and Rubalcaba-Bermejo 1998), and to identify major areas of sectoral articulation between world cities (Taylor *et al*. 2004).

For this study PCA was performed within the framework provided by SPSS (Statistical Package for Social Sciences), a comprehensive software package able to analyze large and complex datasets in very short periods of time. The 2004 data was run with the version of SPSS 13.0 for Windows, release 13.0 of September 1, 2004 (SPSS 2004), available at the Department of Geography of Texas A&M University.

In most software versions performing PCAs the output typically includes several sets of data, the most relevant being:

- a correlation matrix showing the correlation between each pair of the original variables;
- a list of the extracted principal components, the relevance of each one expressed by an *eigenvalue* (corresponding to the proportion of the original variation accounted by that component);
- a matrix of component loadings, showing the correlation between the original variables and the new components, which allows to measure the relevance ones of the former for each of the latter; and
- a matrix of score coefficients, representing the observations in each new component.

To complement this output, city scores were calculated for each metropolitan area and component by multiplying each of the component loadings by the corresponding area employment variables. To make comparisons easier, city scores were then standardized around the average, and expressed in units of standard deviation. In this way it was possible to discuss the level of specialization (having the 53-city dataset average as reference) of each component in each metropolitan area.

Additionally, by rotating the original matrix and running a PCA a second time it was possible to obtain the complete set of correlation coefficients between every city pair. Each coefficient provided a simple and direct measure of the degree of similarity between the employment structures of two cities, each one defined by the shares of total employment in the 19 NAICS segments.

4.4 Using air flights to measure inter-city linkages

Finally, the third question required an investigation of the connectivity of Texan cities, both between themselves and with other American and international metropolises, and this was carried out by the analysis data on air linkages and air passenger flows. Contrasting with the approaches taken in the two previous questions, this case was analyzed from a systemic point of view, identifying the existence of connections and intensity of flows between nodes of a network.

Passenger counts and air linkages have been some of the few readily available datasets enabling to discuss urban hierarchies through relational data (Beaverstock *et al.* 2000b; Smith and Timberlake 2001; Taylor *et al.* 2006). Additionally, figures on flows between city pairs allow comparing links and establish regional patterns and hierarchies. Two major types of datasets are generally available: one expresses traffic (supply side) and can be extracted from timetables; the other expresses volume (demand side), and provided in aggregated form by airlines, airports, government agencies, and international organizations. Traffic information is the most widely available, especially for commercial scheduled connections, but has the inconvenient of rarely being synthesized, thus requiring time-consuming aggregations. Volume information is expressed in number of passengers and weight of freight carried, and in this case the most common problem is just the opposite, excessive aggregation at the source.

The availability of direct flights and the number of passengers flying in or out provide reliable indication on how highly connected each city is with the rest of the world, and frequently considered as the most visible manifestation of world city interactions (Keeling 1995; Simon 1995). Air traffic is also a good indicator of changes in the connectivity of cities due to its relatively rapid capacity to reply, both in terms of supply and demand, to changes in the economic environment (Cattan 1995).

Especially influential in this area was the empirical work of David Smith and Michael Timberlike (1995, 2001), extracting global urban hierarchies through network analysis of passenger flows. More recently attention has been given to limitations of air travel data (Derudder and Wilcox 2005a, 2005b), which include difficulties in separating connecting from direct-flying passengers, the separation of domestic and international data, the lack of information on trip purposes, and double counting when using different airlines for segments of the same trip.

Data availability and its relevance

Figures on passengers circulating through major airports are collected on a regular basis and published by international organizations such as the ACI (Airports Council International) and the International Civil Aviation Organization (ICAO). The need to assemble comparable data from multiple sources restricts the amount of detail, especially in the number of variables and reporting airports. Most figures available refer to total passengers deplaned and enplaned in major civil airports, with in-transit passengers generally counted once. It must be noted that these figures do not allow for comparisons between destinations, since most large cities have more than one airport, and not all of them are reported.

Information on international passenger traffic in and out of the United States was collected by the Department of Transportation (DOT) from 1974 to 1994, and after 1995 also by the U.S. Department of Commerce, Tourism Industries (OTTI 2007). Data is collected from air carriers for each international flight into or from the United States and must includes the number of passengers by country of residence, destination airports, type of service (scheduled or charter), airline flag (U.S. or foreign), and passenger citizenship (American citizens and non-citizens); only for U.S.-bound flights originated in Canada data has not been not collected on a regular basis. Enplanement and cargo data can be extracted from the Air Carrier Activity Information System (ACAIS), a database that contains passenger boarding counts and all-cargo volume (FAA 2007).

The most comprehensive dataset for international travel involving American air gateways is available from the DOT (2006c) and focuses on revenue passengers leaving the country and their final destination, or entering the country and their origin. It includes complete passenger counts by airport, and the share of American and foreign travelers; additionally, the busiest airport links, with passenger counts also disaggregated by type of flight (scheduled versus chartered). Despite the lack of information on trip purpose (e.g. business, personal, pleasure), data has the advantage of counting all passengers, and not considering stops and flight connections. For this analysis were used figures for the whole year of 2005, involving gateways in the contiguous portion of the country.

Several federal organizations collect general data on domestic passenger traffic, namely the Bureau of Transportation Statistics (BTS), the Department of Transportation (DOT), and the Federal Aviation Administration (FAA). The most comprehensive set of figures on domestic revenue passenger traffic is available in the BTS database, were customized tables can be created online. Basic data is released monthly and include time period, origin and destination airports, distance, and number of passengers. Data on aircraft type, freight and mail volumes is also available, but was not considered in this study. Despite its comprehensiveness the data has an important shortcoming: since data is collected and reported by carrier, every trip made up of segments flown by different airlines (or airline alliances) is counted as many times as tickets were issued. But overall, it is the best and most comprehensive air passenger data source available.

Information on flight supply in Texas was also necessary for the final section of Chapter VII, where the effects of air transportation availability over time and space were investigated. Comprehensive information on scheduled commercial flights can be obtained from OAG (Official Airline Guides), a Chicago-based publisher that produces updated monthly guides widely used by travel agents. Data includes origin and destination airports, day and time (departure and arrival), airline and flight number, connections, number of stops, type of aircraft and type of cabins available.

Data on scheduled flights within Texas over a sample period of a week (April 24-30, 2005) was extracted from the OAG Flight Guide of the month (OAG 2005), and used to obtain the total number of flights in the week, average flying time, and average waiting time (to express differences in flight availability) in scheduled routes between airports pairs. The week of April 24-30, 2005, was chosen to avoid anomalies caused by holidays (or their proximity) and transitions between school semesters. For each pair of origin-destination airports the flights scheduled in the week and their duration were extracted from the OAG Flight Guide of the month (OAG 2005). With this information it would be possible to compare driving and flying times, as well as to combinations of both, in order to identify the fastest travel alternative using roads and commercial aviation.

Also for this portion of the chapter it was necessary a Texas map to be used in a GIS environment, as well as the location of airports with scheduled flights and related city centers. A shapefile with state and federal highways, mapped at 1:24000 and based on data from the federal Department of Transportation, was obtained from the Texas General Land Office (BTS 2000). Considering the relatively small number of airports (27 in 25 cities), both the addresses of the main passenger terminal and the town hall for every case were obtained by individual google searches.

Data management

Information on international and domestic travel was treated separately, despite the global focus of this study. Two were the main reasons: first, data came from two different sources, and there was no guaranty of being totally comparable; and secondly, domestic flights are far more reflective of market conditions following deregulation, but international flights are restricted by federal decisions based on market and policy considerations, as recently illustrated by the large number of bids for the awarding of a new flight to China (DOT 2007).

In aviation and tourism flights are generally defined as short-, medium- and long-haul depending on the distance and time in the air needed to travel between a pair of places (McGowan and Seabright 1989; Oster and Strong 2001; Goto *et al.* 2004; Fournier *et al.* 2005). It follows that every list with the destinations of these type must change from place to place. However, since the objective of this dissertation is to provide a general evaluation of the connectivity of places in the TUT and other United States gateways, it was used a simplified definition where all international destinations in the rest of North America plus Central America and The Caribbean where considered as short- or medium-haul, no matter the U.S. link, and all destinations beyond as long-haul. The first two categories were treated in aggregate, due to the relative proximity to some parts of the country (e.g. Toronto is surely a short-haul if the enplanement was in New York, but medium-haul if in Miami; the opposite happens with Nassau, Bahamas).

Since international passenger counts are available by airports pairs, some aggregations were necessary for multiple airport cities in order to obtain passenger flows between pairs of urban areas. In order to better discuss the relevance of Texas gateways, chartered flights, short/medium-haul, and long-haul linkages were discussed separately.

The most common measurement unit in the air travel industry is the RPM (revenue passenger miles), expressing both the volume of passengers and the distance traveled (Sinha 1999; Lapré and Scudder 2004; Liu 2006). In this way, differences between short and long linkages, and high- and low-traffic routes can be factored. But RPMs only allow comparing individual links, and having little meaning in analyses of gateways cities or air travel markets.

In order to perform comparisons with reasonable accuracy, a new type of measurement was proposed in this study. Passengers, flight distances and number of linkages in a network were combined in a single Air Connectivity Index (Ic_i) for each gateway i in a network of n gateways as follows:

$$Ic_i = \log\left[\left(\frac{\sum_{1}^{n-1} pm_{ij}}{d_{2005}}\right)\times\left(\frac{l_i}{l_{n-1}}\right)\right]$$

where the first fraction reflects the average number of passenger miles originated per day in gateway *i* over year 2005 (in other words, the daily passenger traffic and spatial reach of the airport), and the second equation the proportion of all gateways having received passengers originated in gateway *i* in the same year (a measure of overall linkage within the network). To simplify further discussion the results where standardized having as reference the highest index in the set (base 100). Alternative ways to measure the global relevance of U.S. gateways like total long-haul international passengers enplaned and number of linkages were embed in the index.

For the treatment of domestic flights it was necessary to consider the interaction between road and air transportation. If airports with more options (including more competitive prices) are within driving distance, passengers may consider bypassing their local airport and "drive to fly" (Pels *et al*. 2000; Fuelhart 2003). The graphic representation of the passenger enplanement and distance for all linkages obtained for 2005 from the BTS database were graphically represented in Figure 4.1. Arguably the most relevant conclusion from this graphic was the reversal of trends occurring at approximately 250 miles and 500 miles from the gateways: as distance increased, so also increased passenger enplanements; but after about 250 miles, the trend reversed drastically, and changes again by about 500 miles, when started a regular trend for slowly decreasing passengers over an increase in distance.

This threshold of 250 miles was very relevant, because it indicated up to what distance air transportation either was not profitable or had to compete with alternative forms of transportation. In the first case, when two gateways were close enough to allow a relatively short drive, commercial air routes were unnecessary or not competitive (e.g. Philadelphia and New York; Los Angeles and San Diego; Austin and San Antonio). In the second case, distance between gateways was still small enough to allow for competition from (and a split of passenger trips with) land transportation (e.g. Orlando and Miami; New York and other Amtrak stops in the Boston-Washington corridor; College Station and Houston).

Two operational concepts were introduced to assist in the analysis. The first was the 'top-upward linkage' of a gateway, being the destination having a higher connectivity index that receives the highest passenger traffic from the considered origin. In practical terms it corresponded to the stronger vertical link moving up in the gateway hierarchy. The analysis of top upward linkages provided a good indication of the hierarchical arrangement of gateways, since passenger counts tended to be higher to destinations with higher connectivity indexes. To deal with linkages below the 250-mile threshold (where driving to a larger and better linked air gateway was an option, either to take a flight or to end a short trip), a GIS query searched for other gateways with higher connectivity index by applying a buffer of that size; when some were found, the query also identified both the place at the shortest Euclidean distance, and the place with the highest connectivity index. The former corresponded to the closest alternative, the latter to the alternative within the buffer potentially offering more flying out options. When a place of higher connectivity within the buffer did not generate at least 20% more enplanements than the gateway being considered, such place was disregarded; this additional condition eliminated gateways of comparable size (and thus unlikely to offer many more linkages).

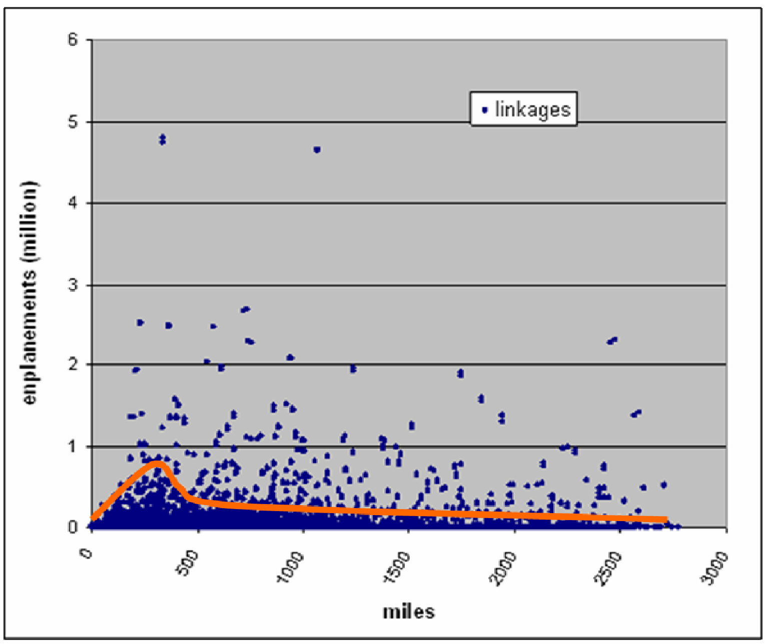


Figure 4.1. Passenger enplanements and distance for domestic air traffic linkages, 2005

Four types of key linkages were differentiated in this exercise, based on the distance between the origin and destination of each top upward linkage, and the existence of competing places of higher connectivity within the 250-mile buffer of a gateway. They were:

- Type A was the top upward linkage of a gateway when there was no relevant alternative drive-and-fly because either:
    - there were no places of higher connectivity within the gateway buffer, or
    - the end of the top upward linkage was within the buffer, and thus being the best short-distance alternative;
- Type B was the top upward linkage of a gateway where both the end of the top linkage was outside the buffer, and there were other places of higher connectivity within the buffer (thus driving and flying out from a better-linked place could be an option;)
- Type C was an additional linkage of a gateway reaching the place of highest connectivity within its buffer (the best option to drive to and then fly out;)
- Type D was an additional linkage of a gateway reaching the closest of highest connectivity within its buffer (a secondary option, when there several options within the buffer, and the highest-connected was not the closest).

To avoid duplications, when the same linkage could be classified as of several types, the highest type prevailed and any other was dropped. The existence of a Type B linkage always implied an alternative linkage, either Type C or more rarely Type D, to a place within the gateway's buffer. In some rare cases it was possible to have three types of linkages (B, C and D) originating from the same gateway. By identifying and graphically representing these linkages it was possible to produce a simpler map reflecting the hierarchical arrangement of significant air travel gateways in the contiguous 48 states. The same approach was applied to passenger data and flights within Texas, and a comparable map produced.

As a complement of the previous analysis, an exercise on the effects of air transportation availability over time and space in Texas was also performed. Data on in-state scheduled flights over a sample period of a week (April 24-30, 2005) was extracted from the OAG Flight Guide of the month (OAG 2005), and used to obtain the total number of flights in the week, average flying time, and average waiting time (to express differences in flight availability) in scheduled routes between pairs of airports. Two square matrices of 27 airports were produced, each cell reflecting the average time taken to fly between two cities, if necessary taking more than one flight; the first matrix had only flying times, the second flying times plus the corresponding average waiting times. This information was later used to identify time-space compression effects due to flight availability.

The time-space analysis of this study was performed through GIS operations involving four sets of data:

- a list of airports with scheduled flights during the study period (27 airports), including the addresses of their main terminal;
- a list of cities whose airport (or airports) had scheduled flights during the study period (25 cities), including the address of the city hall;
- the two matrices of flying time between airports, with and without average waiting times; and
- a shapefile with state and federal highways in Texas.

The first step involved the creation of a network dataset using the Texas highways map. Several steps were executed, in the following sequence:

1. a revision of the topology in order to eliminate unconnected arcs;
2. creation of a field TYPE where to place information on road type;
3. populate the field TYPE based on the formulas:

   If FCLASS = 1 or FCLASSS = 11 then TYPE = 1

   If FCLASS = 2 or FCLASS = 12 or FCLASS = 14 or FCLASS = 16 then TYPE = 2

   If FCLASS = 0 and LANES = 4 then TYPE = 2

   If FCLASS = 6 then TYPE = 3

   If FCLASS = 0 and LANES = 0 or LANES = 2 then TYPE = 3

   with this operation roads (arcs) were reclassified into three types;
4. creation of a field TIME where to place information on driving time;
5. populate the field TIME based on the formula:

   If TYPE = 1 then TIME = MILES / 70

   If TYPE = 2 then TIME = MILES / 60

   If TYPE = 3 then TIME = MILES / 50

   this operation calculated the driving time required to drive each road segment (arc) based on an average speed selected for each road type;
6. creation of a network dataset using the field TIME as the weight
   with this step the nodes feature class was created automatically;
7. creation of fifteen attribute fields called RDTIME_AU, RDTIME_CS, RDTIME_DL, RDTIME_HO, RDTIME_SA, FLTIME_AU, FLTIME_CS,

FLTIME_DL, FLTIME_HO, FLTIME_SA, FLWTIME_AU, FLWTIME_CS, FLWTIME_DL, FLWTIME_HO, and FLWTIME_SA

these attribute fields are to be populated with travel times later in the exercise.

At this point the location of cities and airports was added, using the three following steps:

1. address matching for the list of 27 airports addresses;
2. using geoprocessing to find the road node closer to each airport location;
3. creation of a feature class AIRPORT to identify the node for to each airport;
4. creation of an attribute feature AIRTOCITY to be populated with the driving time between each airport and the nearest city center.

Steps 1 to 3 were followed to create a feature class CITY from the 25 city hall addresses.

In the next step the driving distance between each airport and the corresponding city center is calculated:

A Visual Basics Application was created by adapting the path finder program NetObjVB6, created by ESRI and available at ArcObjects Online (ESRI 2001). The program (see exhibits 4.5 and 4.6 of the Appendix for program details) was based on the following sequence of operations:

1. selecting the name of the city for the run (AUSTIN, CSTATION, DALLAS, HOUSTON or SANTONIO);
2. calculating the driving distance from every node to the center of the selected city;
3. calculating the driving time to the 27 airports, and add the flying time from each airport to the selected city, plus the driving time from the airport to the city center;
4. the program stores the lowest value in the nodes feature class in the attribute field corresponding to the destination city in the run;
5. repeating the exercise for the other four cities.

A total of 15 runs were performed, three sets for the 5 cities, each one calculating: the driving time (only the two initial steps mentioned above were executed), the driving and flying time without average waiting time, and driving and flying time with average waiting time.

Three sets of five maps were created in GIS using IDW interpolation based on the travel times from/to the five selected cities stored in each node.

CHAPTER V

THE GLOBAL ECONOMY AND CORPORATION HEADQUARTERS: MAJOR TRENDS IN TEXAS AND THE WORLD, 1984-2004

In all the other parts of the world light descends upon earth.
From holy Samarkand and Bukhara, it ascends.

Old Uzbek proverb

5.1 Introduction

Temporal trends in the sales volumes of large transnational corporations have assisted in identifying those sectors of the global economy which went through the most significant transformations, either expanding or declining, during the recent decades characterized by processes of economic globalization. The association of sales data and location of corporation head offices has allowed the discussion of global relevance of headquarters cities over time and the role played by Texan metropolises.

5.2 Major trends in the world economy

Identifying major trends in the world economy between 1984 and 2004 will set the stage for analyzing the role of transnational corporations in economic globalization processes. The gross domestic product of both the world and the United States, and total sales achieved by the Top 500 corporations, all have been growing over the study period; all figures have been converted from current to chained year 2000 dollars in order to make them directly comparable (see exhibit 5.1 of the Appendix).

From 1984 to 2004 the estimated world GDP increased from $27.1 to $51.3 trillion of chained 2000 dollars, which amounted to a growth of 89% over twenty-years, an average growth of 3.2% per year. The United States GDP followed an identical path, increasing from $5.8 to $10.8 trillion chained 2000 dollars, with corresponding growth rates of 85% over the study period, or 3.1% per year. But when considering the Top 500 corporations' sales, there was a significant difference. Their aggregate sales grew from $6.8 to $15.4 trillion chained 2000 dollars, amounting to an aggregated growth rate of 125% or an average of 4.1% per year.

Summing up, the sales volume of Top 500 corporations grew much faster than the world' and United States' economies.

Analyzing the growth rates of these three components during the four five-year periods in the study period, 1984-1989, 1989-1994, 1994-1999 and 1999-2004, added valuable insights. They are graphically represented in Figure 5.1. The graph clearly shows that the overall better performance of Top 500 sales was actually due to its growth over the period 1984-1994, when it clearly outperformed both the world and US GDPs. But since then Top 500 sales growth rates dropped, and have remained below world GDP rates. The United States GDP growth rates were similar to (and slightly higher than) the world's over the first fifteen years, but fell behind both Top 500 sales and the world GDP rates in the last five-year period.

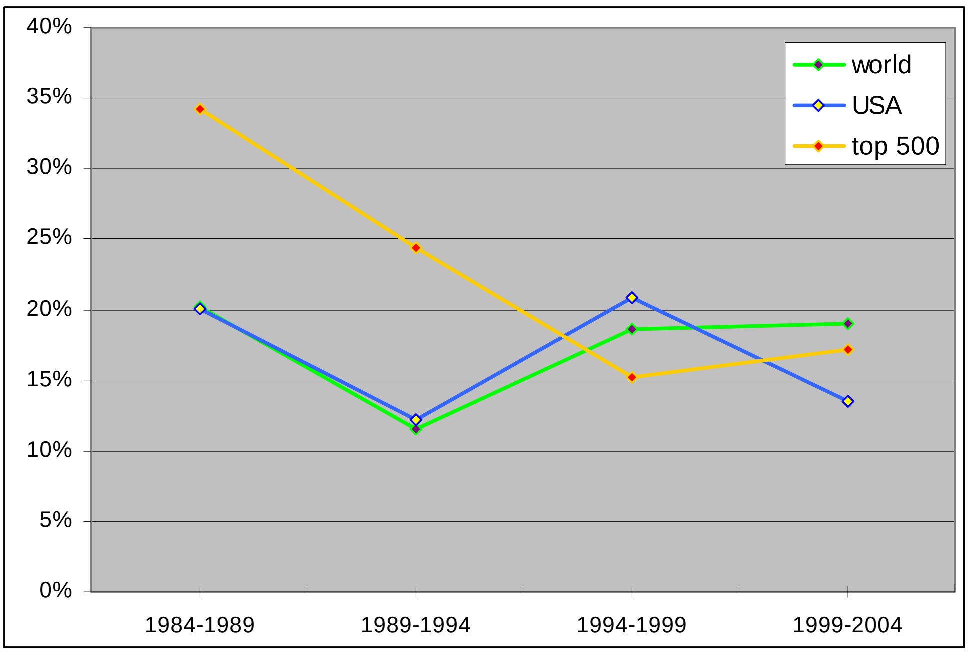


Figure 5.1. Comparison of five-year growth rates of world and USA GDP, and aggregate sales of Top 500 corporations, 1984-2004

From the observation of Figure 5.1, the four five-year periods were summarized in the following way:

- 1984-1989 was a period of high growth rates, especially for Top 500 sales (averaging 6.1% per year, the highest growth of any component over the study period);

- 1989-1994 was a recessionary period, where both the world and US GDPs posted their lowest growth rates; Top 500 sales growth rate also decreased, but still remained considerably high;
- 1994-1999 was a period of mixed trends; GDPs were recovering, stronger in the United States than in the world as a whole, but Top 500 sales reached their lowest growth rate; and
- finally, 1999-2004 also showed mixed trends; both the world GDP and Top 500 sales showed a small acceleration in their growth rates, while the United States GDP went through a recessionary period.

In general, the graph indicates that Top 500 sales followed GDP trends with a lag of about five years; but considering the study period was relatively short, it is not possible to verify if figures are part of long-term drive or the result of a unique context.

5.3 The pool of largest global corporations

Five lists of the 500 largest corporations in the world, based on the sales rankings published in *Fortune* and *Forbes* magazines in the years 1985, 1990, 1995, 2000 and 2005 world, were analyzed to tackle the first research question. At the end of this process a total of 1,031 corporations had been identified. Since 14 corporations moved headquarters to another urban unit, a total of 1,045 records were created (see exhibits 5.2a and 5.2b in the Appendix).

Corporation sizes greatly varied within each list. The ratios between sales of the first and the 500th ranked corporations varied between 30 in 1989 and 18 in 1999, showing a trend to increase over recession and decrease over expansion periods.

Considering the 25 types of activities identified for this study, those with highest frequency were banking (134 companies), insurance (90), mining and oil production & refining (86), general merchandisers (83), and energy & utilities (73); each of these five types accounted for at least 7%, and in aggregate for 45% of the records. The next group included food, beverages & tobacco (56 companies), network & telecommunications (51), wholesalers (50), electronics & specialized equipment (47), motor vehicles & parts (46), metals & metal products (42), pharmaceutical, personal products & health care (42), engineering, construction & real estate (32), and chemicals (29); each of these nine types accounted for at least 2.5% and in aggregate for 38% of the records. The remaining eleven types of activities had the lowest frequency, varying between 8 and 22, and in aggregate accounted for a little over 17% of the records (see exhibit 5.3 in the Appendix).

The 1,045 corporations were all over the world, but in a very disproportionate way. Most were based in North America (40%), Europe (33%) and Eastern Asia (22%), and these three regions account for 95% of the records. Both Latin America & The Caribbean and Australia & Oceania accounted for a little more than 1%, while the Middle East, South Asia and Subsaharian Africa for less than 1% each. Even though most, if not all, of these corporations have their activity spread globally, these figures provide clear evidence that the highest level of decision-making has been heavily concentrated in the developed (and already wealthier) areas.

The location of corporation head offices was even more concentrated. All companies were found within a pool of 147 cities (urban regions) located in 39 countries, which corresponded to an average of seven corporations per urban region. But about one half of these regions (74) were never the location of more than one corporation over the study period, and just 13 cities in nine countries had a minimum of ten corporations at any point of time.

Table 5.1. Company frequency in selected Top 500 lists

frequency	*total count*	*% of total*
in 5 lists	148	14%
in 4 lists	110	11%
in 3 lists	151	14%
in 2 lists	233	22%
in 1 list	403	39%
TOTAL	*1,045*	*100%*

Sources: Fortune and Forbes magazines.

The majority of companies did not appear in all five lists, the average frequency being between two and three (2.4). Movement of companies on and off the lists was relatively frequent (see Table 5.1). Out of the total of 1,045 records only 148 corporations appeared in the five lists; but in spite of representing a mere 14% of the total, their share of total sales was always over 40% of total sales, varying from 42% in 1984 to 43% in 2004, with a peak of 47% in 1989. On the other side of the spectrum, 403 companies (39% of the total) appeared in just one list, varying from 27% in 1984, to 7% in 1994, and 25% in 2004 of listed companies, when their share of total sales represented 18%, 5%, and 15%, respectively.

Overall, these figures confirmed that there is more stability at the top and more mobility at the bottom of the Top 500 lists, which should be expected. Additionally, the number of companies in and out of the lists did not follow a constant pattern. There was a direct relationship between expansion and recession periods and mobility in the lists, with more changes (larger number of new entries, higher proportion of one-time entries) occurring during the former, and more stability (fewer new entries) during the latter.

5.4 Trends in the global sales of largest corporations

Disaggregating sales volume by type of activities showed their relevance over time and more significant temporal trends. The aggregate sales shares of each type of activities and their variation over time allowed the identification of major trends over the study period, along with the types of activities playing major roles.

A quick examination of figures in exhibits 5.3 and 5.4 of the Appendix and Table 5.2 reaffirms the weaknesses of using simple corporation counts. Types of activities with the largest average corporation size were underrepresented in corporation counts. For instance, mining and oil production & refining and motor vehicles & parts, which ranked first and second by aggregate sales in 2004, were only third and fourth by number of companies. In other cases sales and corporation counts followed contradicting trends over time. For instance, general merchandisers' sales share increased by 0.7% from 1984 to 2004, but the corporation count dropped from 48 to 34; or in the case of wholesalers, while sales share declined to less than a half over the same period, the corporation count changed little, from 26 to 23.

Aggregate sales by type of activities changed significantly over the study period. In 1984 the largest aggregate sales corresponded to mining and oil production & refining, with $0.9 out of a Top 500 total of $4.6 trillion; in 1994 it corresponded to wholesalers with $1.4 out of $10.3 trillion; and by 2004 again to mining and oil production & refining, with $2.2 out of $16.8 trillion (see exhibit 5.4 in the Appendix for a complete set of figures).

The top three types of activities changed frequently over the study period: in 1984 they were, in decreasing order, mining and oil production & refining, wholesalers, and motor vehicles & parts; in 1989 wholesalers topped the list, followed by banking, and mining and oil production & refining; in 1994 the top two remained unchanged, but insurance had raised to third; in 1999 banking was at the top, followed by insurance, and motor vehicles & parts; and in

2004 mining and oil production & refining was back at the top, then followed by insurance, and motor vehicles & parts.

Figures in current dollars increased almost four fold from 1984 to 2004 when converted to chained dollars; but general trends and comparisons are more easily tackled if sales figures are converted into simpler shares or rates. A complete list of sales shares over the study period is provided in Table 5.2.

Table 5.2. Sales share by type of activities of Top 500 corporations, 1984-2004

type of activities	*1984*	*1989*	*1994*	*1999*	*2004*
aerospace & defense	1.7%	1.9%	1.3%	1.5%	1.8%
airlines	0.9%	1.0%	1.1%	1.0%	0.8%
banking	9.0%	11.3%	10.3%	11.6%	10.1%
chemicals	4.0%	3.8%	2.6%	1.4%	1.4%
computers	2.1%	2.4%	2.0%	2.7%	2.6%
electronics & specialized equipment	6.0%	7.8%	7.3%	6.4%	6.4%
energy & utilities	5.6%	3.2%	3.3%	4.1%	5.1%
engineering, construction & real estate	0.8%	2.1%	2.6%	1.3%	1.8%
financial services	0.9%	1.8%	1.0%	1.9%	1.3%
food, beverages & tobacco	5.5%	4.8%	4.0%	3.4%	3.1%
forest & paper products	0.6%	0.9%	0.5%	0.6%	0.5%
general merchandisers	7.4%	6.4%	7.2%	7.9%	8.1%
industrial & farm equipment	2.3%	2.4%	2.1%	1.4%	0.9%
insurance	2.5%	3.3%	9.9%	11.3%	11.0%
land transportation	1.7%	0.4%	1.0%	0.9%	0.6%
mail, package & shipping	1.2%	0.5%	1.5%	1.5%	1.9%
metals & metal products	3.4%	3.0%	1.9%	1.4%	1.5%
mining and oil production & refining	19.2%	11.2%	8.1%	7.9%	13.4%
motor vehicles & parts	9.0%	10.2%	9.7%	10.0%	10.3%
network & telecommunications	3.6%	3.7%	5.1%	6.9%	5.7%
pharmaceuticals, personal & health care	1.5%	1.7%	1.9%	3.4%	4.0%
specialized services	0.0%	0.3%	0.4%	0.5%	0.6%
specialty products	0.5%	0.3%	0.7%	1.7%	1.9%
tourism & entertainment	0.3%	0.6%	0.5%	0.9%	1.3%
wholesalers	10.3%	15.0%	14.0%	8.4%	3.9%
Total	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*

Note: some totals do not add because of rounding.

Sources: Fortune and Forbes magazines.

Sales shares were much contrasted, and only five types of activities had surpassed 10% at some point of time, and nine types never reached 2%. Using the highest share ever over the study period as the criterion, it was possible to identify three main groups of types of activities (also shown with different degrees of shading in table 5.2):

- a first group of high-relevance, with five types of activities whose highest sales share surpassed 10%: banking; insurance; mining and oil production & refining; motor vehicles & parts; and wholesalers; this group consistently accounted for about one half of Top 500 sales, varying between 52% in 1994 and 49% in 2004;
- a second group of mid-relevance, made up by eleven types of activities whose highest sales share varied between 2% and 10%: chemicals; computers; electronics & specialized equipment; energy & utilities; engineering, construction & real estate; food, beverages & tobacco; general merchandisers; industrial & farm equipment; metals & metal products; network & telecommunications; and pharmaceuticals, personal & health care; in aggregate, this group accounted for about 40% of Top 500 sales, varying between 42% in 1984 and 40% in 1994; and
- a third group of less-relevance, which included nine types of activities whose highest sales share was below 2%: aerospace & defense; airlines; financial services; forest & paper products; land transportation; mail, package & shipping; specialized services; specialty products; and tourism & entertainment; this group accounted for about 10% of total sales, varying between 8% in 1984 and 11% in 1999.

Out of the five high-relevance types of activities only two, banking and insurance, have been consistently associated to the processes of economic globalization (Friedmann 1986; Sassen 1991/2001, 1994/2006); other key types of activities also identified in specialized literature, like network & telecommunications and financial services, were found in the mid- and less-relevance groups. It must be stressed that smaller sales shares are insufficient to argue that these types of activities are of little relevance in the economic globalization processes or the economy as a whole; activities generally performed by medium and small sized companies, or integrated within conglomerates centered in other activities are underrepresented in this type of data. But it is still possible to argue that, over the study period, these types of activities were not among the most relevant in the operations of large corporations.

The five types of high-relevance deserve closer inspection. Their sales shares, graphically represented in Figure 5.2, followed much contrasted trends over time. The major elements observed in the figure can be described in the following way:

- sales shares of banking and motor vehicles & parts have been the most stable during the study period, following a regular trend pointing slight upward, and minimally affected by wider trends in the economy;
- sales shares of mining and oil production & refining experienced a significant decline from 1984 to 1999, when they fell from an all time high of 19% to less than 8%, and then completely reversed the trend and went back at the top in 2004; its sales shares were higher in periods of faster GDP growth and Top 500 sales were increasing, but declined significantly in recessionary and transitional periods;
- sales shares of wholesalers followed a trend much contrasted with the previous type, growing substantially from 1984 to 1989 and then started declining, first slightly, and then with sizeable share losses after 1994; by 2004 the share had fallen below 4%; and
- sales shares of insurance kept rising over the whole period, but the rate was especially higher between 1989 and 1994, when they increased threefold from 3.3% to 9.9%.

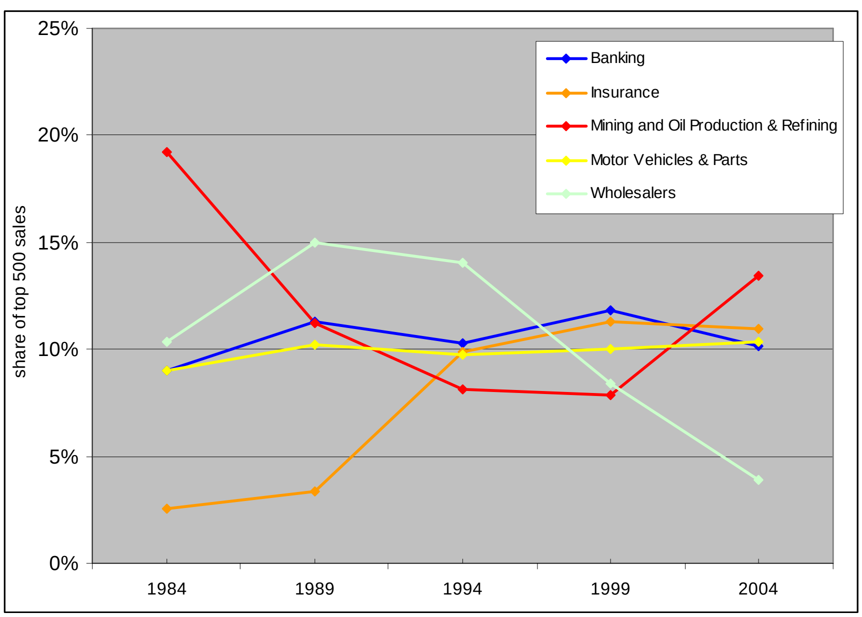


Figure 5.2. Variation of sales shares of selected types of activities, 1984-2004

This empirical data showing the contrasted (and sometimes irregular) patterns of high-relevance types of activities rejects the hypothesis of a dominant single trend over the study period, and is better explained by considering two different trends, separated by a transitional period:

- in the first, from 1984 to 1994, the sales shares of mining and oil production & refining declined sharply, in those of insurance increased sharply, and in wholesalers remained high; and
- by the second, from 1999 to 2004, the sales shares of mining and oil production & refining had a sharp recovery, and those of wholesalers a sharp decline.

The eleven mid-relevance types of activities were easier to overview. But since types of activities can be, due to their smaller sales volume, more strongly affected by the movement of corporations in or out of the lists, only the general trends followed by each one were identified (see Table 5.2). Based on this information, they can be arranged in three sets:

- four types of activities showing a clear but slow trend toward increasing sales shares: computers; general merchandisers; network & telecommunications; and pharmaceuticals, personal & health care; their aggregate share of Top 500 sales increased from 15% in 1984 to 20% in 2004;
- four types of activities showing a clear but also slow trend towards decreasing sales shares: chemicals; food, beverages & tobacco; industrial & farm equipment; and metals & metal products; in aggregate, their sales share decreased from 15% in 1984 to 7% in 2004; and
- three types of activities showing irregular trends: energy & utilities, with changes comparable to mining and oil production & refining; electronics & specialized equipment, comparable to wholesalers, but far less pronounced; and engineering, construction & real estate, with an irregular trend with two peaks and two valleys.

Changes found in mid-relevance types of activities were more closely related to the trends discussed in literature on globalization: types related to services and technology increased their shares, while types related to extraction and transformation decreased theirs.

Overall, not all the empirical evidence corroborated the general dichotomy between growing new sectors linked to a modernizing economy (and to globalization) and declining old sectors linked to natural resources and manufacturing, frequently found in globalization literature. From the data analyzed, two major points must be stressed. Firstly, a few types of activities generally associated with the 'old economy,' namely mining and oil production & refining (one of the pillars of the Texan economy) and motor vehicles & parts, have been playing a major role in the large corporations' businesses, and consequently can not be ignored in discussions of economic globalization processes. And secondly, several types of activities considered as playing key roles in globalization processes were not, at least over the study period, highly relevant in the pool of activities performed by the largest corporations.

5.5 The changing headquarters roles of global metropolises

Movement of headquarters cities in and out of Top 500 lists has been relatively moderate, and affected primarily those cities with only one corporation or situated in fast growing areas. The total count has been increasing since 1989 (when 97 cities were found), and over the following 15 years there was a net gain of 14 cities. Out of the total pool of 147 cities, 100 of them appeared in the 1984 list, and 68 in all five lists. Over time there was a general trend for increasing stability, with a larger number of cities remaining from list to list, and a decreasing number dropping out (see Table 5.3).

Table 5.3. Spatial and temporal distribution of cities with headquarters of Top 500 corporations, 1984-2004

region	*1984*	*1989*	*1994*	*1999*	*2004*
shared with previous list	n/a	79	83	88	96
new entries		18	16	14	15
leaving entries		(21)	(14)	(11)	(6)
TOTAL	*100*	*97*	*99*	*102*	*111*

Sources: Fortune and Forbes magazines.

The spatial distribution of headquarters cities showed a much clustered pattern. Out of the 147 cities, a total of 138 (94%) were located in the northern hemisphere. About three out of four of all cities were either in North America (41%) or Europe (32%) (see Table 5.4). Cities in the United States accounted for 39%, more than one third of the total.

Data summarized in Table 5.4 reveals significant regional trends. The number of North American cities has remained unchanged from 1984 to 2004, even though it went up and down in the intermediary periods. In South Asia, Europe and especially East Asia city counts have been increasing, while in Africa, Latin America and the Middle East have decreased over time.

The opposed directions of city counts in East and South Asian, where combined figures increased from 9 to 21 from 1984 to 2004, and in Latin American and Middle Eastern, where comparable figures fell from 13 to 6 over the same period, was noticeable.

A list with the cities appearing in each list for the first time or the last time is provided in exhibit 5.5 of the Appendix. More changes were found, as expected, in regions with the largest number of cities. From 1989 to 1999 most of the new entries were from North America, but in 2004 nine out of twelve new entries were cities from Asia. Places like Shanghai, Guangzhou, Mumbai, Bangkok, Singapore and Riyadh appeared for the first time in the 2004 list, evidence that Asian cities are becoming increasingly relevant in the world of large corporations, and in processes of economic globalization. The majority of cities dropping from the lists were from the United States (in 1984-1989 and 1999-2004), Sweden and the United Kingdom (1989-1994), and France (1994-1999), most of them smaller urban centers with population under two million. But in other continents cities dropping from the lists were among the largest in their regions, like Buenos Aires, Caracas, Johannesburg and Tehran.

Table 5.4. Spatial and temporal distribution of cities with Top 500 corporations, 1984-2004

region	in region	cities listed per year				
		1984	*1989*	*1994*	*1999*	*2004*
Africa	*1*	1	1	-	-	-
East Asia	*18*	8	9	11	11	18
Europe	*47*	29	33	35	32	34
Latin America	*7*	7	6	4	5	4
Middle East	*6*	4	2	1	-	2
North America	*61*	48	41	45	51	48
Oceania	*4*	2	4	2	2	2
South Asia	*3*	1	1	1	1	3
TOTAL	*147*	*100*	*97*	*99*	*102*	*111*

Sources: Fortune and Forbes magazines.

Overall, from the movement of cities into and out of the Top 500 lists, the general trends pointed to and increasingly dispersed pattern and a slowly increasing number of headquarters cities. In a few cases, like Santa Barbara, Harrisburg, Niles and Dehradun, smaller centers relatively close to much larger metropolises (Los Angeles, Philadelphia, Chicago and Delhi, respectively) their appearance in a list can be indication that the 100 mile-city discussed by Deyan Sudjic (1992) may actually be reaching even farther than he previously assumed. And the case of Dehradun, 150 miles out of Delhi, suggests that this trend is also happening beyond developed western economies.

Changes in the number of headquarters per city also revealed interesting trends, especially in centers housing the largest numbers of headquarters. The top ten cities by number of corporate headquarters during the study period are shown in Table 5.5.

The major conclusions extracted from the analysis of this table are the following:

- New York and Tokyo topped the list, the former in 1984 and the latter from 1989 to present; but in both cities the number of headquarters has been declining, in New York over the whole period and in Tokyo after peaking in 1994;
- headquarters counts in Paris and London have been more stable; over time their headquarters counts became comparable to New York' and Tokyo's, primarily due to the declining numbers in these cities than to their own gains (even though Paris figures have been increased);
- only three other cities appeared in all lists; counts in Zurich have been very stable, while in Osaka (the Kansai) and Cologne (the Rhine-Ruhr) have been declining;
- other higher-ranked North American cities have been losing headquarters, but recently Chicago showed signs of a small recovery; and
- three cities have been increasing their headquarters count: Amsterdam (Randstad Holland), Beijing and Seoul.

Table 5.5. Top ten cities by number of 500 corporation headquarters, 1984-2004

<table>
<tr><th colspan="5">cities ranked by number of headquarters</th></tr>
<tr><th>1984</th><th>1989</th><th>1994</th><th>1999</th><th>2004</th></tr>
<tr><td>New York (63)</td><td>Tokyo (83)</td><td>Tokyo (102)</td><td>Tokyo (74)</td><td>Tokyo (57)</td></tr>
<tr><td>Tokyo (51)</td><td>New York (48)</td><td>Paris (39)</td><td>New York (40)</td><td>Paris (37)</td></tr>
<tr><td>London (33)</td><td>London (41)</td><td>New York (38)</td><td>Paris (35)</td><td>New York (36)</td></tr>
<tr><td>Paris (26)</td><td rowspan="2">Osaka (27)
Paris (27)</td><td>Osaka (32)</td><td>London (34)</td><td>London (32)</td></tr>
<tr><td>Chicago (21)</td><td>London (31)</td><td>Osaka (23)</td><td rowspan="2">Amsterdam (14)
Cologne (14)</td></tr>
<tr><td>Cologne (20)</td><td>Chicago (14)</td><td>Cologne (17)</td><td>Cologne (15)</td></tr>
<tr><td>Osaka (19)</td><td>Cologne (12)</td><td>Zurich (13)</td><td rowspan="2">San Francisco (11)
Seoul (11)</td><td>Osaka (13)</td></tr>
<tr><td>Los Angeles (13)</td><td rowspan="2">Los Angeles (11)
Zurich (11)</td><td>Chicago (11)</td><td>Beijing (12)</td></tr>
<tr><td rowspan="2">San Francisco (10)
Zurich (10)</td><td rowspan="2">Amsterdam (9)
Munich (9)
San Francisco (9)
Seoul (9)</td><td rowspan="2">Beijing (10)
Zurich (10)</td><td>Chicago (11)</td></tr>
<tr><td>San Francisco (10)</td><td>Seoul (10)
Zurich (10)</td></tr>
<tr><td colspan="5">Notes: cities in small capitals remained in this list during the whole period.
Sources: Fortune and Forbes magazines.</td></tr>
</table>

All trends combined, it is evident that the movement of headquarters away from the trio of top global cities early identified in literature (Friedmann 1986; Thrift 1989; Sassen 1991/2001; The Economist 1998; Hall 2002), and the strengthening of centers in other advanced and/or emerging economies. A complete list with of the 147 cities and their respective Top 500 corporation counts is provided in exhibit 5.6 of the Appendix.

In Asia the dominant role of Japanese cities has declined since 1994, with significant losses of corporate headquarters. This should be directly linked to the major financial crisis that affected Japan in 1995 and led to a wave of bankruptcies, and was further exacerbated by the 1997 collapse of several national economies in the region (Schaede 1996; Blustein 2001; Pettis 2001). Since then cities in other East Asian countries, especially Seoul and Beijing, have been increasing their number of Top 500 headquarters and moved up in the rankings.

The relative position of London, more modest than in many empirical studies on the location of advanced services offices (Beaverstock *et al.* 2000a; Taylor *et al.* 2002a; Beaverstock 2005), where it was often found at the top of the global city hierarchy, deserves a special reference. This discrepancy can be explained by a major difference in methodology, since those studies of advanced services generally deal with the location of field and regional offices, and in this study only corporate head offices were considered. It should also be emphasized that the British economy has been increasingly interlocked with the American economy, making London the top location for regional offices of American corporations, as shown by the proportion of service sales by American-owned affiliates (the United Kingdom accounting by 20% in 1989 and 24% in 2003 of all their international sales).

To overcome some limitations of corporation counts, the aggregate sales shares corresponding to each city and year were also calculated (the complete set of figures is shown in exhibits 5.7 and 5.8 of the Appendix). For each selected year Table 5.6 shows the top ten cities ranked by Top 500 sales share.

Once more the quartet made of Tokyo, New York, Paris and London stood out with larger sales shares than other cities, in spite of a temporary intrusion of Osaka in 1989 and 1994. Over time the share gap between these cities and the rest of the pack keep increasing, but the top position is no longer as dominant as it was ten or twenty years ago. Several differences between these rankings and those shown in Table 5.5 must be emphasized:

- Tokyo, New York, Paris and London in aggregate consistently had higher shares of Top 500 sales than of headquarters counts in every list; their combined weight peaked in 1994 (42% of headquarters, 49% of sales), but has been declining since then (32% of headquarters and 34% of sales in 2004), due to drops in Tokyo and New York;

- the gap separating Paris and London from Tokyo and New York has been closing, both due to share gains of the former and share losses of the latter;
- some cities with a relatively small number of (large) corporations showed significant sales shares, as illustrated by Detroit; or, conversely, cities with a large number of (smaller) corporations had relatively lower rankings by sales share, as illustrated by Los Angeles, Zurich and Seoul; and
- a decline in the number of companies did not necessarily mean a decrease in sales share as could be observed in Cologne, which lost 30% of its corporation headquarters from 1984 to 2004, while its sales share remained stable.

Table 5.6. Top ten cities by share of 500 corporation sales, 1984-2004

cities ranked by sales share									
1984		*1989*		*1994*		*1999*		*2004*	
NEW YORK	15.51	TOKYO	24.04	TOKYO	25.54	TOKYO	15.89	TOKYO	10.04
TOKYO	13.99	NEW YORK	11.14	Osaka	8.84	NEW YORK	9.51	NEW YORK	8.53
LONDON	5.86	LONDON	6.30	NEW YORK	7.78	PARIS	6.89	PARIS	8.33
PARIS	4.74	Osaka	5.89	PARIS	7.21	LONDON	5.82	LONDON	7.15
DETROIT	4.26	PARIS	5.31	LONDON	4.60	Osaka	5.07	AMSTERDAM	4.29
Chicago	3.91	DETROIT	4.00	DETROIT	3.59	DETROIT	3.34	COLOGNE	3.12
Osaka	3.73	AMSTERDAM	2.45	COLOGNE	3.12	COLOGNE	3.10	S. Francisco	2.76
COLOGNE	3.39	Chicago	2.30	AMSTERDAM	2.34	Munich	2.67	DETROIT	2.75
AMSTERDAM	3.05	COLOGNE	2.15	Zurich	1.98	AMSTERDAM	2.62	Beijing	2.35
S. Francisco	2.31	Nagoya	1.62	Munich	1.97	Dallas	2.28	Munich	2.31

Notes: cities in small capitals remained in the top ten during the whole period.

Sources: Fortune and Forbes magazines.

The relatively strong share gains of European cities, especially noticeable between 1999 and 2004, can be linked to a wave international mergers and acquisitions that peaked in 2000. In this year alone $1.114 trillion were spent globally in these operations, with European buyers accounting for 70% of all purchases (50% within Europe, 20% abroad) (UNCTAD 2005b). Some of the results of this wave, particularly strong in finance and communications, were an increase in the size of many European companies, thus moving up in corporation rankings.

Over the whole study period, the largest sales share gains from 1984 to 2004 were found in Paris (+3.59%), Beijing (+2.12%), Fayetteville (+1.73%), Munich (+1.45%), London (+1.29%), Amsterdam (+1.24%), Dallas (+1.14%), and Zurich (+1.06%). Conversely, the largest share drops corresponded to New York (-6.98%), Tokyo (-3.95%), Chicago (-2.13%), Osaka (-1.62%), Detroit (-1.51%), Los Angeles (-1.46%), Philadelphia (-1.11%), and Pittsburgh (-1.11%). Up to 2004 most of the cities having benefited the most from large corporation globalization were found in Europe, but also in Asia and North America, Dallas and San Antonio (+0.57%) among them. But cities showing the most severe share declines were all located in the United States and Japan, the two largest national economies.

Temporal trends were irregular, and varied from place to place. Table 5.7 lists the cities showing the largest share gains and share losses over each five-year period. It is apparent that there was not one single city in the list posting only gains or only losses; on the contrary, in most cities trends were irregular, with frequent short-term reversals. Even in cases where the general trend has been clear, there were episodic exceptions, periods characterized by brief share changes against the predominant direction. For instance, the regular share gains posted by Paris were interrupted by a share loss in 1994-1999, and the regular share losses posted by New York were also interrupted by a share gain in 1994-1999.

Table 5.7. Top five cities by largest share gains or losses, 1984-2004

cities ranked by share gain or loss							
1984-1989		*1989-1994*		*1994-1999*		*1999-2004*	
Tokyo	+ 10.05 %	Osaka	+ 2.95 %	New York	+ 1.73 %	Amsterdam	+ 1.67 %
Osaka	+ 2.16 %	Paris	+ 1.90 %	Beijing	+ 1.23 %	Paris	+ 1.44 %
Paris	+ 0.57 %	Tokyo	+ 1.50 %	London	+ 1.23 %	London	+ 1.33 %
Zurich	+ 0.51 %	Washington	+ 1.02 %	Houston	+ 0.89 %	Beijing	+ 0.72 %
Turin	+ 0.51 %	Cologne	+ 0.97 %	Dallas	+ 0.83 %	San Francisco	+ 0.70 %
New York	- 4.38 %	New York	- 3.36 %	Tokyo	- 9.64 %	Tokyo	- 5.85 %
Chicago	- 1.60 %	London	- 1.70 %	Osaka	- 3.77 %	Osaka	- 2.95 %
Cologne	- 1.24 %	Los Angeles	- 0.79 %	Rome	- 0.53 %	New York	- 0.85 %
Tel Aviv	- 0.98 %	Philadelphia	- 0.66 %	Vienna	- 0.36 %	Detroit	- 0.59 %
San Francisco	- 0.77 %	Toronto	- 0.61 %	Paris	- 0.32 %	Munich	- 0.59 %
Sources: Fortune and Forbes magazines.							

These constant variations and contrasted performances reinforced the idea of complexity in globalization processes discussed in the previous section of this chapter, while discussing trends in types of activities. The following set of four graphs illustrates this lack of common trends in first- and second-tier global cities. It should be noted that plots are not comparable from graph to graph due to scale changes in the y axis (ordinates).

The sales shares of the four major global cities – London, New York, Paris and Tokyo –are represented in Figure 5.3. Overall, the major change was observed after 1994, consistent with some trends identified when discussing temporal changes in Types of Activities.

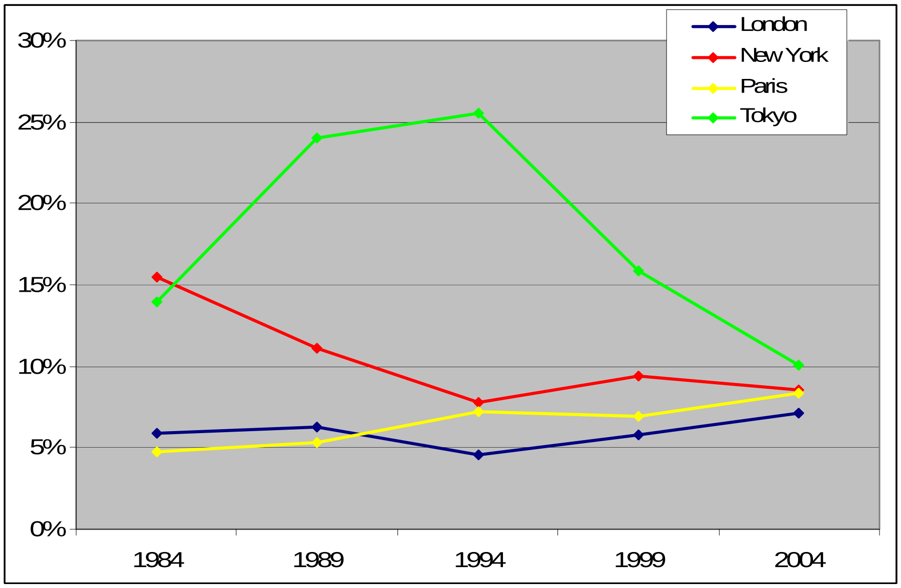


Figure 5.3. Variation of sales shares of selected global cities, 1984-2004

The trends in each city are much contrasted, with Tokyo showing the most dramatic changes and London and Paris more stability. Tokyo was the city making the most dramatic share gains, almost doubling its share from 1984 to 1994, but even more dramatic losses from 1994 to 2004, when its sales share dropped from over 25% to just 10%. The decline observed in New York from 1984 to 1994 reduced the sales share by about one half, then followed by a more regular pattern of small recoveries and losses.

Sales shares variations in second-tier North American cities are represented in Figure 5.4. Over the study period only five cities – Chicago, Dallas, Detroit, Los Angeles and San Francisco – had sales shares higher than 2% at same point in time. Like New York, all of them lost share between 1984 and 1989, but their plots have been diverging since then. In Dallas and San Francisco sales shares have been increasing, while in Detroit and Los Angeles have been decreasing. The case of Chicago was unique, with a major declining trend flattening by 1999 and starting to reverse thereafter.

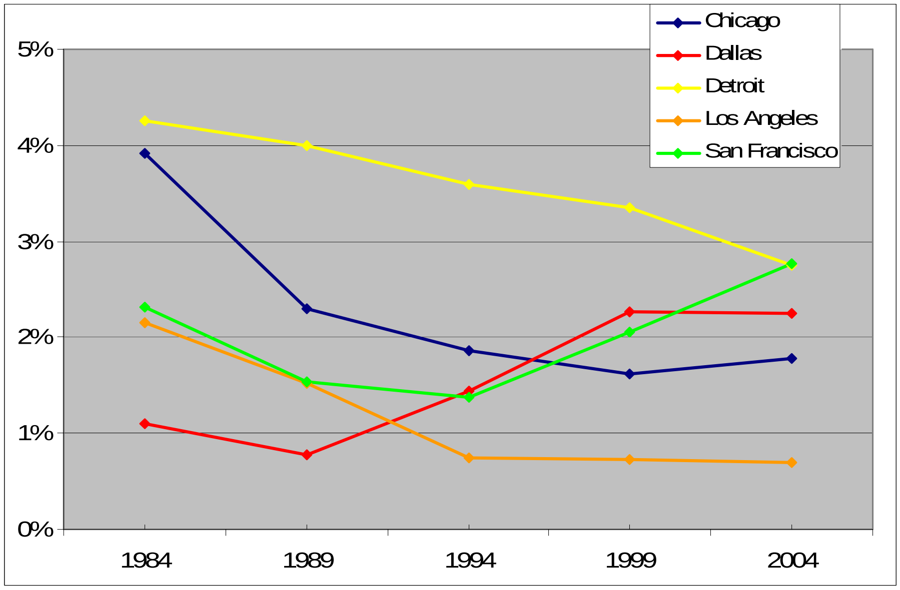


Figure 5.4. Variation of sales shares of selected American cities, 1984-2004

The concentration of large automotive corporations explained the relatively high sales shares of Detroit, event though declining over the whole period. It is interesting to note that Chicago and Los Angeles, sometimes identified as top-tier or Alpha global cities (Friedmann 1986; Beaverstock *et al.* 1999a), had sales shares relatively modest. In the case of Chicago, sales shares dropped to less than one half from 1984 to 1994, and were surpassed by Dallas and San Francisco. The case of Los Angeles was even more remarkable, its sales share having dropped below 1% after 1989, and by 2004 had being surpassed not just by Dallas, but also by several North American cities – Fayetteville (Wal-Mart's base), Houston, Atlanta, Washington, Minneapolis, Charlotte, Philadelphia, Boston, Toronto, Seattle and Cincinnati.

The sales shares of second-tier European cities are shown in Figure 5.5. Over the study period, only four cities showed sales shares above 2% at some point – Amsterdam, Munich, Cologne, and Zurich. Once again there was no clear general trend, even though three cities had been increasing sales shares. From 1984 to 1994 the trends in Munich and Zurich were almost identical, but after 1994, Zurich's trend was closer to Cologne's. Amsterdam was the city showing the most dissimilar series, in some way suggestive of trends in San Francisco.

A most conspicuous absence in this group was Frankfurt, seat of the European Central Bank and a major stock exchange, a city often placed very high in global city hierarchies (Sassen 1994/2006; Short *et al.* 1996; Beaverstock *et al.* 1999a; Taylor 2001a). Its Top 500 sales share peaked in 1984, just surpassing 1.5%, and has been declining since then; by 2004 it was only slightly higher than Madrid's. And Milan, sometimes classified as an Alpha-city (Beaverstock *et al.* 1999a, Taylor 2001a) never showed a sales share surpassing 0.5% over the whole period.

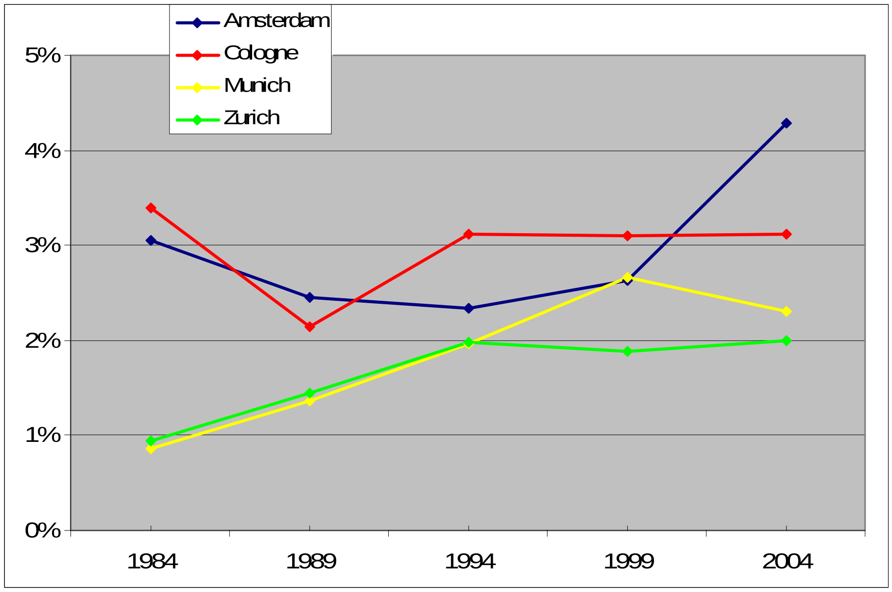


Figure 5.5. Variation of sales shares of selected European cities, 1984-2004

The last graph in this set (Figure 5.6) represents second-tier cities in the Asia-Pacific region. Since only three cities had surpassed the 2% threshold at least once – Beijing, Nagoya and Osaka – Seoul, whose sales share has been approaching 2%, was also added to the group. Once more 1994 is the big trend divider; until then, the first period was characterized by sharp share increases in Osaka, while after even sharper share decreases in Osaka contrasted with the steady gains being made by Beijing. The sales shares of Nagoya and Seoul have been more stable, the former slowly declining and the latter slowly increasing.

Like in Europe, some high-ranked cities in specialized services, like Hong Kong, Singapore and Sydney (O'Brien 1992; Beaverstock *et al.* 1999a; Taylor 2001a) were absent from the top of the list; none of them had sales shares above 0.5% over the whole period. By 2004 the sales share of Hong Kong and Singapore were smaller than those of emerging places like Mumbai, Kuala Lumpur, Delhi, Shanghai, and even Guangzhou.

Their cases reinforce the idea that concentration of large corporation headquarters and specialized services do not necessarily match, and it is possible to have a relevant role in the latter without having a sizeable number of the former. Concentrations of headquarters without a wide range of top specialized services should be related to sizeable pools of local capital, while specialized services without headquarters denote vertical links to higher places.

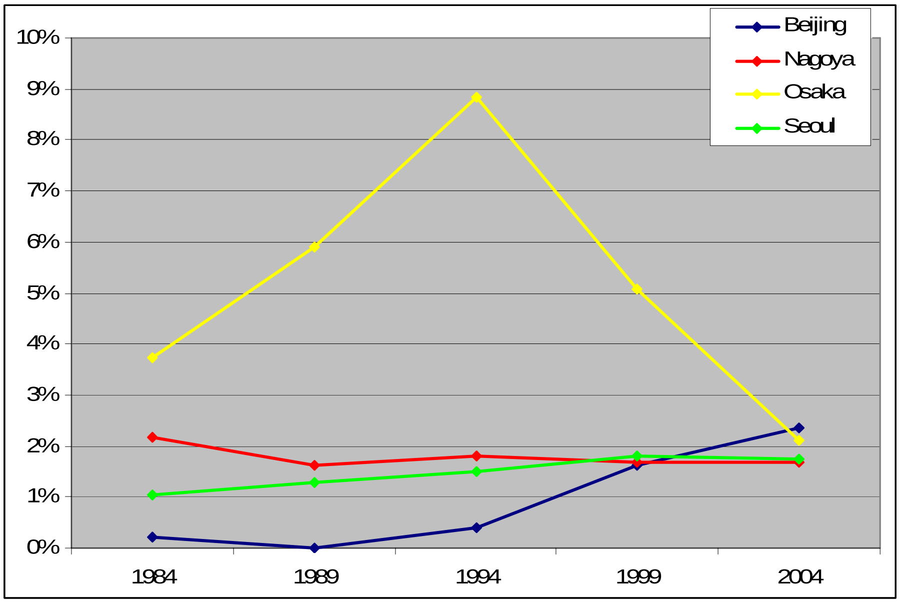


Figure 5.6. Variation of sales shares of selected Asian-Pacific cities, 1984-2004

5.6 Cities and key types of activities in the global economy

In section 5.3 five types of activities were identified as being the most relevant in terms of Top 500 corporation global sales: banking; insurance; mining and oil production & refining; motor vehicles & parts; and wholesalers. In this section the concentration of corporation headquarters for each type is discussed in a temporal context. Figures are presented in terms of sales shares within each type of activities.

Banking

Banking has been one of the most stable types of activities, its sales growth following closely (and slightly bettering) the Top 500 general trend, and consequently there is little variation in sales share. But when analyzing the relative performance of cities, considerable changes were observed (see Table 5.8). The location of banking headquarters followed two main temporal trends:

- the first, from 1984 to 1994, was characterized by strong share gains by Japanese cities, especially large in Tokyo, and share losses in New York and London;
- the second, from 1994 to 2004, was marked by dramatic share losses in Japanese cities, and modest recoveries in New York and London.

Table 5.8. Top cities by sales share in banking, 1984-2004

1984		***1989***		***1994***		***1999***		***2004***	
New York	13.5 %	Tokyo	20.9 %	Tokyo	25.7 %	Tokyo	11.9 %	Paris	11.1 %
Tokyo	11.7 %	New York	11.3 %	Paris	10.8 %	New York	9.0 %	New York	9.7 %
Paris	11.4 %	London	10.6 %	Osaka	7.7 %	Paris	8.7 %	London	8.3 %
London	11.3 %	Paris	10.1 %	London	7.6 %	Frankfurt	8.1 %	Brussels	7.1 %
Tel Aviv	9.4 %	Osaka	8.9 %	Frankfurt	7.0 %	London	8.1 %	Zurich	6.8 %
Osaka	4.3 %	Frankfurt	4.2 %	New York	6.4 %	Brussels	5.9 %	Glasgow	6.3 %
Frankfurt	3.9 %	S Paulo	4.2 %	Zurich	4.3 %	Zurich	5.2 %	Frankfurt	6.1 %
S. Paulo	3.7 %	Zurich	2.9 %	Munich	3.5 %	Charlotte	4.9 %	Charlotte	5.4 %
Toronto	3.6 %	Brasilia	2.8 %	Amsterdam	3.1 %	Beijing	4.4 %	Tokyo	5.1 %
San Francisco	3.5 %	Toronto	2.8 %	Brussels	2.6 %	Amsterdam	4.1 %	Beijing	4.5 %

Sources: Fortune and Forbes magazines.

There were some additional facts deserving notice:

- Tokyo, whose banks accounted for more than a quarter of Top 500 banking sales in 1994, lost more than 80% of its share over the next ten years, and ranked 9th in 2004;
- Paris and Frankfurt were the cities least affected by the changing trends; by 2004 Paris was topping the list, due to a combination of its share stability and losses by other major cities; Frankfurt posted important gains between 1984 and 1999;
- alternative major banking centers have emerged after 1994 in both the United States (Charlotte) and the United Kingdom (Edinburgh, in the Glasgow urban region); the former clearly surpassed San Francisco, Los Angeles and Chicago (and Toronto) to become the second largest banking center in North America;
- Brussels and Zurich, in Europe, and Beijing, in Asia, have emerged as major banking centers between 1994 and 2004; and
- a few cities in the Latin America and the Middle East, São Paulo the most relevant, had sizeable shares at the beginning of the study period, but became irrelevant after 1989.

Three key conclusions stood out from the data sequence. First, Paris, New York and London remained the major banking headquarters over the study period. Second, Tokyo has been losing sales share over the last decade, and should no longer be considered as a primary banking center. And third, the gap between primary and secondary banking centers has decreased, both due to share decline in primary centers and the rise of new centers in North America, Europe and Asia.

Insurance

This type of activity has been increasing sales share over the study period. By 1984 it ranked 12th out of the 25 types considered. It was the fastest growing type of activity in 1989-1994, when its sales share increased threefold, from 3.3 to 9.9 %, making it the big winner of the first round of globalization. In the following decade sales share kept increasing, but posting modest gains.

Insurance sales share of Top 500 corporations is shown in Table 5.9. In this case it is more appropriate to identify three main trends over the study period:

- the first period, from 1984 to 1989, European cities made strong share gains, especially London and Paris, whilst Japanese cities posted considerable share losses;
- the second period, from 1989 to 1994, corresponded to the raise of insurance to a major global role, and was characterized by a dramatic revamping of rankings; Tokyo raised to the top of the list with a share increase larger than fivefold, Osaka also made major share gains, and contrastingly London posted a share loss larger than fourfold;
- the third period, from 1994 to 2004, was characterized by a sharp decrease in the sales shares of Japanese cities, and relative stability in western cities.

In a more detailed analysis the several details deserve mention:

- despite the dramatic growth and reorganization of the sector, some cities, especially New York, Zurich and Trieste, showed a remarkable share stability;
- by 2004 New York had became the leading center for insurance, with Munich, London, Paris and Tokyo as the main secondary centers;
- the sales share of second-order national centers, especially in the United States, has been declining;

- cities outside the most affluent western societies did not have any minimally representative sales share.

Table 5.9. Top cities by sales share in insurance, 1984-2004

1984		***1989***		***1994***		***1999***		***2004***	
Osaka	18.9%	London	19.2%	Tokyo	29.8%	Tokyo	15.5%	New York	13.2%
New York	12.1%	New York	13.0%	Osaka	13.5%	New York	12.0%	Munich	9.7%
Hartford	11.5%	Paris	12.6%	New York	13.4%	London	11.1%	London	9.7%
Tokyo	10.9%	Zurich	11.5%	Paris	10.9%	Munich	10.2%	Paris	9.7%
London	10.9%	Munich	9.9%	Zurich	6.6%	Osaka	9.5%	Tokyo	9.1%
Munich	8.1%	Amsterdam	6.6%	Munich	5.9%	Paris	9.1%	Amsterdam	7.7%
Zurich	7.3%	Tokyo	5.3%	London	4.6%	Amsterdam	5.9%	Zurich	5.8%
San Francisco	4.6%	Hartford	5.2%	Peoria	3.8%	Zurich	5.3%	Osaka	5.0%
Houston	4.6%	Trieste	4.8%	Amsterdam	3.8%	Trieste	3.7%	Trieste	4.5%
Amsterdam	4.0%	Fort Wayne	3.4%	Trieste	2.0%	Peoria	3.1%	Omaha	4.0%

Sources: Fortune and Forbes magazines.

In spite of the leading position shown by New York, about one half of the Top 500 sales in insurance corresponded to European-based corporations. Contrasting with the sales share stability of New York, Japanese cities showed patterns identical to other types of activities, peaking by 1994, and dropping since then. In Europe there was no dominant continental center, with Europe the shares of Munich, London, and Paris being often comparable, and Amsterdam and Zurich next; in aggregate share of these cities dropped from 60% in 1984 to 43% in 2004, another indication that new centers have been emerging.

Among the five most relevant types of activities, insurance has shown the highest concentration pattern, with almost all Top 500 corporations located in the largest capitalist economies. And when compared to banking, evidence on the emergence of secondary headquarters cities in other parts of the world has been fewer and much less relevant. Insurance companies based in Seoul and Sydney entered the list in 1999, and in Beijing in 2004, but these cities still having small shares of Top 500 insurance sales.

More recently there has been a trend to a greater spatial dispersion of headquarters, especially within North America and Europe. From 1984 to 1994 the number of insurance corporations in the Top 500 grew from 21 to 52, while headquarters cities only grew from 12 to 15. But over the following decade the corporation count stabilized, passing from 52 to 49, while the number of headquarters cities increased from 15 to 25.

Mining and oil production and refining

These activities, frequently associated with the so-called old economy, went through a dramatic reversal of fortune during the study period, from topping Top 500 sales in 1984, then falling to 5th in 1994 and 1999, and returning to the top in 2004.

The sales shares of major headquarters cities are shown in Table 5.10. In this case three main periods can be identified over the study period:

- the first period, from 1984 to 1989, was characterized by a dominant (but declining) position of New York, and several secondary centers in the United States;
- the second period, from 1989 to 1999, coinciding with declining aggregate sales shares in this type of activity, was marked by the sudden raise of Dallas to the top of the rankings, and a dramatic reduction in sales share in New York; and
- the third period, from 1999 to 2004, was characterized by major share gains by London and Houston, and the disappearance of New York from the top rankings.

Table 5.10. Top cities by sales share in mining and oil production & refining, 1984-2004

1984		***1989***		***1994***		***1999***		***2004***	
New York	27.3%	New York	21.7%	**Dallas**	**12.1%**	**Dallas**	**17.6%**	London	13.8%
Amsterdam	9.6%	Amsterdam	10.6%	Amsterdam	11.3%	Amsterdam	10.4%	**Dallas**	**12.0%**
London	5.7%	Tokyo	7.2%	Tokyo	10.1%	London	9.4%	Amsterdam	11.9%
Los Angeles	5.7%	London	6.7%	Paris	7.7%	Paris	8.2%	**Houston**	**8.3%**
Houston	**4.7%**	Los Angeles	5.6%	Washington	7.1%	Tokyo	6.3%	Paris	6.8%
Paris	4.3%	Paris	5.0%	London	6.1%	Beijing	6.2%	San Francisco	6.6%
Tokyo	4.1%	Cologne	4.8%	New York	4.0%	New York	4.9%	Beijing	6.3%
Chicago	3.5%	San Francisco	3.6%	Rome	3.9%	Rome	3.4%	Tokyo	4.0%
San Francisco	3.1%	Tulsa	3.5%	San Francisco	3.7%	San Francisco	3.2%	Rome	3.3%
Rome	2.9%	Rome	3.4%	Mexico	3.4%	Caracas	3.2%	Mexico	2.8%
Sources: Fortune and Forbes magazines.									

The following are the most relevant changes observed in the table:

- the contrasted fates of New York and Dallas, whose sales shares followed opposed directions were actually related, and resulted from the merge of Exxon and Mobil and its headquarters move from New York to Texas;
- different trends in American cities, as Los Angeles, Chicago and Washington had major sales share losses, while Houston and San Francisco had major increases;

- Beijing's emergence as a major headquarters city after 1994, reaching a sales share comparable to Tokyo in 1999, and a significantly larger one in 2004;
- the sporadic and less relevant appearance of cities from oil producing areas, like Mexico and Caracas, at the bottom of the list.

There are a few major trends occurring in this type of activities. The first relates to a succession of merges, some of them including headquarters relocation; this led to the reduction of Top 500 corporations from 52 to 39 over the study period, and the emergence of a few very large corporations – by 2004 the largest three accounted for 37% of sales and the largest six for 55%. Several headquarters cities, including a few highly placed at the sales share rankings, had only one corporation of this type of activities. The second trend showed a re-concentration of headquarters, with the emergence of two major clusters, the first in Texas (Dallas, Houston and San Antonio), the second in the southern North Sea (London and Randstad Holland); in aggregate they accounted for close to one half of the 2004 sales.

Along the traditional concentration in North America, Western Europe and Japan, the weight of corporations based in other parts of the world has been increasing. In spite of a small increase from 12 to 14 cities from 1984 to 2004, their combined sales share rose from 14 to 20% over the same period. It should also be noted that there has been a significant instability, since only a few corporations (and few headquarters cities) were found in every list over the study period.

Motor vehicles and parts

Even more than banking, motor vehicles & parts was the most stable of the top types of activities. In spite of their quite comparable sales volumes, there were fundamental differences between the two types of activity over the study period. On average, corporations in motor vehicles & parts were larger and more concentrated. The largest count was just 34 (reached in 2004), and number of headquarters cities only 17 (in both 1989 and 2004); these corresponded to about a half of the equivalent figures in banking. Overall, a single and relatively continuous trend was found over the whole period, characterized by a steady decline of Detroit's sales shares, countered by slow and steady increases of German cities' shares (see Table 5.11).

Other important points observed in this data set were the following:

- more than 80% of sales remained concentrated in corporations based in just seven cities of four countries over the whole period;

- the number of second-tier cities, behind Detroit, increased from one to three, and their aggregated shares from 32% in 1989 to 41% in 2004;
- Detroit remained as the only headquarters city of significance in United States;
- the aggregated sales share of corporations based in Nagoya and Tokyo remained relatively stable, even though the shares of each city went through significant changes; and
- the sales shares of Paris and Turin were relatively stable over the whole period.

Table 5.11. Top cities by sales share in motor vehicles & parts, 1984-2004

1984		**1989**		**1994**		**1999**		**2004**	
Detroit	39.3%	Detroit	35.1%	Detroit	33.4%	Detroit	30.5%	Detroit	24.8%
Nagoya	20.2%	Tokyo	14.4%	Tokyo	17.4%	Stuttgart	14.7%	Nagoya	14.4%
Tokyo	7.0%	Nagoya	10.5%	Nagoya	11.4%	Tokyo	14.1%	Tokyo	13.3%
Paris	5.7%	Stuttgart	7.7%	Stuttgart	8.5%	Nagoya	11.3%	Stuttgart	13.1%
Cleveland	5.7%	Paris	7.0%	Paris	6.2%	Paris	6.2%	Hanover	7.3%
Stuttgart	5.2%	Turin	5.2%	Hanover	4.9%	Hanover	6.2%	Paris	7.0%
Hanover	3.9%	Hanover	4.7%	Turin	4.1%	Munich	4.0%	Munich	4.3%
Turin	3.3%	Munich	3.2%	Munich	3.7%	Turin	4.0%	Turin	3.5%
Gothenburg	2.5%	Cleveland	2.5%	Hiroshima	2.2%	Cleveland	2.3%	Seoul	2.7%
Hiroshima	1.6%	Hiroshima	2.3%	Cleveland	2.1%	Seoul	1.6%	Gothenburg	1.7%
Sources: Fortune and Forbes magazines.									

Even though this motor vehicle & parts has remained relatively stable and concentrated, an important reorganization has been happening. The sales share of Top 500 United States corporations dropped from 46% in 1984 to 27% in 2004; this last figure was quite similar to the aggregated shares of corporations based in the two major Japanese centers, or the three major German centers. Two of the top four global cities, London and New York, have been of little relevance as headquarters cities for this type of activities.

Wholesalers

The inclusion of wholesalers in this section is primarily due to its past relevance during the first wave of globalization. Aggregate sales grew impressively between 1984 and 1989, posting a share increase of 4.7% and becoming the largest type of activities in 1989. Share declined ensued, and by 2004 it had dropped to a sales share of just 3.9% and ranking 10th out of 25 categories.

Sales shares of headquarters cities are shown in Table 5.12. Based on this data, three major temporal trends stood out:

- the first, from 1984 to 1989, was dominated by corporations based in Tokyo and Osaka, and in a lesser extent in Seoul (in 1989 they accounted for 93% of sales);
- the second, from 1989 to 1994, was a transitional period, showing a significant decline in the sales share of Tokyo, and the appearance of small centers in Europe and China; and
- the third, from 1994 to 2004 was marked by a sharp sales share decline in Tokyo and Osaka, along with the emergence to primary status of Cologne, in Europe, and San Francisco and Columbus, Ohio, in North America.

Table 5.12. Top cities by sales share in wholesalers, 1984-2004

1984		***1989***		***1994***		***1999***		***2004***	
Tokyo	69.5%	Tokyo	74.3%	Tokyo	55.7%	Tokyo	43.9%	Tokyo	19.6%
Osaka	11.3%	Osaka	15.2%	Osaka	24.2%	Osaka	18.6%	Cologne	13.1%
Seoul	6.0%	Seoul	3.3%	Seoul	6.1%	Seoul	8.8%	S. Francisco	12.3%
Helsinki	1.9%	Helsinki	1.4%	Cologne	3.6%	Cologne	6.4%	Columbus	10.0%
London	1.7%	Nagoya	1.2%	Beijing	1.8%	Los Angeles	4.2%	Philadelphia	8.1%
Hamburg	1.7%	Oklahoma	1.1%	Munich	1.2%	San Francisco	3.4%	Beijing	5.3%
Minneapolis	1.3%	Minneapolis	1.0%	Nagoya	1.1%	Beijing	2.5%	London	5.2%
Oklahoma	1.2%	San Francisco	0.7%	Minneapolis	1.1%	Columbus, OH	2.3%	**Houston**	**4.5%**
Nagoya	1.0%	**Houston**	**0.7%**	Oklahoma	1.1%	Munich	1.9%	Seoul	4.2%
San Francisco	1.0%	London	0.6%	Amsterdam	0.9%	Minneapolis	1.9%	Los Angeles	3.9%

Sources: Fortune and Forbes magazines.

The spectacular growth of this type of activities was related with the expansion of giant trading conglomerates like Mitsui, Mitsubishi, Sumitomo and Marubeni, which in 1989 and 1994 ranked among the largest corporations in the world. After the East Asian crises of 1995 and 1997, their sales started declining sharply, some of them went bankrupt, and the by 2004 the survivors were no longer among the 100 largest global companies by sales. In spite of the decline, Tokyo still retained its top position, but in a type of activities increasingly irrelevant.

5.7 Texan corporations and their role in the global economy

The presence of Texas-based corporations in the Top 500 lists has been increasing over time. In 1984 the aggregate sales shares of corporations based in the TUT was 2.5%, and after a big drop in 1989 has been increasing since then. In 2004 it had reached 4.6%, higher than the Amsterdam, the fifth largest headquarters urban region in the world (see Table 5.6).

The aggregate sales ranking of Texan cities is represented in Figure 5.7. Dallas and Houston have been among the top 20 cities for most of the study period, excepting in 1989 (both cities) and Houston in 1994. San Antonio appeared for the first time in 1994, and Austin in 1999. There has been a general upward trend through the rankings, only interrupted in 1984-1989. Houston was the highest ranked Texan city in 1984, and Dallas from 1989 to 2004. In 2004, Dallas ranked 11th, Houston 18th, San Antonio 39th and Austin 54th in a pool of 111 headquarters cities.

In all four Texas cities the corporation sales average has been consistently above the Top 500 average; in 2004 all four were among the top twenty cities ranked by corporation sales average; figures varied between a 60% above the Top 500 average in Dallas, to 24% above the average in Houston (actual figures in exhibit 5.2a in the Appendix).

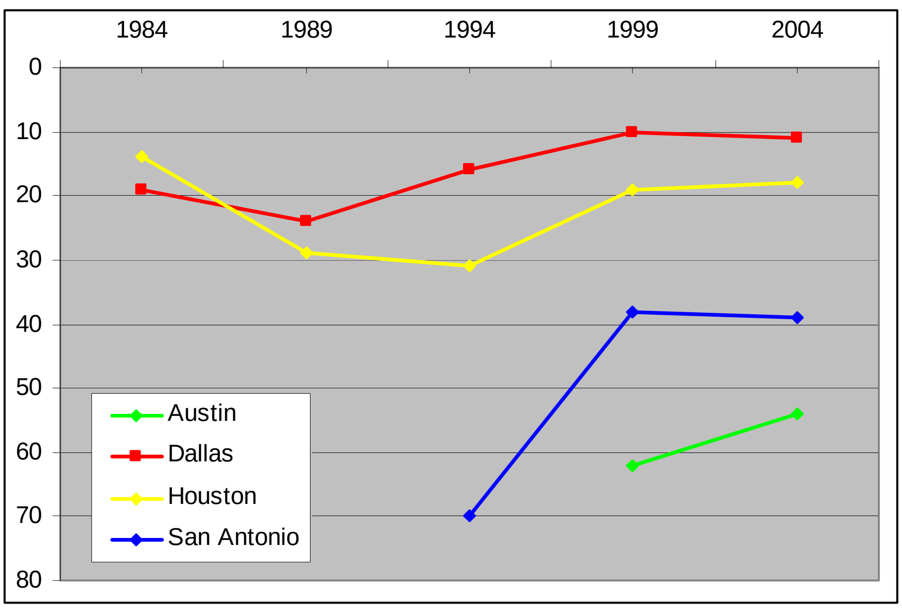


Figure 5.7. Sales shares ranking of Texan cities, 1984-2004

But it should be noted that Texas cities have been increasingly linked to just one very large corporation. In 2004 Exxon Mobil accounted for 72% of Top 500 sales in Dallas, ConocoPhillips for 49% in Houston, Valero Energy for 57% in San Antonio; Austin had only one corporation listed for the whole period, Dell Computer. The weight of large oil-related companies in the Top 500 sales of Texas cities is graphically illustrated in Figure 5.8. Before 1994 the highest sales shares attained by a single company in a city over the study period were 32% of Shell Oil in Houston in 1984, and 29% of J.C. Penney in Dallas in 1989.

Another major factor favoring aggregate corporate sales increase in Texas cities, and one that can not be properly assessed in all previous tables, has been headquarters moves. Texas cities, and especially Dallas, have been very attractive for headquarters relocation, as illustrated by the moves of JC Penney from New York and Kimberly-Clarke from Appleton between 1984 and 1989, and Exxon and Mobil from New York and Washington. Houston also benefited from the relocation of Halliburton from Dallas between 1989 and 1994, and from the absorption of Chicago-based Amoco and Tulsa-based Phillips Petroleum by ConocoPhillips (see exhibits 5.2a and 5.2b in the Appendix). This trend has slowed down but not ended, as the recent transfers of the headquarters of AT&T from New York to San Antonio, and of Fluor from Los Angeles to Dallas in 2005 just proved (Fortune 2006b).

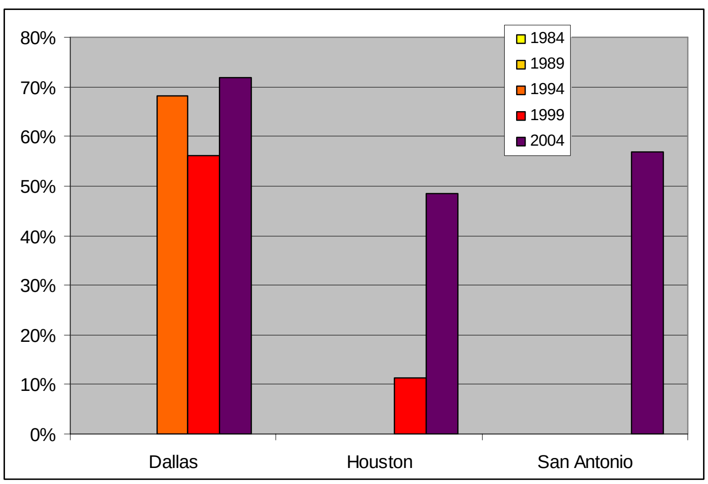


Figure 5.8. Sales shares of largest oil corporation in Dallas (Exxon Mobil), Houston (ConocoPhillips) and San Antonio (Valero Energy), 1984-2004

The raise in aggregate sales in Texas headquarters cities, reinforced by headquarters moves, has been masking another and paradoxical trend. The individual performance of Texas-based Top 500 corporations has been extremely irregular, and the majority of them were listed for short periods of time. Exhibit 5.9 in the Appendix provides details about new entries and exits from Top 500 lists in each city. During the study period a total of 39 Texas-based corporations appeared among the global Top 500, but only one (AMR, American Airlines) was in every list. A total of 16 (41%) corporations were listed just one time, and disappeared in the next list; this instability has been prominent in Houston, where 10 out of the 16 corporations were based. Additionally, some of the exits listed in exhibit 5.9 of the Appendix were related to major corporation difficulties, like the collapse of Enron (Schepp 2002; BBC News 2006b) and legal problems of Reliant Energy (Piller 2003; Egelko and Martin 2004), or outside acquisitions of companies in trouble like Compaq's by Hewlett Packard (Morgensen 2004).

In short, sales and corporation mobility showed that Texas headquarters cities have been characterized by the increasing dominance of a few but very large oil-related firms, and by great instability among smaller firms.

In sections 5.3 and 5.4 it was discussed the relevance of mining and oil production & refining, as well as its importance in the Texas Urban Triangle, and especially in Dallas and Houston. This was the only major type of activities where Texas cities had sizeable sales shares and ranked high in the corporation headquarters world. During the study period, Texas cities did not have any banking and motor vehicle & parts corporation, and lost their relevance in insurance. Houston has been increasing sales share in wholesalers since 1994, but had little significance since it was happening in a fast declining type of activities.

The sales shares of all the types of activities represented in Texas cities during the study period are displayed in Table 5.13. In the five main types of activities, besides what was previously discussed, the most relevant fact was the sales share rise of mining and oil production & refining in San Antonio, whose 2.4% share in 2004 was the 12th globally.

From the analysis of Table 5.13, several points pertaining to the group of mid-relevance types of activities identified in section 5.3 (see Table 5.2) deserved notice:

- sales shares of growing types of activities have been, and still are, relatively significant in Dallas (computers; general merchandisers; and pharmaceuticals, personal & health care), San Antonio (network & telecommunications), and Austin (computers); Houston had some relevant sales shares in computers (1994 and 1999), when Compaq was still operating, but no longer has large headquarters in any of these activities;
- sales shares of irregularly-trended types of activities showed localized trends; energy & utilities has been the most relevant over time, especially in Houston (where its share reached 15.1% in 1999) and Dallas, but figures have been declining; engineering, construction & real estate more recently emerged as

significant activities both in Dallas and Houston, with sales shares over 4% in 2004; electronics & specialized equipment has been represented in Dallas, with small and stable sales shares; and

- the declining types of activities (chemicals; food, beverages & tobacco; industrial & farm equipment; and metals & metal products) did not have any significant representation; metals & metal products and chemicals were present earlier in Dallas and Houston, respectively, but over time disappeared from the lists.

Table 5.13. Top 500 sales shares of Texas cities by type of activities, 1984-2004

city	*type of activities*	*1984*	*1989*	*1994*	*1999*	*2004*
Austin	**computers**				**7.2 %**	**11.3 %**
	all types				***0.20 %***	***0.29 %***
Dallas	**airlines**	**13.6 %**	**14.6 %**	**14.9 %**	**15.9 %**	**14.4 %**
	computers		3.2 %		**5.3 %**	4.8 %
	electronics & specialized equipment	2.1 %	1.2 %	1.4 %		1.2 %
	energy & utilities	2.9 %			3.2 %	
	engineering, construction & real estate					4.3 %
	financial services				**5.0 %**	
	general merchandisers	3.4 %	3.5 %	2.9 %	3.2 %	1.9 %
	metals & metal products	4.5 %	2.9 %			
	mining and oil production & refining	1.6 %	0.7 %	**12.1 %**	**17.6 %**	**12.0 %**
	pharmaceuticals, personal & health care		4.6 %		2.9 %	2.3 %
	all types	***1.11 %***	***0.78 %***	***1.45%***	***2.28 %***	***2.24 %***
Houston	**airlines**		**9.3 %**			
	chemicals		2.0 %			
	computers			**5.4 %**	**10.9 %**	
	energy & utilities	**7.0 %**	4.3 %	2.7 %	**15.4 %**	2.5 %
	engineering, construction & real estate				**7.8 %**	4.2 %
	insurance	4.6 %			0.7 %	
	mining and oil production & refining	4.7 %	2.8 %	2.8 %	2.0 %	**8.3 %**
	wholesalers		0.7 %	0.8 %	1.6 %	4.5 %
	all types	***1.41 %***	***0.72 %***	***0.52 %***	***1.42 %***	***1.49 %***
San Antonio	mining and oil production & refining				1.1 %	2.4 %
	network & telecommunications			2.2 %	**5.6 %**	4.3 %
	all types			***0.11 %***	***0.47 %***	***0.57 %***
TUT	**all types**	**2.52 %**	**1.50 %**	**2.08 %**	**4.36 %**	**4.59 %**

Note: types of activities having reached 5% at least once are shown in bold.

Sources: Fortune and Forbes magazines.

A special reference should be made to computers, a sector discussed in Chapter III and identified as having a growing importance in Texas economy, responsible for a sizeable portion of the state's exports. Table 5.14 lists the sales shares of all Top 500 computers headquarters cities over the study period. Even though this type of activities was already present in Dallas in 1989, it was in 1999 and 2004 that both appeared in other TUT cities and their aggregate sales shares surpassed 10%. In spite of the disappearance of Houston-based Compaq, which resulted in a decline from 23.4% to 16.1% in the region aggregate sales share from 1999 to 2004, in the last decade the TUT emerged as one of the five major concentrations of computers headquarters in the world. In 2004 the TUT ranked as the fourth urban region by sales, following the North Atlantic Megalopolis (centered in New York, with a share of 28.9%), Central Japan (centered in Tokyo, with 24.6%), and California (centered in San Francisco, with 21.9%).

Table 5.14. Sales shares of headquarters cities in computers, 1984-2004

city	*1984*	*1989*	*1994*	*1999*	*2004*
Austin				*7.2 %*	*11.3 %*
Dallas		*3.2 %*		*5.3 %*	*4.8 %*
Houston			*5.4 %*	*10.9 %*	
TUT		**3.2 %**	**5.4 %**	**23.4 %**	**16.1 %**
Boston	6.4 %	7.5 %	6.6 %		
Cincinnati	4.2 %	3.4 %			
Detroit	4.9 %				
Los Angeles					3.6 %
Minneapolis	5.1 %	4.2 %			
New York	**64.2 %**	**46.4 %**	**40.5 %**	**30.3 %**	**28.9 %**
Philadelphia		5.8 %			
San Francisco	**6.4 %**	**10.2 %**	**16.9 %**	**17.0 %**	**18.3 %**
Seattle				5.6 %	8.5 %
Nagano (Suwa)					3.2 %
Tokyo	**8.8 %**	**19.3 %**	**30.6 %**	**23.6 %**	**21.4 %**
Sources: Fortune and Forbes magazines.					

Finally, among the nine types of activities classified as of less-relevance (aerospace & defense; airlines; financial services; forest & paper products; land transportation; mail, package & shipping; specialized services; specialty products; and tourism & entertainment) only airlines had some significance over the whole study period. Since 1984 Dallas has retained a sales share higher than 10% in airlines, and by 2004 was ranking 4th in sales out of seven main headquarters cities.

Overall, Texan cities showed high levels of specialization, with computers in Austin, and mining and oil production & refining in the other cities being the dominant type of activities. Large corporation presence was more significant in Dallas and Houston over the whole study period, but Austin and San Antonio have been emerging as attractive alternative locations.

The two most important sectors in the Texan economy had different relevance at the world scale. Mining and oil production & refining has been one of the most relevant types of activities, measured by large corporation rankings and total sales, and since the late 1990s has rebounded to the top of the global economy (Lustgarten 2006). Computers has been a slowly emerging type of activities, but still playing a secondary role in large corporation business.

The TUT became one of few major headquarters clusters in the world in both mining and oil production & refining, and computers. But TUT cities have also showed a lower degree of diversification than top global cities; this reliance on a few sectors makes them more vulnerable to changing economic cycles, and ultimately limits their growth potential.

5.8 Summary

Data on corporation sales showed that economic globalization has been neither a steady set of processes, nor been dominated by a few economic sectors linked to emerging technologies. Actually, it has been showing changing phases, each characterized by the changing performances of several types of activities. Areas of the old economy, especially mining and oil production & refining and motor vehicles & parts followed different temporal trends, but remained among the most relevant in the global economy.

The location of corporation headquarters showed an ongoing trend for higher dispersion, with declining relevance of traditional major centers like New York and Tokyo, and the emergence of new secondary centers especially in North America and East Asia. But it also showed both diversification in and lack of convergence at the top of the global city hierarchy, since each major city presented a particular combination of types of activities.

Texas cities, especially Dallas and Houston, have been increasing their share of Top 500 corporation sales over time, with Dallas ranking among the top 10 and Houston among the top 20 in 2004. Dallas has been the most diversified of the four TUT headquarters cities. During the study period Texan cities have benefited from important headquarters relocations, especially of oil-related corporations. The trend for dispersion was also found in Texas, with the emergence of San Antonio and Austin as new headquarters alternatives. But in all four Texas cities the aggregate sales share has been increasingly linked to just one very large corporation, and have shown a noticeable instability in the sales shares of less relevant types of activities.

The global relevance of Texan cities has been unquestionable in a key type of activities, mining and oil production & refining, and also in an emerging but much less relevant, computers. But Texas cities (or the TUT) lack the diversification found in high-ranked global cities and regions.

CHAPTER VI

THE ECONOMIC MAKEUP OF TEXAN AND AMERICAN METROPOLISES

I think,
therefore I exist
… SOMEWHERE.

Man always knew that he lived in the space,
the economist sometimes pretends to forget about it.
Pierre Dockès

6.1 Introduction

The relative composition of local employment, measured by the number of employees by economic sector, provides a tool to compare the economic make up of American metropolitan areas, and to identify relevant contrasts and similarities. Using standardized data in the context of a principal component analysis (PCA) has the advantage of removing distortions related to scale, i.e. the contrasted sizes of metropolitan areas, and prioritizes the identification of relationships between variables. Conversely, and since data was transformed into relative figures, it is not possible to carry out analyses of individual economic sectors, which was dealt with in previous chapters.

The second research question of this dissertation deals with the relative significance of key economic sectors both in the TUT metropolises and TUT as a whole, and how they compare with other American global cities and major urban regions. To address the question a PCA was performed using metropolitan employment data for the year of 2004.

6.2 Principal components of metropolitan employment in American metropolises

Employment data at the metropolitan level was obtained from the U.S. Bureau of Census *CenStats* databases (USBC 2006a). At the source figures for total employment and employment by size of establishments in each spatial unit are organized according to the NAICS classification of economic sectors. The original data required a few transformations before being ready to use. Firstly, figures not provided due to confidentiality issues had to be estimated using a combination of linear regression and a system of equations. Secondly, there a few cases were the boundaries of metropolitan areas as defined in this study and by *CenStats* did not match, as the latter breaks down some Consolidated Metropolitan Areas into a few smaller units; in such situations, the problem was easily solved by aggregating the corresponding figures . And thirdly, figures had to be converted from total employment by sector and city in relative employment, the proportion of the city employment by sector.

A matrix showing the percent of the 2004 employment in each two-digit NAICS industry codes (also called segments in the context of this dissertation) by the American metropolitan areas with population above one million was built to perform a principal component analysis (PCA). The possibility of using more detailed three-digit NAICS data implied having to deal with a very large number of confidential data cells, which would increase substantially the margin of error, and therefore had to be disregard. The last two-digit NAICS segment (code 99, relating to unclassified activities) was also not considered. The final result was a matrix of 19 segments by 53 cities.

The data was run using SPSS 13.0 for Windows at the Department of Geography of Texas A&M University. When running the PCA for 19 components (the same number as variables) the model identified seven main components with a relevant *eigenvalue* above 1, which in aggregate explained 76.6% of the variance found in the dataset (see exhibit 6.1 in the Appendix). City scores for each component were calculated based on the component loadings and local employment data, and then standardized; in each component zero corresponded to the average of the 53 cities, and the unit to one standard deviation. A brief description of each component, especially discussing the most relevant economic segments and the city scores is presented in the next paragraphs, followed by some brief comments on the scores of the four metropolises of the TUT (see exhibit 6.2 in the Appendix for a comprehensive list of figures).

The first (and the most important) component, explaining about 22% of the data variance, was primarily defined by NAICS segments segment 53 (real estate and rental & leasing, from this point on abbreviated as “real estate”) 23 (construction) and 72 (accommodation and food services, henceforth also abbreviated as “accommodation”) all with loadings above 0.7, but also showing a significant degree of association with segments 56 (administrative & support and waste management & remediation services, henceforth abbreviated as “management services”) and 71 (arts, entertainment and recreation, henceforth “leisure”), all with loadings higher than 0.5. Some significant negatives component loadings were also found, especially with segment 31 (manufacturing), and to a lesser extent with segments 62 (health care and social assistance, henceforth “health care”) and 61 (educational services, henceforth “education”).

A quick analysis of the city scores (graphically represented in Figure 6.1) showed significant regional variations, with the highest scores occurring in fast-growing cities of the South and West, and the lowest in smaller or older industrial centers of the Midwest and Northeast. The three highest scores (Las Vegas, Orlando and Norfolk) corresponded to cities having very relevant tourist infrastructure, directly linked to gaming, Disney World, and Williamsburg-Jamestown, respectively. Overall, the general trend shows scores increasing from North to South and from East to West; the high scores of Washington (the fourth overall), and the negative scores in the Carolinian Piedmont were the most significant exceptions. Also the largest cities showed scores much closer to the average than smaller cities, which should be associated both with their size but also higher economic diversification (in the original data matrix larger cities had, in general, relative employment values closer to segment averages). The city score amplitude, from the highest (3.89 in Las Vegas) to the lowest (-1.89 in Grand Rapids) was the widest of the seven components.

All four metropolises of the TUT had city scores clearly above the average, which is consistent with the high population growth rates observed in recent years . Austin the highest score (0.89), while those of the other cities were relatively close: San Antonio (0.45), Houston (0.44), and Dallas (0.38). This was also the component where the differences between Dallas, Houston and San Antonio scores, and between the highest and lowest TUT scores were lower.

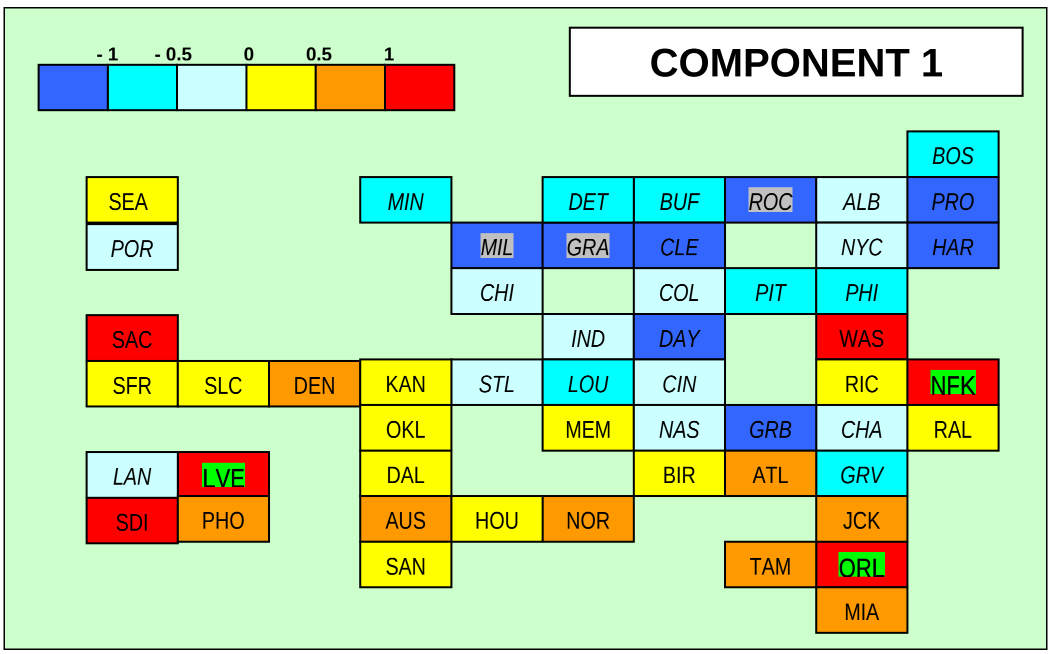


Figure 6.1 – Component 1 – Real estate, construction and accommodation associated with management services and leisure

Notes – The three highest scores were bolded and highlighted in green; negative scores were italicized and the three lowest ones highlighted in grey. Cities names were arranged according to geographical proximity; any distance is meaningless. Key to the abbreviations: ALB – Albany; ATL – Atlanta; AUS – Austin; BIR – Birmingham; BOS – Boston; BUF – Buffalo; CHA – Charlotte; CHI – Chicago; CIN – Cincinnati; CLE – Cleveland; COL – Columbus; DAL – Dallas; DAY – Dayton; DEN – Denver; DET – Detroit; GRA – Grand Rapids; GRB – Greensboro; GRV – Greenville; HAR – Hartford; HOU – Houston; IND – Indianapolis; JCK – Jacksonville; KAN – Kansas City; LAN – Los Angeles; LOU – Louisville; LVE – Las Vegas; MEM – Memphis; MIA – Miami; MIL – Milwaukee; MIN – Minneapolis; NAS – Nashville; NFK – Norfolk; NOR – New Orleans; NYC – New York; OKL – Oklahoma City; ORL – Orlando; PHI – Philadelphia; PHO – Phoenix; PIT – Pittsburgh; POR – Portland; PRO – Providence; RAL – Raleigh; RIC – Richmond; ROC – Rochester; SAC – Sacramento; SAN – San Antonio; SDI – San Diego; SEA – Seattle; SFR – San Francisco; SLC – Salt Lake City; STL – St. Louis; TAM – Tampa; WAS – Washington..

Component 2, explaining 14% of the data variance, was primarily defined by segment 42 (wholesale trade), with a significant association with segments 65 (management of companies and enterprises, henceforth "corporation management") and 48 (transportation and warehousing, henceforth "transportation"). This component also presented important negative component loadings in segments 62 (health care) and 44 (retail trade).

City scores (see Figure 6.2) showed a more complex pattern, expressing both spatial and scale trends. Firstly, scores tended to increase, like in Component 1, from North to South and from East to West; and secondly, within each region they also tended to be higher in larger cities, which is consistent with the importance of market size. The three highest scores were found in Atlanta (2.04), Dallas (1.90), and Charlotte (1.80), all important air transportation hubs and served by major highways, and the lowest in smaller cities of the Northeast and South relatively close to large cities. This component also showed the lowest city score amplitude.

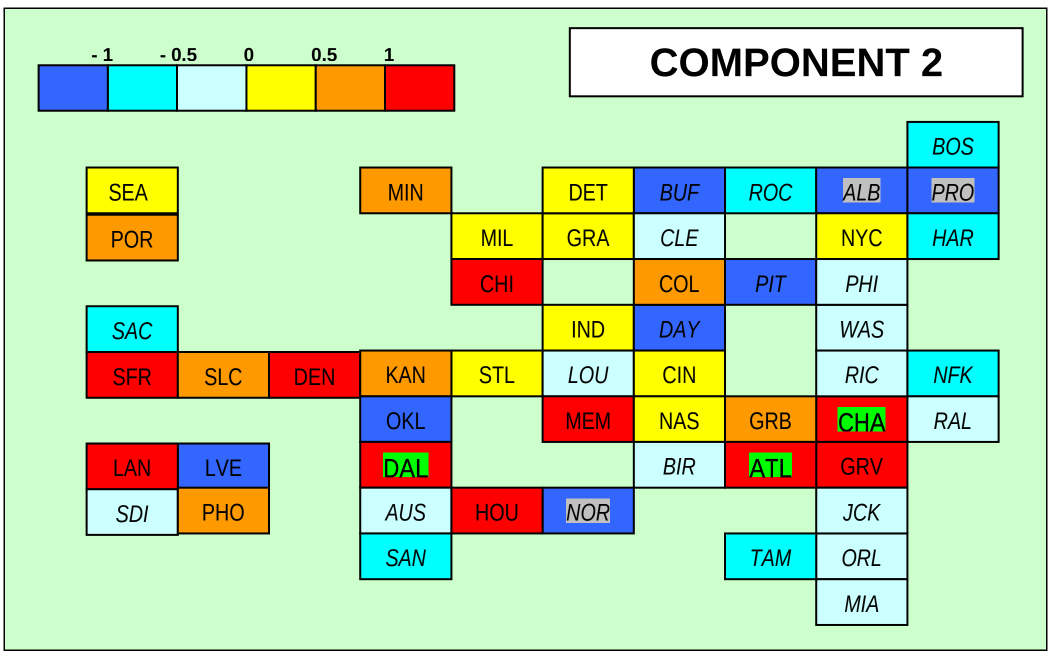


Figure 6.2 – Component 2 – Wholesale trade associated with corporation management and transportation

TUT city scores were quite contrasted, but consistent with the general trends – positive in the two largest markets, and negative in two smallest. Especially relevant was Dallas' score (1.90), the second largest overall, very close to top-scored Atlanta, and the only positive in the southern portion of the Highway 35 corridor, which asserts the important role of the city at the national level. Houston' score (1.14) was also relevant, well above the average. Austin showed a negative score (-0.02), but very close to the average, while San Antonio' (-0.78) was clearly below the average. This component presented the most contrasted scores in the TUT, including the largest score difference (2.67, between Dallas and San Antonio).

Component 3, explaining 11% of the data variance, was primarily defined by segments 52 (finance and insurance, henceforth "finance", 48 (transportation), and 81 (other services except public administration, henceforth "other services"). What was most relevant in this case were the low loadings of the three main segments, all between 0.45 and 0.50; actually, in absolute numbers the negative loading shown by segment 54 (professional, scientific, and technical services, henceforth "specialized services") was much higher. It should be also noted that this component captured another relevant dimension of transportation contrasting with that one showed in Component 2, a clear indication of the heterogeneity of this segment.

The city score distribution (see Figure 6.3) showed a complex combination of patterns. The scale dimension was the most evident, not just with higher scores in smaller cities, but also negative scores in most of the largest cities (Washington and San Francisco were the bottom two). The spatial dimension was still noticeable, showing three feeble trends overlapped, each one characterized by increasing scores from West to East, from North to South, and from more peripheral to more central locations. Overall the highest values were found in smaller cities in the eastern part of the country, and to a lesser extent in the center (the latter very likely related to transportation). Additional interesting features were the high scores showed by places linked to the insurance sector, like Hartford, Columbus, and Birmingham, and to shipping, like Memphis and Richmond.

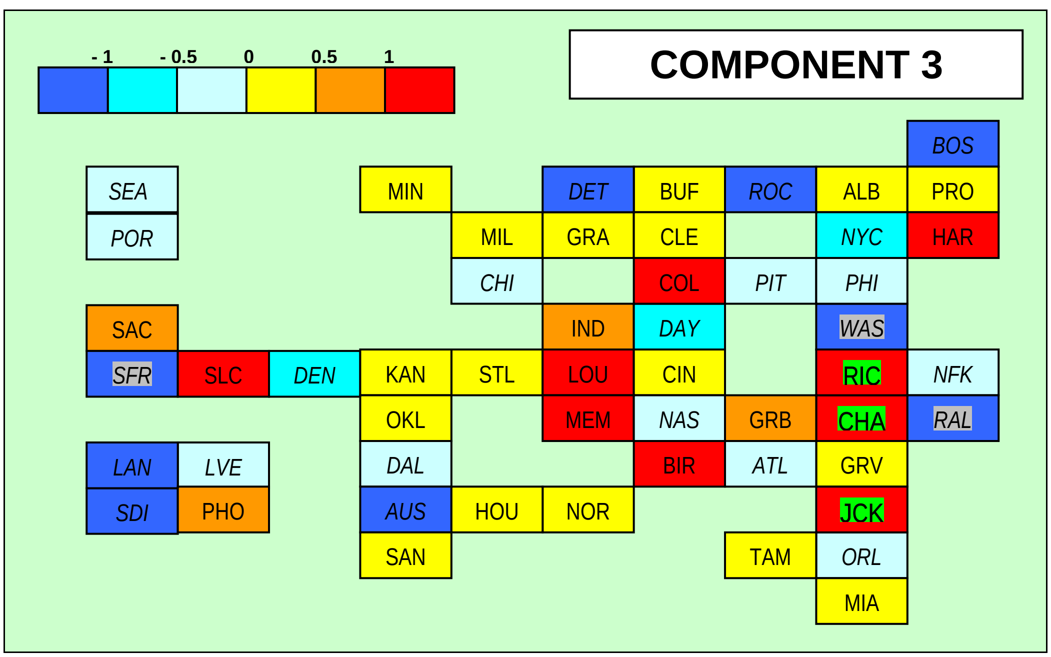


Figure 6.3 – Component 3 – Finance, transportation and other services

All Texas cities had city scores relatively low. San Antonio (0.36) had the highest, while Houston' (0.04) was slightly above the average. The other two were negative, Dallas' (-0.14) close to the average, and Austin' (-1.38) clearly an outlier.

Component 4, explaining 10% of the data variation, was primarily defined by segment 51 (information), with a significant association with segment 22 (utilities) and a second dimension of 52 (finance), and to a lesser degree 54 (specialized services). In this case there were no relevant negative component loadings.

City scores (see Figure 6.4) once more showed a confusing superposition of patterns. There was an important scale factor, with higher scores in larger cities (Washington and New York had the highest scores) and lower in smaller, but with important exceptions, namely Chicago and Houston. Spatial patterns were more complex, with a trend for decreasing scores from peripheral to central locations: the highest values were found in the Northeast and in a lesser extent the West, and the lowest in East Central areas and the Carolinian Piedmont. Las Vegas was a relevant outlier, with the lowest score (-3.19) found in all components.

This was another component were Texas cities showed relatively comparable scores, all not significantly far from the average. San Antonio (0.53) had the highest score, followed by Dallas (0.35), Austin (0.33), and finally by the only negative score in Houston (-0.11). It was in this component that the pairs Austin-Dallas and Austin-San Antonio had closer scores.

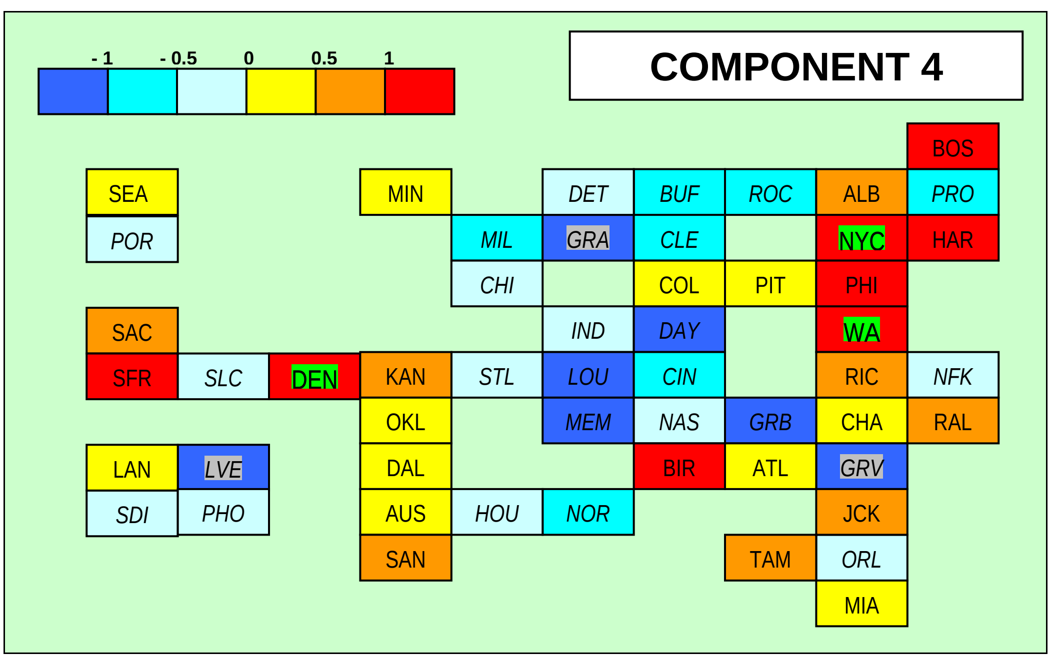


Figure 6.4– Component 4 – Information associated with utilities and finance

Component 5, explaining 7% of the data variation, was the most distinctive in the whole set, by presenting the fewest relationships with the 19 segments. It was basically defined by segment 21 (mining), with the second-highest component loading (0.76) of the whole PCA, and having no significant positive association with any other segment. The most remarkable secondary detail was the not-very-high negative component loading in segment 11 (forestry, fishing, hunting, and agriculture support, henceforth "country activities").

City scores (see Figure 6.5) showed overlapping spatial patterns, generally increasing from North to South and from both East and West to Central, and especially South-Central areas. There was a less significant scale dimension, with the scores of larger cities closer to the average and of smaller cities farther (Houston was the major exception). This was also the component with more regionally concentrated high scores, with 6 out of the top 9 found within a polygon with vertices by New Orleans, San Antonio, Oklahoma City, and St. Louis.

City scores in Texas cities showed strong contrasts. In Houston (1.52), and to a lesser extent San Antonio (0.65) they were well above the overall average, while in Dallas (-0.05) and Austin (-0.20) were negative but close to the average. It was in this component that the pair Dallas-Houston had their most contrasted scores.

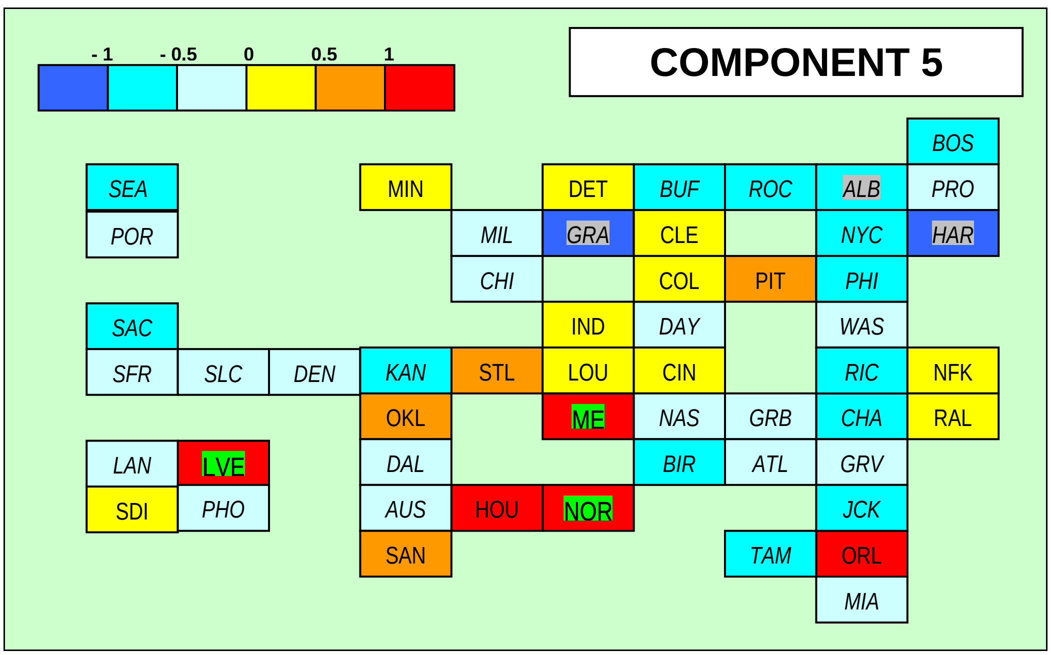


Figure 6.5 – Component 5 – Mining

The two last components must be approach with caution because they were weakly defined by secondary dimension of segments already represented in previous components. Consequently, their interpretation is difficult without additional data.

Component 6 was primarily related to segment 71 (leisure), with a loading of just 0.46; the next highest positive was segment 11 (country activities, with 0.37). There was also a negative association with sector 81 (other services).

Higher and lower scores appeared relatively disperse, the highest in smaller cities of the Midwest and Southeast, but also in the West, the lowest in Washington and farther South. There were also weak trends for increasing scores from East to West and from South to North. Interestingly, the highest scores appeared in places very close to lakes or mountains.

Houston (0.44) was the only TUT center with a positive score. Dallas (-0.82), Austin (-1.14), and especially San Antonio (-1.77) had scores well below the average.

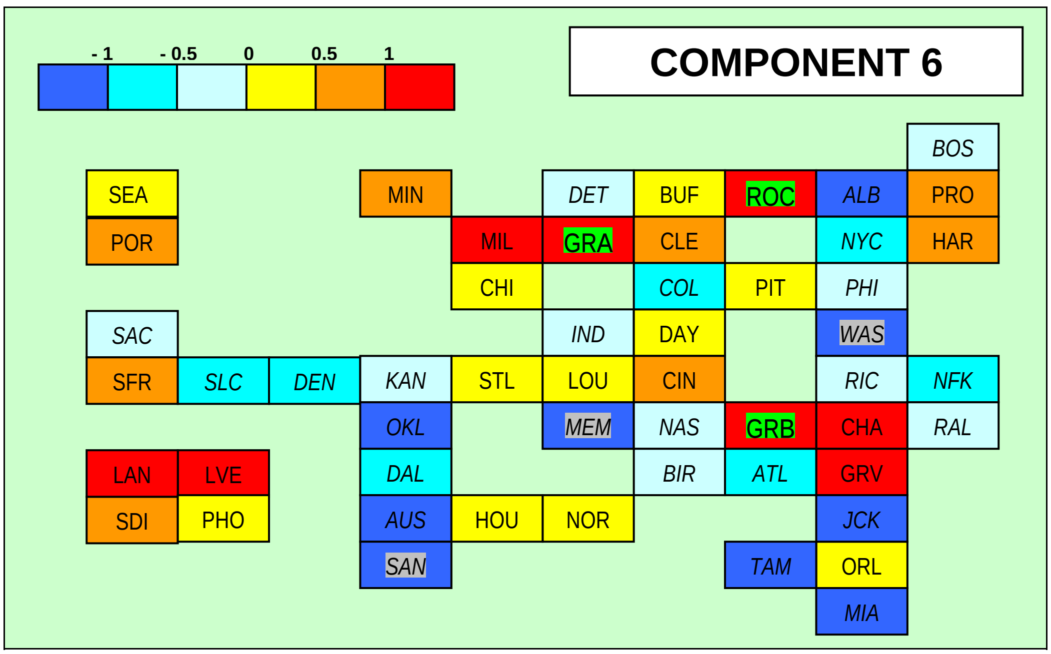


Figure 6.6 – Component 6 – Leisure (additional dimension)

Component 7 was directly related to segment 52 (finance and insurance), with no significant association (positive or negative) with any other segment. It reflects another dimension of this segment not captured by components 3 and 4.

City scores (see Figure 6.7) showed a dual pattern with values increasing from West to East and, to a lesser extent, from North to South. The highest scores were found in Hartford, Jacksonville and San Antonio, and the lowest in smaller cities by the Great Lakes and the Piedmont. There was no clear relationship between scores and city size.

The scores of the TUT cities were much contrasted. San Antonio (1.76) had a high score, Dallas one slightly above the average (0.07), and both Austin (-0.64) and Houston (-0.73) had negative scores.

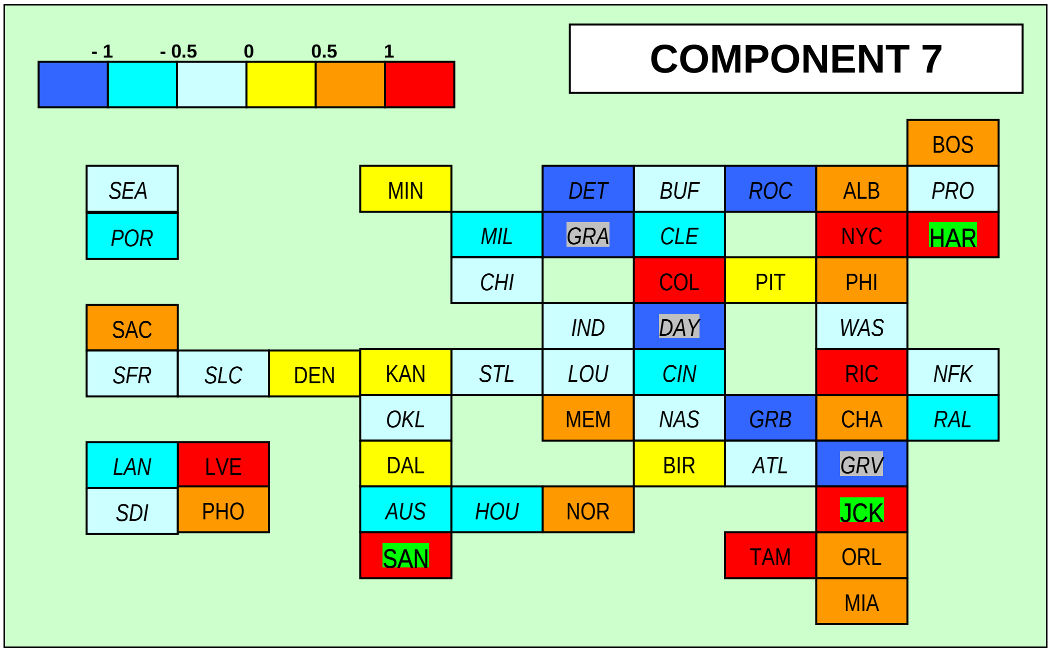


Figure 6.7 – Component 7 – Finance (additional dimension)

Five NAICS segments did not have any significant positive association to the seven components identified by the PCA. They were segments 11 (country activities), 31 (manufacturing), 44 (retail trade), 61 (education), and 62 (health care). This little contribution to explain variations found by the PCA in the data set could be either related to generally comparable values across the set of 53 metropolitan areas, or to scale factors, especially their lack of significance in metropolitan areas (and likely higher relevance in other places, urban or rural), not considered in this study.

After this overview of the relevant components and the spatial patterns showed by their city scores, the major conclusion that emerged was the relative independence of most segments. Only three components presented significant degrees of association, namely Component 1 (with three component loadings higher than 0.70), and to a lesser extent Component 2 and 4 (three component loading higher than 0.50); the other components were either defined by one single segment or by a combination of weak loadings (lower than 0.50). Additionally, other three main conclusions were derived:

- in most components the variation in city scores followed regional patterns, not always very clear, with values increasing from north to south (components 1, 2, 3, 5 and 7), from south to north (component 6), east to west (components 1, 2, and 6) from west to east (components 3, 4 and 7), from periphery to center (components 3 and 5), or from center to periphery (component 4);

- some components also showed a scale dimension, with the larger values prevailing in smaller cities (component 3), in larger cities (components 2 and 4), or being closer to the average for larger cities and more dispersed for smaller (components 1 and 5); and
- overall, the largest cities showed less contrasted scores within each component.

Contrasts between New York, Los Angeles and Chicago were significant. For instance, the highest score found in New York corresponded to Component 4 (information associated with utilities and finance), in Los Angeles to 6 (leisure, additional dimension), and in Chicago to 2 (wholesale trade associated with corporation management); the lowest score in New York corresponded to Component 6, in Los Angeles to 3 (finance, transportation and other services), and in Chicago to 1 (real estate, construction and accommodation associated with management services and leisure). New York showed three positive scores (components 4, 7 and 2, in descending order), Los Angeles also three (6, 2, and 4) and Chicago two (2 and 6). Conversely, Chicago had five negative scores (components 1, 7, 5, 3 and 4, in ascending order), Los Angeles four (3, 7, 5 and 1), and New York also four (6, 3, 5 and 1).

The four Texan metropolises showed contrasted scores when looking at each component individually, and unique combinations of high and low scores. Component 1 (real estate, construction and accommodation, associated to management services and leisure) was the exception, with all Texas cities scoring above the average. The higher (above +0.5) and lower scores (below -0.5) found in each city, all seven components considered, were in the following components:

- in Austin, high score in Component 1 (real estate, construction and accommodation associated with management services and leisure), and low in 3 (finance, transportation and other services), 6 (leisure, additional dimension), and 7 (finance, additional dimension);
- in Dallas, high score in component 2 (wholesale trade associated to corporation management), and low in 6;
- in Houston, high scores in components 5 (mining) and 1, and low in 7; and
- in San Antonio, high scores in components 7, 5 and 4 (information associated with utilities and finance), and low in 6 and 2.

From these results it is apparent that Texan cities have been taking advantage of strong growth in real estate, construction and accommodation. Taking in consideration other segments highly relevant in globalization processes most Texas city scores in components related to information and mining (4 and 5) were high or very close to the average; the most relevant where the scores of Houston and San Antonio in Component 5 (1.52 and 0.65, respectively), and San Antonio in 4 (0.53). In Component 2, the most closely related to corporate management, both Dallas (1.90) and Houston (1.14) had quite high scores, especially the former, Austin' was by the average, but San Antonio's was well below. And in components related to finance (3, 4, and 7), only in San Antonio scores were all positive and relatively high (0.36, 0.53 and 1.76); Dallas and Austin also had relatively good scores in Component 4 (0.35 and 0.33, respectively).

Overall, it was apparent that Dallas had the most diversified combination of segments, and San Antonio the most specialized, confirming data discussed in Chapter III. But the most surprising finding of all was San Antonio's highly significant combination of positive scores, especially in components linked to the segments more relevant to economic globalization. Despite its relatively low economic diversification, the strengths were in the right places.

6.3 Comparing the Texas Urban Triangle centers to other American metropolises

The discussion on the main PCA components was complemented by an analysis of the correlations between cities, obtained by performing a new PCA after rotation of the original matrix. In this way it was possible to investigate which other major centers had an overall employment composition more comparable (or more contrasted) to specific Texas cities.

Since the primary purpose of this dissertation is the discussion of how the TUT cities compare between themselves and with other major cities in the context of ongoing economic changes, the 53 cities in the data set were grouped into four major regional groups (West, South, Midwest and Northeast), to simplify discussions and enhance graphic visualization. Exhibit 6.3 in the Appendix shows the matrix of correlation coefficients between all 53 cities, and exhibit 6.4 identifies graphically the most relevant coefficients (both the highest and lowest for each city, and also all other correlations higher than 0.95 or lower than 0.75).

The average overall correlation between the employment composition of the set of cities was relatively high (0.861). All correlations were positive; the highest in the set was between Cincinnati and Nashville (0.991), the lowest between Las Vegas and Rochester (0.492). The cities with highest average correlation were Nashville (0.900), followed by Oklahoma City (0.898), Portland (0.895) and Raleigh, St. Louis and Indianapolis (all with 0.894). The cities with lowest average correlation were Las Vegas (0.654), Washington (0.762), Orlando (0.800), and Memphis (0.806). There were 17 cities with average correlations higher than 0.880, and 14 with average lower than 0.850.

From the analysis of the complete set of correlation coefficients, the following four major conclusions must be emphasized:

- few cities showed a very contrasted set of correlation coefficients, and those standing out for their uniqueness did so due to their lower correlations with other cities (this was the case of Las Vegas, Washington and Orlando);

- the largest U.S. cities, New York, Los Angeles and Chicago, showed few high and few low correlations with other cities, but relatively high correlations between themselves; Atlanta, Dallas and San Francisco formed another group with similar characteristics;
- smaller cities in the Midwest, and especially in the Ohio River basin and around the Great Lakes, showed the highest degree of intra-regional correlation; and
- cities in the South and West had more high correlations with cities in other regions than with cities within their own region.

Compared to cities in other regions, Texan cities showed neither many low nor many high correlation coefficients. All four had average correlations very close to the overall average of 0.861 (Houston, 0.883; Dallas, 0.869; Austin, 0.868; San Antonio, 0.859).

Correlations between TUT cities were also high, especially, and are shown in Table 6.1. From the table analysis, the major conclusions were consistent with previous findings:

- the correlation with Dallas was the highest for all the other three cities;
- the correlation with San Antonio was the lowest for all the other three cities;
- the highest correlation was between the pair Austin-Dallas; and
- the lowest was between the pair Austin-San Antonio, but practically identical to the pairs' Houston-San Antonio.

Table 6.1 – Correlation between the employment composition of Texas cities, 2004

	AUS	***DAL***	***HOU***	***SAN***
Austin	-	0.950	0.898	0.856
Dallas	0.950	-	0.928	0.871
Houston	0.898	0.928	-	0.858
San Antonio	0.856	0.871	0.858	-

Source: CenStats and author's calculations

Each TUT center presented unique correlation patterns and some strong contrasts. Table 6.2 lists the ten highest and lowest correlations found for each TUT city. Overall, there were few aspects in common, the following two being the most relevant:

- when comparing the four sets of highest correlations, there was very little in common; the four top correlation were different cities in different parts of the country; as the most shared element, three TUT cities had Birmingham, Portland and Tampa among their top ten correlations; and

- all TUT centers had their lowest correlation with Las Vegas, and three of them counted Greensboro, Hartford, Orlando, Rochester, and Washington among their ten lowest correlations.

One of the most interesting findings from the analysis of TUT cities coefficients was their higher correlations with cities outside Texas, especially in the West and South, then with their TUT neighbors. Out of the six possible pairings, only two showed high correlations. The pair Austin-Dallas (0.950) was the most significant case, being one of the top ten for both cities 5th and 2nd, respectively); correlation between the pair Dallas-Houston was also relevant, with Houston as Dallas' 10th highest link, and Dallas as Houston's 11th . Conversely, the correlation between Houston and San Antonio was one of the lowest for the first city.

Extremely interesting was the diversity in the patterns of higher and lower linkages. Each TUT city had the highest correlations with varied city sets, including places of contrasted locations and sizes across the nation; in the case of lowest correlations, the sets had more common features . This is a synthesis of main patterns in each place:

- in the case of Austin, most of the higher correlations were with cities of the West Coast (with San Francisco at the top), and the list included cities of contrasted sizes, from Los Angeles to Raleigh; the lower correlations were primarily with smaller cities in the East side of the country (Piedmont, Great Lakes, and Florida);
- in the case of Dallas, the list of highest correlations was the most varied, including cities of every size and every region; among the four TUT cities Dallas showed the highest correlation overall (with Atlanta), the highest with another Texas city (Austin), and the only high correlation with New York; most of the lower correlations were with cities in the Northeast, and of small size (Washington being the exception);
- in the case of Houston, despite the top place being Salt Lake City, most higher correlations were with smaller inland cities in the Mississippi basin; the list of lowest correlations was the most varied among TUT cities, including a few large cities and a majority of smaller cities in several parts of the country, including Texas; and
- in the case of San Antonio, the highest correlations were with relatively small cities, most of them in the South; its set of lower correlations was the most contrasted in city size, including four large cities, and among TUT cities, the one having more places in the West and South.

The correlations between Texas cities and the largest American cities were rarely among the top ten, the exceptions being the pairings of Austin with San Francisco, Atlanta and Los Angeles, and of Dallas with Atlanta and New York. To further discuss their similarities, the ten American cities more frequently identified as global or world cities in the literature were selected for additional examination. They included the trio New York, Chicago and Los Angeles (Friedmann 1986; Abu-Lughod 1999; Hahn 2004), and also, Atlanta, Boston, Detroit, Miami, San Francisco, Seattle, and Washington (Friedmann 1986; Hill and Feagin 1989; Nijman 1996; Warf and Erickson, 1996; Taylor 1997; Beaverstock et 1999a; Taylor 2004c; Taylor and Lang 2005).

Table 6.2 – Ten highest and lowest correlations between the employment composition of Texas cities and other major U.S. cities, 2004

	10 highest correlations		***10 lowest correlations***	
Austin	0.971 – San Francisco	0.950 – Los Angeles	0.698 – Las Vegas	0.836 – Orlando
	0.961 – Raleigh	0.949 – Denver	0.768 – Hartford	0.836 – Richmond
	0.953 – Oklahoma C.	0.949 – San Diego	0.800 – Memphis	0.840 – Charlotte
	0.951 – Atlanta	0.938 – Tampa	0.801 – Greensboro	0.841 – Cleveland
	0.950 – Dallas	0.933 – Portland	0.805 – Jacksonville	0.843 – Milwaukee
Dallas	0.983 – Atlanta	0.940 – New York	0.697 – Las Vegas	0.839 – Providence
	0.950 – Austin	0.937 – Kansas City	0.791 – Washington	0.843 – Albany
	0.947 – Salt Lake C.	0.929 – Tampa	0.811 – Rochester	0.847 – Greensboro
	0.943 – Portland	0.928 – Birmingham	0.822 – Hartford	0.850 – Orlando
	0.941 – Denver	**0.928 – Houston**	0.836 – Cleveland	0.852 – Grand Rapids
Houston	0.968 – Salt Lake C.	0.947 – Nashville	0.726 – Las Vegas	**0.858 – San Antonio**
	0.966 – Portland	0.945 – Indianapolis	0.786 – Washington	0.871 – San Francisco
	0.955 – Raleigh	0.945 – St. Louis	0.813 – Hartford	0.878 – Richmond
	0.948 – Oklahoma C.	0.936 – Louisville	0.840 – Rochester	0.878 – Albany
	0.947 – Birmingham	0.936 – Cincinnati	0.858 – Orlando	0.879 – Greensboro
San Antonio	0.960 – Tampa	0.929 – Birmingham	0.761 – Las Vegas	0.810 – San Francisco
	0.957 – Richmond	0.925 – Oklahoma C.	0.781 – Greenville	0.825 – Rochester
	0.948 – Jacksonville	0.924 – Nashville	0.791 – Grand Rapids	0.830 – Los Angeles
	0.944 – Columbus	0.923 – Norfolk	0.792 – Washington	0.830 – Atlanta
	0.934 – Albany	0.919 – Sacramento	0.799 – Memphis	0.832 – Greensboro

Source: CenStats and author's calculations.

The correlations between Austin, Dallas, Houston and San Antonio and each of the ten selected American global or world cities are shown in Table 6.3. Overall, Austin was the city with the highest average correlation, and San Antonio the lowest. When looking at the ten sets of four correlation coefficients (between each of the selected cities and the four TUT centers), and identifying the highest and the lowest in each set, Austin had the highest correlations with a half of the ten cities (Boston, Detroit, Los Angeles, San Francisco and Washington), Houston with three (Chicago, Miami and Seattle), Dallas with two (Atlanta and New York), and San Antonio with none. But San Antonio had seven out of ten of the lowest correlations (the only exceptions were Boston and Seattle, whose lowest correlations were with Dallas, and Washington, its lowest correlation was with Houston.

Overall, both from the comparison of intra-TUT correlation coefficients with the whole set and from the pattern of highest and lowest correlations of each TUT metropolises it was noticeable that similarities were much fewer than contrasts. The strongest correlations in all Texas cities were with places outside Texas, but in states having shown solid economic and demographic growth over the last decade, especially the West and South. Conversely, most of the lower correlations were with places in areas recently going through slow or negative growth, most in the Midwest and the North Atlantic coast.

Table 6.3 – Correlations between the employment composition of Texas cities and other major U.S. cities, 2004

	Austin	**Dallas**	**Houston**	**San Antonio**
New York	0.927	**0.940**	0.907	*0.902*
Boston	**0.914**	*0.888*	0.890	0.908
Washington	**0.883**	0.791	*0.786*	0.792
Chicago	0.902	0.915	**0.917**	*0.858*
Detroit	**0.930**	0.879	0.909	*0.850*
Atlanta	0.951	**0.983**	0.927	*0.830*
Miami	0.906	0.899	**0.906**	*0.882*
Los Angeles	**0.950**	0.920	0.928	*0.830*
San Francisco	**0.971**	0.904	0.871	*0.810*
Seattle	0.916	*0.886*	**0.917**	0.894
average	***0.925***	***0.901***	***0.896***	***0.856***

Source: CenStats and author's calculations

These broad generalizations support two major conclusions. One was relates with the predominant positive aspects emerging from the comparison between TUT cities and other American metropolises, since stronger correlations where found with cities and regions performing above the national average, which is consistent with data presented in Chapter III. The second relates with the significant degree of diversity within the TUT, both between its components and the types of cities outside Texas they have stronger correlations with (or they are more alike). This second conclusion strengthens the case of complementary between TUT places, even though there are some obvious exceptions, especially the overlapping between Dallas and Austin, and in a lesser degree Dallas and Houston.

In regard to comparisons between TUT centers and American world or global cities, the overall conclusions pointed to a different direction. Dallas and Houston, the top TUT candidates for world/global city status did not show strong analogies with other American equivalent. Dallas show a relatively high correlation with New York, but overall Atlanta emerged clearly as its major competitor; in the case of Houston, and somewhat surprisingly, the highest correlations where with smaller cities in the central part of the country, more an indication of its strength of functioning as a second-level regional center than as a place with functions comparable to New York, Chicago, Los Angeles, and the like. Austin was the TUT city with higher correlations with the top layer of American cities, but taking in consideration its weakness in most relevant globalization segments (with the sole exception of information), this should be considered more as a sign of cosmopolitanism than movement towards global city status.

6.4 Comparing the Texas Urban Triangle to other American urban regions

From the previous sections it was apparent the diversity between cities within the TUT, but also the lack of strong similarities when comparing TUT cities with the major American cities outside Texas. In this section previous findings are complemented with a comparison between the patterns of employment composition in the TUT and in other major American urban regions.

With this purpose, the most relevant urban regions in the U.S. were identified based in both existing literature (Gottman 1961; Swatridge 1971; Brunn and Ghose 1983/2003; Lang and Dhavale 2005), and the additional requirement of having at least four metropolitan areas with over a million inhabitants. The following five urban regions were considered:

- California, including Sacramento, San Francisco, Los Angeles and San Diego;
- Great Lakes, including Milwaukee, Chicago, Grand Rapids, Detroit, Cleveland and Pittsburgh;
- Northeast, including Boston, Providence, Hartford, New York, Philadelphia and Washington;
- Piedmont, including Greensboro, Charlotte, Greenville, Atlanta and Birmingham; and
- Florida, including Jacksonville, Orlando, Tampa and Miami.

The first three were identified earlier by Jean Gottmann (1961) and have been also designated as Sansan (San Francisco to San Diego), Chipitts (Chicago to Pittsburgh) or Midwest, and Bowash (Boston to Washington). The other three have emerged more recently.

Once including the TUT, the analysis involved a total of six regions and 29 cities. Since the major traits of each component city were already discussed in previous sections, the focus here was on general intra- and inter-regional comparisons.

One comment must be made at this point. City scores, being only relative measures of the composition of regional employment, can not be used in analyses of economic performance; a positive score only indicates that the proportion of employment in the most relevant segments in that component and cities was higher than the average of the set of metropolitan areas (and a negative score, the opposite). Thus, for instance, a very high score in a component defined by mostly obsolete segments would never be a comparative advantage.

Using regional standard deviations of non-standardized component loadings as a measure of internal diversity, a quick comparison of the overall six figures identified Florida as the urban region with the largest overall variation, and the Great Lakes with the lowest. The TUT figure was very close to those of California and the Northeast (see Table 6.4). In other words, the overall composition of regional employment in the TUT, all components considered, showed an internal diversity comparable to other urban regions.

Comparing scores at the component level, Component 1 showed, consistently with the nature of PCAs, the highest variation, not only overall but in all regions but the TUT.

Table 6.4 – Standard deviations of non-standardized component loadings by component and urban region, 2004

	C 1	***C 2***	***C 3***	***C 4***	***C 5***	***C 6***	***C 7***	***all***
California	4.5	3.1	3.4	1.8	0.3	0.8	1.5	6.7
TUT	**1.8**	**3.7**	**2.1**	**0.9**	**1.0**	**1.0**	**2.5**	**6.6**
Piedmont	6.1	2.9	2.5	5.0	0.2	1.2	3.0	5.6
Great Lakes	4.7	2.6	1.8	3.2	0.9	1.1	2.7	4.4
Northeast	6.7	2.3	4.0	3.3	0.6	1.2	1.8	6.4
Florida	4.7	0.9	2.4	2.0	1.1	1.0	1.2	8.3
average	***4.8***	***2.6***	***2.7***	***2.7***	***0.7***	***1.0***	***2.1***	**-**

Source: CenStats and author's calculations

The complete set of city scores, considering the 29 cities and seven components discussed in section 6.2 are graphically represented in Figures 6.8 and 6.9. The cities were grouped by urban region (each column corresponding, in the following order, to California, TUT, Piedmont, Great Lakes, Northeast, and Florida).. It should be noted that the table only shows city scores for 29 of the original pool of 53 cities, since isolated cities or smaller urban regions were excluded. Consequently, if some component shows a disproportionate number of positive scores in the table that indicates its key economic segments tend to be more concentrated in urban regions; if it shows a predominance of negative scores that is a sign its segments occur more often in smaller or isolated cities.

Comparing the distribution of scores in the table from region to region, some common patterns became apparent. The following were the most significant:

- every component showed a very unique combination of scores, with stronger contrasts from region to region than between cities of different sizes;

- all components showed clear clusters of the higher or lower scores in a few regions, but these regions differed from component to component;
- cases where all cities in the same region had either all positive or all negative scores were not frequent (3 cases of positive scores, and 4 of negative); overall, all components showed some degree on intra-regional variation;
- each components had clusters of positive scores in different regions: Component 1 (real estate, construction and accommodation associated with management services and leisure) in Florida, California, and the TUT; Component 2 (wholesale trade associated with corporation management) in the Piedmont and Great Lakes; Component 3 (finance, transportation and other services) in the Piedmont; Component 4 (information associated with utilities and finance) in the Northeast, California, Florida and TUT; Component 6 (leisure, other dimension) in the Great Lakes, Piedmont, and California; Component 7 (finance, other dimension) in Florida and Northeast; Component 5 (mining) did not show clear clusters of positive scores;
- the clusters of negative scores also varied from region to region: Component 1 in the Great Lakes and Northeast; Component 2 in the Northeast and Florida; Component 3 in California and Northeast; Component 4 in the Great Lakes; Component 5 in the Northeast, Piedmont, California and Florida; Component 6 in Florida and the TUT; and Component 7 in the Great Lakes and California; and
- the stronger inter-regional contrasts were found in the initial (and most relevant components), especially 1, 2 to 4.

To reduce a little the amount of data analysis, at the intra-regional Component 6 was disregarded due to the lesser relevance of its defining segment in the ongoing processes of economic globalization. Reviewing one region at a time, the following were the most relevant single aspects:

- in California, all components showed a combination of positive and negative scores, but the positive clusters were in Components 1 (especially in Sacramento and San Diego), and 3 (in San Francisco and Sacramento); most scores were negative in components 3, 5 and 7, related to finance and mining; comparing cities, the most noticeable aspect was the contrasting scores of larger and smaller cities;
- in the TUT, there was a majority of positive scores, especially in Component 1 (all cities); strongly positive scores were less frequent then in other regions except the Great Lakes, but strongly negative scores were few, only second to Florida; (inter-city analogies and their mixed patterns were previously discussed in section 6.4);

- the Piedmont presented the most varied combination of components and scores of all regions, with a combination of positive and negative scores in all but one component (5, all scores were negative); scores also indicated strong regional specialization in Component 2, and to a lesser extent 3; more contrasted scores occurred in smaller cities (mostly positive in Birmingham and Charlotte, mostly negative in Greensboro and Greenville); overall Atlanta's scores were the closest to the average;
- the Great Lakes showed a the largest set of negative scores in any region; all scores were negative in Component 1 and the large majority in Components 4 and 7; Component 2 showed some degree specialization; Pittsburgh was the place with more positive scores, while Chicago had only negative (but not far from the average); Grand Rapids and Milwaukee were the cities with most comparable scores;

Component 1, 2004	SAC	DAL	GRB	MIL	BOS	JCK
real estate, construction and accommodation	SFR	AUS	CHA	CHI	PRO	ORL
associated with management services and leisure	LAN	SAN	GRV	GRA	HAR	TAM
	SDI	HOU	ATL	DET	NYC	MIA
			BIR	CLE	PHI	
				PIT	WAS	
Component 2, 2004	SAC	DAL	GRB	MIL	BOS	JCK
wholesale trade	SFR	AUS	CHA	CHI	PRO	ORL
associated with corporation management	LAN	SAN	GRV	GRA	HAR	TAM
	SDI	HOU	ATL	DET	NYC	MIA
			BIR	CLE	PHI	
				PIT	WAS	
Component 3, 2004	SAC	DAL	GRB	MIL	BOS	JCK
finance, transportation and other services	SFR	AUS	CHA	CHI	PRO	ORL
	LAN	SAN	GRV	GRA	HAR	TAM
	SDI	HOU	ATL	DET	NYC	MIA
			BIR	CLE	PHI	
				PIT	WAS	
Component 4, 2004	SAC	DAL	GRB	MIL	BOS	JCK
information	SFR	AUS	CHA	CHI	PRO	ORL
associated with utilities and finance	LAN	SAN	GRV	GRA	HAR	TAM
	SDI	HOU	ATL	DET	NYC	MIA
			BIR	CLE	PHI	
				PIT	WAS	

City scores (x); for key to abbreviations please refer to Figure 6.1		
$x \geq 1.0$ (red)		$0 < x < -0.5$ (light cyan)
$0.5 \leq x < 1.0$ (orange)		$-0.5 \leq x < -1.0$ (cyan)
$0 \leq x < 0.5$ (yellow)		$x \geq -1.0$ (blue)

Figure 6.8 – Principal components (1 to 4) in cities of major urban regions, 2004

- the Northwest was the region presenting a most clear pattern of specialization, with a clear dominance of positive (Components 4 and 7) or negative scores (Components 1, 2, and 5); the trio New York-Boston-Philadelphia showed identical trends in all component, indicating some relevance of scale, while Washington and Providence were the most contrasted places; and
- Florida also presented a relatively clear pattern of specialization, but not as pronounced as the Northeast; all scores in components 1 and 7 were positive, mostly positive in 3 and 4, and mostly negative in 5, and all negative in 2; Orlando was clearly the outlier, the other three cities having score sets quite analogous.

Component 5, 2004 mining	SAC	DAL	GRB	MIL	BOS	JCK
	SFR	AUS	CHA	CHI	PRO	ORL
	LAN	SAN	GRV	GRA	HAR	TAM
	SDI	HOU	ATL	DET	NYC	MIA
			BIR	CLE	PHI	
				PIT	WAS	
Component 6, 2004 leisure (additional dimension)	SAC	DAL	GRB	MIL	BOS	JCK
	SFR	AUS	CHA	CHI	PRO	ORL
	LAN	SAN	GRV	GRA	HAR	TAM
	SDI	HOU	ATL	DET	NYC	MIA
			BIR	CLE	PHI	
				PIT	WAS	
Component 7, 2004 finance (additional dimension)	SAC	DAL	GRB	MIL	BOS	JCK
	SFR	AUS	CHA	CHI	PRO	ORL
	LAN	SAN	GRV	GRA	HAR	TAM
	SDI	HOU	ATL	DET	NYC	MIA
			BIR	CLE	PHI	
				PIT	WAS	

City scores (x); for key to abbreviations please refer to Figure 6.1				
	$x \geq 1.0$	(red)	$0 < x < -0.5$	(light cyan)
	$0.5 \leq x < 1.0$	(orange)	$-0.5 \leq x < -1.0$	(cyan)
	$0 \leq x < 0.5$	(yellow)	$x \geq -1.0$	(blue)

Figure 6.9 – Principal components (5 to 7) in cities of major urban regions, 2004

From this detailed summary, three major points stood out: first, the most frequent type of contrast was between larger and smaller cities; second, more varied and extreme scores were found in smaller places; and third, large cities show some relevant analogies, both within and across regions.

One last exercise was performed to complement previous findings. For each TUT center the highest coefficient correlation in every other region was identified (resulting in a set of five cities/correlations, one per region. Then each of the sets (Austin, Dallas, Houston and San Antonio) was compared to all the identical sets for the 25 cities outside the TUT, in order to identify the largest number of matches. Dallas and Atlanta were the only case of a perfect match, consistent with data already discussed. In the other TUT cities there were at least one case of 4 out of 5 matches: Austin with both Los Angeles and San Diego, Houston with both Detroit and Pittsburgh, and San Antonio with Hartford. These cases of strong correlation analogies, with each of its cities having closer matches in a different part of the country, reinforce the case of high internal diversity in the TUT.

All six urban regions showed important contrasts in their city scores, but also particular combinations of higher and lower scores, supporting the hypothesis of inter-regional specialization. At the same time, and somewhat less pronounced, within each urban region its cities presented a diversity of combinations of high and with low scores, in almost every component the high ones of some cities compensating for the low ones in others.

A dual pattern of inter-regional and intra-regional specialization stood out in every urban region, indicative of significant levels of complementarity (and diversity) within both the national and regional economies, with analogies to the cases discussed by Nestor Rodríguez and Joe Feaguin (1986) in the context of the world economy.

Restricting the comments just to the components more strongly related to economic globalization, despite the combinations of high and low scores, the result was not just a complex mosaic. In this particular components, in the current context, high scores reflect higher involvement, and in some regions, namely Florida, California and the TUT, they predominated; conversely, in the Great Lakes city scores were mostly negative, indication of weak involvement in globalization processes. Some regions showed very strong specializations, especially the Northeast in Components 4 and 7, Florida in Components 1 and 7, and the Piedmont in Component 3. In other cases, like in California and the TUT, there were good sets of positive scores, but either not in all or most of the cities, or not significantly above the average (or both).

To situate everything in the proper context, it is timely a brief reference to a fundamental issue, whose analysis is beyond the scope of this dissertation: the relationship between data sets collected at a point in time, and the larger economic processes occurring at other scales. With data for just one year it is almost impossible to separate what was local from regional responses to wider trends, and what was contextual. Different segments and different regions can perform in contrasted ways during periods of expansion or recession. In this case, the data set corresponded to a year of strong economic growth, when the GDP posted a real growth rate of 4.2%, and the American economy was recovering from a small recessionary period initiated in 2001 (USBEA 2005). Despite the consistency of this context and the relevance of real estate identified by the PCA, since this segment is considered as one of the short-term drivers of the national economy, especially after the last recession (Case, 2000; Benjamin *et al*. 2004; Leonhardt 2005), such strength may mask other longer-term and fundamental processes.

Regarding the TUT, the general overall conclusion was that the region showed a reasonable intra-regional diversity, and mostly positive scores in key components; but in both cases, not with the depth found in some other regions and components.

6.5 Summary

In order to compare the relevance of specific economic sectors in major cities in the TUT and the United States, a PCA was performed in SPSS using metropolitan employment figures for 2004. Data was obtained from the United States Bureau of Census and, after estimations of confidential values, was organized in a matrix of 53 metropolitan areas with population over one million and 19 two-digit NAICS segments. The program identified seven relevant components, explaining 77% of the data variation. Five segments were found with no significant positive association to any of component.

From the analysis of the PCA components it clearly emerged a dual pattern of score variation. Scores in some components showed a trend to increase/decrease across physical space (latitude or longitude), while in other components the scale dimension (variation related to city size) was more relevant. But no clear city typologies emerged from the data set. Most cities presented unique combinations of high-score and low-score components, and even the three American cities more often identified in the literature as global cities – New York, Los Angeles and Chicago – showed relevant differences.

The cities in the TUT also showed contrasted scores. In general, Texan cities showed stronger similarities with cities in the West and South rather than with other cities in their state or with cities of a particular size.

At the regional scale the TUT showed general characteristics comparable to other American urban regions – a unique combination of strong and weak components, and significant internal contrasts. In regard to relevant globalization-related components, the region consistently showed positive (but rarely too high) scores in those related to real estate and construction, and to a lesser extent mining and information; conversely, scores tended to be mixed in components related to finance and corporate management.

CHAPTER VII

AIR LINKAGES AND PASSENGER FLOWS IN TEXAS AND AMERICAN METROPOLISES

Ships and sails proper for the heavenly air should be fashioned.
Then there will also be people, who do not shrink from the dreary vastness of space.
Johannes Kepler, letter to Galileo Galilei, 1609

7.1 Introduction

Finding a good set of empirical data to measure connectivity between places is a difficult task, and the air travel industry is one of the few that collects comprehensive data based on links and flows from point to point. The nature of the industry, focusing in medium and long distance connections, the relative few providers and gateways, and the need to provide customers with reliable information ahead of time make data collection easier and widely available. Despite its primary function of moving people and cargo, it has been an industry widely affected by the information revolution: from internet ticket sales, flight take-off, on-air route control and landing, to the development of better performing and far-reaching vehicles, information systems are everywhere. It is undisputable that air is, with the existing technologies available, the type of transportation between global cities.

Texas cities are well served by international airports, and the headquarters of two major international carriers. Passenger flows originated (or ending) in TUT gateways are arguably the best available to measure the importance of their connections, and also the role of these gateways both within the country and in the Texas context.

7.2 Air passenger flows at the global scale

Major differences in air travel regulation and data collection previously discussed justified analyzing international and domestic data separately. Limited data is available from international organizations like the ACI, ICAO or IATA due to lack of comparability and insufficient reporting. But available data still can provide a good overview of the industry and identify the key airports and airlines.

The twenty largest airports in the world ranked by the 2005 passenger traffic are listed in Table 7.1. Two details stand out from the table: firstly, the high proportion of American airports, amounting to eleven out of the top twenty; and secondly, the presence of two Texan airports in the list: Dallas/Fort Worth International (DFW) ranking sixth, and Houston's George Bush International Airport (IAH) ranking 17th. The ranking of these Texan airports has been stable over the last years, as Dallas dropped from 5th to 6th (surpassed by Tokyo) and Houston remained in the same position from 2000 to 2005 (ACI 2001 and exhibit 7.1 in the Appendix).

Table 7.1. Busiest airports in the world by total passengers, 2005

rank	*city*	*airport code*	*passengers*
1	Atlanta, GA	ATL	85,907,423
2	Chicago, IL	ORD	76,510,003
3	*London, UK*	*LHR*	*67,915,403*
4	*Tokyo, Japan*	*HND*	*63,282,219*
5	Los Angeles, CA	LAX	61,489,398
6	**Dallas, TX**	**DFW**	**59,176,265**
7	*Paris, France*	*CDG*	*53,798,308*
8	*Frankfurt, Germany*	*FRA*	*52,219,412*
9	*Amsterdam, Netherlands*	*AMS*	*44,163,098*
10	Las Vegas, NV	LAS	43,989,982
11	Denver, CO	DEN	43,387,513
12	*Madrid, Spain*	*MAD*	*41,940,059*
13	New York, NY	JFK	41,885,104
14	Phoenix, AZ	PHX	41,213,754
15	*Beijing, China*	*PEK*	*41,004,008*
16	*Hong Kong, China*	*HKG*	*40,269,847*
17	**Houston, TX**	**IAH**	**39,684,640**
18	*Bangkok, Thailand*	*BKK*	*38,985,043*
19	Minneapolis, MN	MSP	37,604,373
20	Detroit, MI	DTW	36,389,294

Notes: Figures for Passengers refer to total passengers enplaned and deplaned, with passengers in transit counted once.

Source: Airports Council International.

Other major facts noticed were the presence of Atlanta at the top of the ranking, instead of leading global cities like New York, Tokyo or London, and the absence of airports in Miami, Washington or San Francisco from the top twenty. Atlanta has only one large airport in its urban area and operates as the main hub for Delta Airlines, while the other urban areas referred here have their traffic distributed by more than one major airport.

Air passenger traffic was seriously disrupted by the events of September 11, 2001, leaving major airlines in financial difficulties (Isidore 2005). But comparing 2005 and 2000 passenger traffic, most top airports had recovered and even surpassed the previous figures (ACI 2001, 2006). Houston's IAH posted a significant growth rate in this period (+12.6%), but still lower than other major airports in the United States, especially in the east coast (27.5% at New York's JFK; 26.5% in Philadelphia; 19.3% in Las Vegas), Europe (27.5% in Madrid), and especially Asia (89.3% in Beijing; 31.6% in Bangkok; 23% in Hong Kong). Only four of the 2005 top twenty airports had shown negative growth, all of them in the United Sates. Dallas (-2.5%) was one of them. But even though the other cases of negative growth were posted in major western and southern airports (-20.1% in San Francisco; -7.8% in Miami; -7.4% in Los Angeles), the relatively poor performance in Dallas has little to do with any regional trend and was more likely related to the pullout of Delta Airlines, which early in 2005 ceased to use DFW as a regional hub (Okada 2005).

The high ranking of both Texas cities, as well as Atlanta's, is related to being the headquarters and main hub of large carriers. American Airlines Inc. (AA), the largest global airline by number of passengers, is based in Dallas, and Continental Airlines, Inc. (CA), the 10th largest, is based in Houston (see Table 7.2). Passenger figures also show that major American carriers rely more in the domestic market than foreign counterparts, which have a higher proportion of international passengers, especially those based in Europe (like Lufthansa and Air France). Among the top five American carriers, AA and CA conveyed larger proportions of international passengers than their three counterparts, hypothetically an indication of more relevant international connections.

Table 7.2. Largest passenger airlines in the world, 2005

rank	*airline*	*passengers*	*domestic*	*international*
1	**American Airlines Inc.**	**98,038**	**79%**	**21%**
2	Delta Air Lines, Inc	86,007	90%	10%
3	United Airlines	66,717	85%	15%
4	Northwest Airlines, Inc.	57,547	82%	18%
5	Japan Airlines International	50,884	75%	25%
6	Deutsche Lufthansa A.G.	48,958	27%	73%
7	All Nippon Airways	48,315	92%	8%
8	Société Air France	47,787	40%	60%
9	China Southern Airlines	43,228	93%	7%
10	**Continental Airlines, Inc**	**42,777**	**77%**	**23%**

Notes: Figures for passengers shown in thousands.

Sources: IATA, World Transportation Statistics, 2006.

Dallas and Houston are major centers in the global air transportation network, because they serve a high number of passengers and benefit from their role as the major hub of a primary airline. But total passenger figures, while useful, provide a very incomplete picture of air traffic. They only allow for comparisons between airports, not destinations, and give no indication of types of traffic or flows between places. Thus, it is necessary to complement them with other data.

7.3 Passenger flows between American and foreign destinations

The Department of Transportation (DOT 2006a, 2006b, 2006c) publishes regularly aggregated data on in- and out-passenger flows which airlines have to provide for every international flight. Rough information from the DOT was synthesized by elaborating and running several Microsoft Excel routines. Total 2005 international passengers originated in major urban areas of the contiguous portion of the United States are shown in the exhibit 7.2 in the Appendix. New York, with close to 30 million passengers, was by far the largest gateway, distantly followed by Los Angeles, Miami and Chicago, all three with more than 10 million. Houston and Dallas were among the top ten gateways, ranking 7th and 9th with 6.6 and 5.1 million passengers, respectively.

Total passengers leaving major United States airports in scheduled international flights (charter traffic not considered) in 2005 are shown in exhibit 7.4 in the Appendix. From these figures, the following major points deserve notice:

- in major urban areas like New York, Miami, Chicago, San Francisco and Washington international traffic originates in more than one airport;
- the share of foreign passengers varies significantly from place to place, being higher in airports of large urban areas (Los Angeles, New York, San Francisco), but also of some specialized major tourist destinations (Orlando, Tampa, Las Vegas);
- the share of American passengers also varies significantly; in general, it was higher in airports serving smaller urban areas (Salt Lake City, Cincinnati, Charlotte); and
- in major air carrier hubs the share of U.S. passengers was generally high, like in Dallas (89%), Houston (82%) and Atlanta (80%).

Information on the destination of international revenue passengers leaving the U.S. is also available from the DOT (2006c). Data for 2005 referred 22,739 links between 289 U.S. and 401 foreign airports. Once data for multi-airport locations was aggregated, it remained 2,132 linkages between 180 U.S. and 290 foreign metropolitan areas. Total passengers by major foreign destinations are shown in exhibit 7.3 in the Appendix. Out of the top 20 foreign destinations, eleven were medium-haul (four in Canada, five in Latin America and two in The Caribbean), and nine were long-haul (one in South America, five in Europe, and three in East Asia). London was, and by far, the top destination with over 15 million passengers (11% of total 139 million), followed by Toronto with about 8.5 million; next were Frankfurt, Tokyo and Paris, all three with over 6 million. In Latin America and The Caribbean, Cancun was the largest medium-haul, and Sao Paulo the largest long-haul destination.

The DOT also provides figures on scheduled passengers flying into the United States from other countries (2006a). Foreign airports with the highest number of 2005 U.S.-led passengers are listed in exhibit 7.5 in the Appendix. The following points are especially relevant:

- in general, more distant airports in East Asia, Europe, and Oceania have higher shares of foreign travelers, while airports in American countries have higher shares of U.S. travelers;
- in the Americas, airports in coastal areas have significantly larger shares of U.S. travelers than those located inland; and
- in Cancun, Santo Domingo, Puerto Vallarta and Aruba, all medium-haul gateways, the U.S. share is higher than 90%.

In year 2005 a total of 4.8 million passengers departed the U.S. in chartered flights (DOT 2006c), the lion's share traveling to Mexico (39%) and the United Kingdom (21%). The aggregated share of Texas gateways was 8.7%, or 418 thousand passengers; the large majority of these traveled to Cancun (69%) and to other destinations in Mexico (13%). In exhibit 7.6 of the Appendix, showing the city pairs with highest chartered passenger flows, only three linkages involving Texas cities appeared among the top 40, and only one among the top ten. The link between Dallas and Cancun deserved especial attention, because it was the charter connection with more passengers within the Americas, and overall only surpassed by the transatlantic pairs Orlando-Manchester and Orlando-London. But considering that most passengers in international charter flights from Orlando were foreigners, while most from Cancun were Americans, it is safe to conclude that the route Dallas-Cancun was the most relevant charter linkage for U.S. citizens traveling abroad.

In year 2005 about 60.1 million passengers, both scheduled and chartered, traveled between U.S. gateways and short- and medium-haul foreign destinations (DOT 2006c). The corresponding share of Texas gateways was 13% of the total, amounting to 8.0 million passengers, of which 64% traveled to Mexico, 15% to Canada, and 21% to other countries.

In order to compare the performance of different gateways it was created an Air Connectivity Index based on passenger flows, flight distances, and length of linkages. Its justification and formula were discussed in detail in Chapter IV, along with the operational definitions for short-, medium- and long-haul flights adopted in this study.

Applying the Air Connectivity Index to U.S. gateways for international destinations, New York emerged as the top gateway for short- and medium-haul international traffic (see Table 7.3). Using New York's index as base 100, Miami and Los Angeles were the places having closer scores (99.1 and 97.4, respectively). Two cities stood out next, Houston (94.4) and Chicago (93.2). Dallas (90.8) appeared in a third group of three cities, with a score almost identical to Atlanta's, and higher than San

Francisco. A total of 41 gateways had scores above 50, and among them were San Antonio (26th; scoring 67.2) and Austin (39th; scoring 55.0).

Table 7.3. U.S. gateways with largest connectivity scores for short- and medium-haul international flights

urban area	*passengers*	*links*	*passenger miles*	*score*
New York	8,317,538	60	10,702,428,895	100.0
Miami	9,972,779	65	8,524,255,316	99.1
Los Angeles	6,247,694	44	9,568,069,363	97.4
Houston	**4,623,862**	**54**	**4,751,139,980**	**94.4**
Chicago	4,096,098	42	4,963,343,497	93.2
Dallas	**3,168,220**	**40**	**3,519,736,378**	**90.8**
Atlanta	2,946,560	37	3,496,185,981	90.2
San Francisco	2,291,199	27	3,523,458,967	88.4
Philadelphia	1,686,442	34	1,778,933,212	85.6
Washington	1,427,463	38	1,478,204,237	85.2
Phoenix	1,592,687	27	1,891,176,848	84.6
Charlotte	1,570,333	26	1,816,693,002	84.1
Minneapolis	1,541,448	25	1,724,348,088	83.6
Orlando	980,804	42	982,284,133	83.3
Boston	1,185,415	35	1,161,263,039	83.2

Notes: Passengers refer to all enplanements of any type; links refer to final destination of passengers.
Source: United States Department of Transportation and author's calculations.

From exhibit 7.7 in the Appendix, listing the top 40 city pairings by total passengers, Miami appeared as the U.S. gateway with more top connections (11), followed by New York (8), Los Angeles (6) and Chicago (4). The table also shows clearly that the only two foreign cities receiving relevant passenger traffic from Texas were Cancun (Dallas and Houston were its 1st and 2nd U.S. gateways, respectively), and to a lesser extent Mexico City (Houston and Dallas were its 2nd and 5th U.S. gateways).

The larger metropolitan areas in the six major urban regions in the country accounted for 85.3% of the international short- and medium-haul passenger traffic. The Northeast was the region generating more (21.2% of the national total), followed by Florida (18.7%), California (14.9%) and the TUT (13.3%). The Great Lakes (9.6%) and the Piedmont (7.5%) were the regions with lower passenger traffic.

In the same year 79.0 million long-haul passengers flew from U.S. gateways to foreign destinations (DOT 2006c), of which 3.8 million (4.8%) originated in Texas. Texas-originated passengers departed to 27 foreign destinations, 15 being in South America (accounting for 26% of passengers), 7 in Europe (60% of passengers), 3 in East Asia (14% of passengers), and 2 in Africa (with irrelevant passenger counts).

Applying the Air Connectivity Index to long-haul linkages, a different pattern emerged. Only 26 gateways showed scores above 50, and New York was, in this case by far, the best connected gateway (see Table 7.4). Using New York's score as base 100, Los Angeles appeared as second-best connected gateway, and then followed by a group of five cities with scores between 85 and 90 (Chicago, Miami, San Francisco, Washington, and Atlanta). Dallas and Houston appeared in a third group of six cities, all with scores between 78 and 82. No other gateway in Texas had a score above 50.

Table 7.4. U.S. gateways with largest connectivity scores for long-haul international flights

urban area	*passengers*	*links*	*passenger miles*	*score*
New York	20,767,043	99	92,134,884,220	100.0
Los Angeles	10,764,203	39	67,320,698,662	93.5
Chicago	7,126,666	38	35,315,943,648	90.0
Miami	6,951,434	48	22,607,590,372	88.8
San Francisco	6,122,644	25	36,510,449,374	87.9
Washington	4,272,039	46	18,043,567,448	87.4
Atlanta	4,348,337	32	20,568,256,869	86.2
Boston	2,735,986	28	9,190,256,335	81.3
Detroit	2,734,188	18	13,921,103,426	81.2
Orlando	2,214,320	24	9,479,932,990	80.7
Dallas	**1,883,514**	**20**	**9,653,067,022**	**79.8**
Houston	**1,947,171**	**20**	**9,446,975,245**	**79.7**
Philadelphia	2,006,865	21	7,582,031,271	78.8
Seattle	1,275,024	12	6,427,528,985	75.0
Minneapolis	1,054,023	15	4,962,263,181	74.8

Notes: Passengers refer to all enplanements of any type; links refer to final destination of passengers.

Source: United States Department of Transportation and author's calculations.

Other ways to measure the global relevance of U.S. gateways are total long-haul international passengers enplaned and number of linkages. The preeminence of New York is apparent, the gateway for over-20 million passengers (26% of total), a figure almost double the second-ranked gateway, Los Angeles. Houston and Dallas ranked 12th and 13th, respectively, both with close to 2 million passengers, less than gateways with smaller total (domestic and international) and international (short-, medium- and long-haul) traffic like Boston, Detroit, Orlando and Philadelphia.

New York's primacy was even more evident considering the number of linkages, with more than twice the next U.S. gateway, Miami, (99 and 46 international linkages, respectively). Both

Houston and Dallas had links to 20 cities. Comparing the two Texas gateways to Atlanta, also a major southern airline hub, they had significantly fewer passengers and city linkages.

The table in exhibit 7.8 of the Appendix shows the top 40 long-haul city pairs in 2005, ranked by total passengers. There is a clear spatial pattern in the pairing of the most-linked U.S. gateways in the table, being especially relevant New York (paired to 10 cities, 7 of them in Europe), Los Angeles (to 7 cities, 3 in East Asia), San Francisco (to 5, 4 in East Asia), Miami (to 4, 3 in South America), Chicago (to 3, 2 in Europe) and Washington (to 3, all in Europe); Atlanta, Detroit, Orlando, Boston and Minneapolis also appeared in the list . None of the top 40 city pairs included a Texas gateway, a second significant indication of weaker linkages with long-haul foreign destinations than other major U.S. gateways.

From these figures it was apparent that the Texas gateways were of much lesser relevance in international long-haul air traffic than in short- and medium-haul. One of the obvious reasons was the relatively small number of links. While Houston had scored significantly higher than Dallas in short- and medium-haul connectivity, their long-haul connectivity was practically identical – Houston had more passengers, but Dallas had more passenger miles (resulting from more distant links).

At first glance Dallas and Houston had very comparable performances, with identical connectivity scores and total passengers, and the same number of city linkages. A few differences only emerged when contrasting their city pairings. Table 7.5 lists the top 20 long-haul international linkages originated in Texas.

The top long-haul international destination for both Texas gateways was London, and the number of passengers was comparable. But Houston had significantly higher passenger counts than Dallas going to Amsterdam, Paris and Bogotá, while Dallas had higher ones to Frankfurt, Tokyo, Sao Paulo, Zurich, Buenos Aires, Santiago and Seoul. In general, Houston had stronger links to Europe, and Dallas to East Asia and South America, a pattern that mirrored the composition of airline alliances: Houston-based CA and Air France-KLM are among the members of SkyTeam, while Dallas-based AA, Cathay Pacific and LAN Chile are members of Oneworld (OAG 2006; see exhibit 7.10 in the Appendix).

This contrast between a more Asia-oriented Dallas and a more medium-haul America-oriented Houston also reflected contrasting orientations in their economic relationships with the outside world. The Customs District of Houston, benefiting from its coastal location, was the 4th in the nation in 2006, and close to a quarter of its business where with Mexico and Venezuela, two major oil producing countries (WorldCity 2007a). The inland Customs District of Dallas, the 15th in the nation in the same year, had China as its top partner with close than 30% of the business; in spite of its location, Dallas was one of the top five custom districts dealing with China (WorldCity 2007b, c).

It must be stressed that the larger metropolitan areas of the six major urban regions of the United States accounted in aggregate for a staggering 94.2% of the international long-haul traffic in the country in 2005. But there are major contrasts from region to region: the Northeast generated far more passenger traffic than any other region (37.7% of the total), followed by California (21.4%), Great Lakes (12.5%), Florida (11.8%), Piedmont (6.0%), and finally the TUT (4.8%). It became apparent that the TUT was the least relevant of the major urban regions for long-haul traffic.

Table 7.5. Major long-haul international air traffic linkages of Texan gateways by total passengers, 2005

rank	*Texas city*	*foreign city*	*foreign country*	*passengers*
44	Houston	London	UK	448,740
46	Dallas	London	UK	435,972
59	**Houston**	**Amsterdam**	**Netherlands**	**372,536**
67	**Houston**	**Paris**	**France**	**317,622**
72	**Dallas**	**Frankfurt**	**Germany**	**299,593**
78	**Dallas**	**Tokyo**	**Japan**	**273,123**
142	Houston	Tokyo	Japan	158,976
149	**Dallas**	**Sao Paulo**	**Brazil**	**154,353**
161	Houston	Frankfurt	Germany	143,324
170	Houston	Sao Paulo	Brazil	130,790
173	**Dallas**	**Zurich**	**Switzerland**	**130,215**
177	Dallas	Paris	France	125,426
203	**Dallas**	**Buenos Aires**	**Argentina**	**111,599**
213	**Dallas**	**Santiago**	**Chile**	**101,216**
217	Houston	Lima	Peru	97,851
221	Dallas	Lima	Peru	96,220
245	**Houston**	**Bogotá**	**Colombia**	**70,896**
248	**Dallas**	**Seoul**	**South Korea**	**67,502**
253	Houston	Caracas	Venezuela	64,064
254	Dallas	Caracas	Venezuela	63,567

Notes: Passengers refer to total passengers starting their trips at the location; in transit traffic was not considered. For each foreign city the top Texan gateway is shown in bold; if numbers were too close no gateway is highlighted.

Source: United States Department of Transportation and author's calculations.

From the previous set of figures on international passenger traffic it was concluded that Dallas and Houston were long-haul gateways of comparable size, with some important differences in their market orientation. But none of them could be considered as a major U.S. international gateway, as their passenger flows and number of linkages were significantly lower than a top tier of seven cities (New York, Los Angeles, Chicago, Miami, San Francisco, and to a lesser extent Atlanta and Washington).

Medium-haul traffic was more relevant, especially to a few Mexican destinations, with Houston originating more scheduled and Dallas more charter passengers. Houston had significantly more passenger enplanements than Dallas, and considering the higher relevance of passengers going to North and Central America (70.4% versus 62.7% in Dallas) and its higher foreign share of international passengers (17.9% versus 11.0%), it is safe to conclude that Houston has a larger role as gateway for immigrants and visitors from this region. But again, with the exception of vacation-oriented Cancun, both Texas cities were second-tier gateways, behind leading places like New York, Los Angeles, Miami and Chicago.

Overall passengers originated in the four TUT metropolises were also of less relevance than comparable figures from the other five urban regions considered, especially for long-haul traffic. In this case, the TUT was the region that originated fewer passengers, with a mere 4.8% of all enplanements in the contiguous states total, and just 45 linkages altogether, less than the Washington metropolitan area alone. The TUT had more relevance for short- and medium-haul traffic, but still its figures were not comparable to the Northeast or California.

7.4 Passenger flows within the United States

The most comprehensive source for domestic air travel is the database created by the Bureau of Transportation Statistics (BTS), which allows the creation of customized tables. Data for all the commercial passenger traveling within U.S. airports in 2005 was extracted and reorganized through Excel routines to provide annual flows between pairs of urban areas.

In 2005 a total of 624.7 million revenue passengers were enplaned in 565 airports in the contiguous 48 states (BTS 2007), located in 411 urban areas (metropolitan or micropolitan areas) or single non-metropolitan counties, and corresponding to 12,954 linkages. Almost one tenth of enplanements (59.7 million passengers, or 9.6% of the total) originated in Texas.

A much larger number of gateways was found for domestic traffic, as should be expected, since shorter distances allow for the use of a wider variety (and size) of planes and airports, and the absence of international border crossings implies fewer legal restrictions. The majority of the gateways were relatively small, 93% of them with fewer than 5 million enplanements, and 79% less than half million, but in aggregate they still accounted for 21% and 4% of all domestic enplanements, respectively.

The largest gateways in 2005 and respective enplanement figures are presented in exhibit 7.11 in the Appendix. Chicago had the largest number of enplanements, totaling 38.8 million (6.2% of the total), closely followed by Atlanta (38.2 million); next were New York (35.4), Los Angeles (32.3), Washington (28.4) and Dallas (28.1), all of them with more than 25 million enplanements. In aggregate, these top six gateways accounted for over 201 million enplanements, or almost one out every three enplanements (32.2%). A second group of nine cities with between 15 and 23 million enplanements came next, and included Houston (11th, 19.3 million). Two other TUT metropolitan areas were also among the 40 largest domestic gateways: Austin (36th, 3.6 million enplanements) and San Antonio (37th, 3.5 million).

Applying the Air Connectivity Index to domestic passenger traffic, New York emerged once more as the best connected gateway in the contiguous states (see Table 7.6). Using New York's index as base 100, it was possible to group the major gateways into two groups:

- the first included New York and the five cities with scores higher than 97.5, which from this point will be considered as national centers: Chicago, Los Angeles, Atlanta, Dallas and Washington; and
- a second group of seven cities, with scores still relatively high (between 94 and 96), which from this point will be called as sub-national centers: Las Vegas, San Francisco, Denver, Houston, Miami, Minneapolis and Phoenix.

Table 7.6. U.S. gateways with largest connectivity scores for domestic flights

urban area	*passengers*	*links*	*passenger miles*	*score*
New York	35,388,117	160	37,742,105,684	100.0
Chicago	38,812,136	156	32,642,416,268	99.0
Los Angeles	32,293,384	129	35,493,714,432	98.4
Atlanta	38,155,321	161	27,917,477,358	98.3
Dallas	**28,069,728**	**170**	**23,036,566,487**	**97.5**
Washington	28,429,039	171	22,611,558,585	97.5
Las Vegas	20,332,148	138	21,313,845,017	95.9
San Francisco	22,863,962	112	25,177,048,505	95.7
Denver	19,792,628	159	17,606,475,870	95.6
Houston	**19,342,669**	**147**	**16,240,750,009**	**94.7**
Miami	20,182,398	118	20,192,605,747	94.7
Minneapolis	16,331,063	168	13,885,918,168	94.6
Phoenix	19,249,665	117	18,343,491,161	94.1
Detroit	16,198,408	157	11,183,693,472	92.9
Boston	13,182,265	131	12,905,039,535	92.7
Austin	*3,636,505*	*110*	*2,435,422,095*	*82.2*
San Antonio	*3,514,700*	*98*	*2,270,985,255*	*81.2*

Notes: Passengers refer to all enplanements of any type; links refer to final destination of passengers.
Source: United States Department of Transportation and author's calculations.

The two leading Texas gateways had prominent positions nationally, with Dallas (5th overall, scoring 97.5) in the group of national centers, and Houston (10th overall, scoring 94.7) among the group of sub-national centers. In this case, a total of 157 gateways had scores above 50, and among them were Austin (36th, scoring 82.2) and San Antonio (41st; 81.2), but also seven other Texan gateways, all outside the TUT: El Paso (51st, 75.7), Lubbock (91st, 63.4), Midland (100th, 61.0), Amarillo (101st, 61.0), Brownsville (102nd, 60.8), Mcallen (110th, 59.6), and Corpus Christi (116th, 58.3).

These findings were complemented by analyzing the number of linkages found in each gateway, distances to the corresponding destinations and total enplanements per linkage. Table 7.7 lists the gateways having the largest number of links according to a few basic criteria. The following are the most relevant general conclusions:

- in domestic air traffic linkage counts tended to privilege centrality over market size, as evidenced by the absence of major gateways from the West coast and Florida from the top 15 more-linked places, and the high ranking of central places like Minneapolis, Denver, St. Louis or Memphis;
- linkage counts tended to be higher in the East, where higher population density is higher and a larger number of medium- and small-size destinations are found; and
- Washington, Dallas and Minneapolis stood out as the gateways with more links.

The pattern did not change significantly if only trips over 500 miles, those beyond twice the threshold where trends in passenger counts reversed (from this point on these flights are called medium-haul linkages) where considered. But overall, larger urban areas such as Los Angeles and New York tended to move up in the ranking. All four TUT metropolises were relatively well connected, especially Dallas which ranked nationally second in the overall number of links, and first if only medium-haul linkages were considered.

The analysis of medium-haul linkages with higher frequency (those having at least a quarter of a million passengers annually, which from this point on are called upper linkages) provided valuable additional insights. The exclusion of lower-traffic and shorter connections reduced the number of linkages from 12,954 to 392, and of gateways from 411 to 44. Even though upper linkages represented just 3.0% of total linkages in 2005, they accounted for 265 million enplanements (42.8% of the total). Texas contributed with 26.7 million enplanements, about one tenth of the total. Table 7.7 also includes all trips over 500 miles, all with over a quarter of a million enplanements annually, and upper linkages for the top gateways. The following conclusions were particularly relevant:

- in most urban areas the majority of links were to destinations beyond 500 miles, but only a small number of them mobilized over a quarter of a million passengers;
- the majority of higher-traffic linkages (over a quarter of a million passengers) involved destinations beyond 500 miles;
- three gateways – Atlanta, Dallas, and Chicago – stood out as having the largest number of upper linkages (25 to 27), and concentrated 20% of all upper linkages in the nation;

- a second group of gateways were still relatively well-connected, in each one upper linkages both representing no less than 10% of all local linkages and totaling between 14 and 21 linkages; along with Houston this group included Washington, New York, Denver, Las Vegas, Boston and Los Angeles;
- among the top 20 best-linked urban areas a total of five (Memphis, Pittsburgh, Kansas City, Cleveland and Cincinnati) had fewer than 5 upper linkages; this was also the case of Austin and San Antonio, which had about one hundred links but only one upper linkage each (Austin to Chicago, and San Antonio to Atlanta).

Table 7.7. Gateways with largest number of domestic linkages, 2005

rank	*metropolitan area*	*all linkages*		*over 250,000 enplanements*	
		total	*>500 miles*	*total.*	*>500 miles*
1	Washington	171	106	34	18
2	**Dallas**	**170**	**121**	**36**	**26**
3	Minneapolis	168	118	15	13
4	Atlanta	161	94	46	27
5	New York	160	117	29	20
6	Denver	159	99	24	21
7	Detroit	157	90	19	14
8	Chicago	156	104	38	25
9	**Houston**	**147**	**108**	**22**	**17**
10	Philadelphia	147	99	19	12
11	St. Louis	144	84	7	5
12	Pittsburgh	144	76	7	2
13	Memphis	141	86	1	0
14	Charlotte	139	76	11	6
15	Las Vegas	138	106	23	16
37	*Austin*	*110*	*92*	*3*	*1*
43	*San Antonio*	*98*	*85*	*3*	*1*

Notes Texas major gateways are shown in bold.

Source: Bureau of Travel Statistics and author's calculations.

Upper linkages deserve further analysis because they displayed a much more organized hierarchy, one showing the penetration of larger centers. Total upper linkage passengers and their corresponding share in the top 20 gateways are represented in the table in exhibit 7.12 in the Appendix. Two details immediately stand out: larger cities like New York and Los Angeles tended to benefit from scale effects (larger market base) and ranked better in total passengers than in number of linkages. At the same time, cities with a relatively peripheral location in the nation, like Miami and Seattle, tend to have higher shares of upper linkage passengers.

The calculation of the Air Connectivity Index based on just upper linkages produced scores and rankings relatively similar to those obtained with all linkages (see Table 7.8). With New York at the top, gateways could be subdivided into two similar major groups. But two important differences were found when comparing overall and upper linkage scores:

- firstly, only three gateways improved their scores when compared to New York, all of them national centers – Chicago, Atlanta and Dallas; and
- secondly, Washington moved from the national to sub-national group, and Minneapolis no longer appeared as a sub-national center.

The first difference is particularly significant. The large majority of gateways (40 out of 44) had lower upper linkage connectivity scores then overall connectivity scores, a clear indication of a larger weight of local and regional linkages, and lesser of flights longer and/or higher-traffic linkages. Conversely, in the three cities with improved connectivity, their scores came even closer to the highest one (top-ranked New York); this indicated a relatively more relevant role at the national level, and confirmed their role as national centers.

Table 7.8. U.S. gateways with largest connectivity scores for upper linkage domestic flights

gateway	*passengers*	*links*	*passenger miles*	*score*
New York	24,372,219	20	32,647,159,329	100.0
Chicago	23,689,180	25	25,878,936,793	99.9
Atlanta	21,527,932	27	20,289,443,936	99.0
Los Angeles	17,168,404	17	28,052,039,816	98.2
Dallas	**16,575,845**	**26**	**17,421,505,601**	**97.9**
Washington	14,660,527	18	16,699,018,059	95.6
Denver	13,196,321	21	12,891,398,475	95.0
San Francisco	12,466,952	14	18,923,102,221	94.9
Las Vegas	9,171,824	16	14,022,870,534	93.9
Miami	15,307,301	12	15,891,001,026	93.0
Phoenix	9,611,696	17	11,041,473,215	92.9
Houston	**9,109,905**	**17**	**10,446,066,719**	**92.6**
Seattle	8,741,619	15	10,776,637,134	92.0
Boston	7,192,585	14	9,490,486,932	90.9
Orlando	8,772,577	13	8,911,146,900	90.1
Austin	*295,070*	*1*	*288,578,460*	*55.9*
San Antonio	*272,449*	*1*	*238,120,426*	*54.8*

Notes: Passengers refer to all enplanements of any type; links refer to final destination of passengers.

Source: United States Department of Transportation and author's calculations.

This hierarchy with five national centers, each in a different part of the country, was confirmed by the analysis of the main linkages in each gateway (the one with more passengers). A GIS query was used to first identify the linkage to a place with higher connectivity having the highest passenger traffic (from this point called top upward linkage). In the case of New York, at the top of the hierarchy, there was no such connection. In the large majority of gateways (41 out of 43), the top upward linkage was also the link with enplanements. Only in two cases (Los Angeles and Atlanta) the top upward linkage (New York for both cities) did not coincide with the linkage with highest passenger traffic (which were San Francisco and Miami, respectively).

In the analysis of top upward linkages competition from land transportation should be considered, especially in those cases where a better linked gateway is within driving distance. Empirical evidence discussed in Chapter IV showed a threshold at about 250 miles. Considering this possibility major links were classified in four types (a more detailed discussion was also provided in Chapter IV): types A (upward linkage without interference), B (upward linkage with interference), C (stronger upward intervening opportunity within a 250-mile buffer), and D (closer upward intervening opportunity within the same buffer.

The results of this exercise are summarized in the map of Figure 7.1 where only the linkages from the 120 gateways with a minimum of a quarter of a million passengers were represented. In a few cases it was possible to have two (B and either C or D), or even three types of linkages (B, C and D) originating from the same gateway like in Tampa. .Two major groups and five subsystems were apparent:

- an western group, with two subsystems centered in Los Angeles and Dallas; and
- an eastern group, with three subsystems centered in New York, Chicago and Atlanta.

The two subsystems were defined based on the existence of a top upward linkage to a counterpart within the same group: Dallas to Los Angeles, and Atlanta, Chicago and Miami to New York. The higher number of linkages in the eastern part of the country was reflective of its higher population density and larger number of urban centers. If only the same 120 gateways were considered, Chicago was the destination with more Type A linkages (12), followed by Los Angeles and Atlanta (9), Dallas (7) and New York (5). When contrasting these numbers and figures in Table 7.8 (total upper linkages and enplanements) it was apparent that New York was a destination concentrating fewer linkages from larger and more distant gateways, while other centers had more connections, but either shorter and/or with lower traffic.

Among the sub-national gateways, Charlotte, Houston, Minneapolis and Seattle were the destination of two Type A linkages; Denver, Miami, Phoenix, Portland, and Washington of one.

Additionally, San Francisco, Salt Lake City, and Cincinnati were the destinations of two Type B linkages.

Three other major aspects also were worth of note:

- the large number of Type B linkages to New York, Dallas and Atlanta;
- the strong linkages between the three largest urban areas in Florida and New York; and
- the contrast between Atlanta, having strong linkages from most coastal gateways, and Dallas, whose stronger linkages were inland gateways.

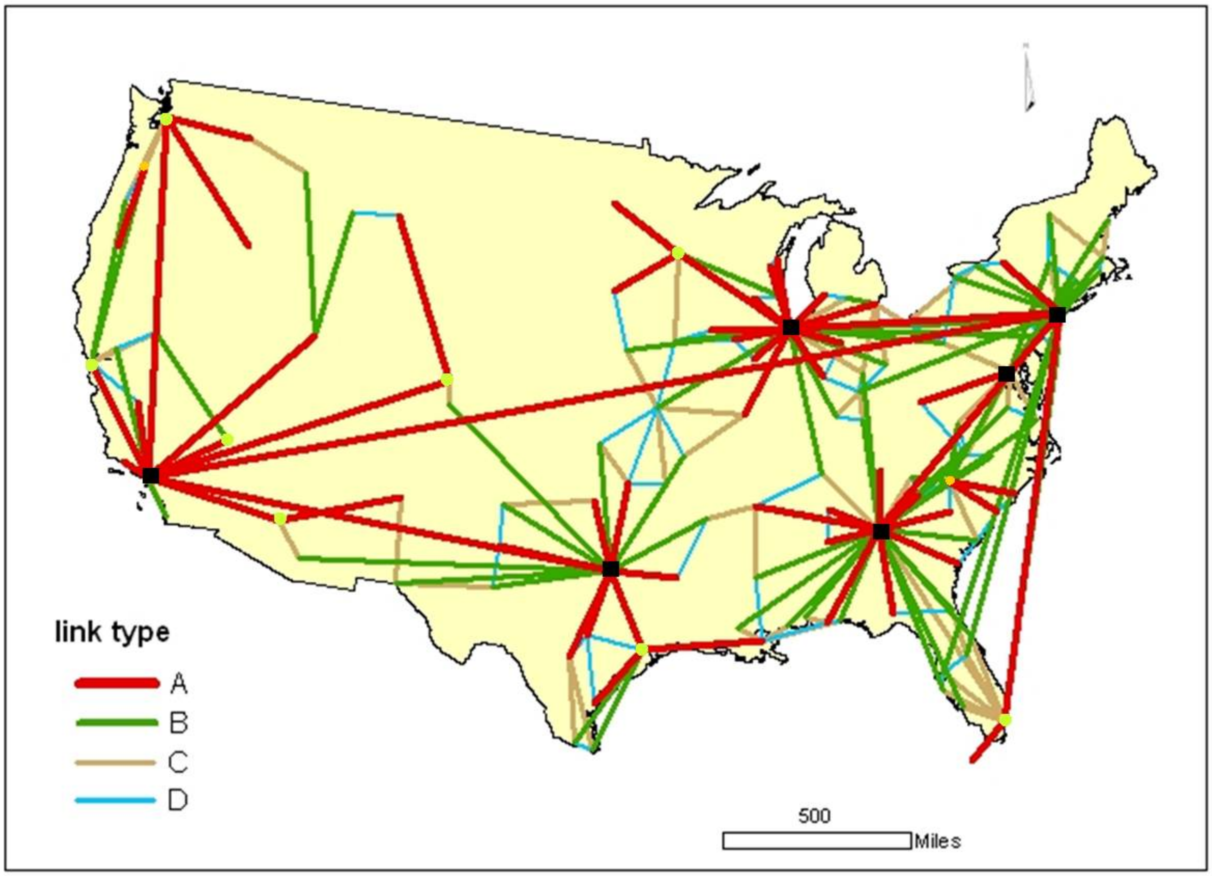


Figure 7.1 Top upward linkages and closer alternatives for domestic air traffic gateways, 2005

This last aspect is important to explain the large difference in passenger enplanements between the two urban areas. While Atlanta serves a more populated area and operates as a turning point for short- and medium-haul traffic to/from Florida and other important coastal vacation destinations in the Southeast, Dallas serves a larger but less populated area and does not provide access to comparable vacation destinations.

The subsystem centered in Dallas was relatively extensive, including practically the totality of Texas and Oklahoma, most of Louisiana and Arkansas, and part of Kansas. At the next hierarchical level Houston was the only place of significance, as the top destination from gateways in the western Gulf Coast, including New Orleans.

Dallas was also the destination of Type B linkages from relatively distant secondary urban areas (Springfield, MO, Colorado Springs, Little Rock, and Tucson), but it should be noted that each has a gateway of higher connectivity within driving distance (St. Louis, Denver, Memphis, and Phoenix, respectively). This could be an indication of transition areas between subsystems. A similar situation was found in Louisiana, where Baton Rouge is within driving distance of New Orleans but had a Type B linkage to Atlanta.

This exercise helped to characterize the role of the Texas metropolises in domestic air transportation. It was apparent that Dallas and Houston were the only relevant gateways in the state, since Austin and San Antonio had significantly lower passenger enplanements, linkages and connectivity scores. But also there were some major differences between the top two gateways. On the one hand Dallas, more central in the context of the country, better linked and enplaning more passengers, should be considered as a national gateway, the major origin/destination for most places in the Southwest. On the other hand, Houston, with fewer linkages and enplanements but second only to Dallas in the region, was a major sub-national gateway, with a set of figures comparable to major regional centers like Washington, Denver, San Francisco, and Seattle. Houston was the top destination from gateways along the Gulf of Mexico between Brownsville and New Orleans. Passenger traffic from gateways away from the coast, including Austin, San Antonio, and even Laredo, was primarily oriented to Dallas.

These different roles in domestic air transportation were best illustrated by a direct comparison of total passengers enplaned in major domestic gateways traveling to the two major Texas centers. Table 7.9 compares enplanements to Dallas and Houston from the twenty major gateways (in passenger traffic) outside Texas. In all the twenty cases there were a larger number of enplanements to Dallas than to Houston. In three cases (Boston, Los Angeles, Charlotte) enplanements to Dallas almost doubled those to Houston; but also in three other cases (Detroit, Philadelphia and Phoenix), enplanements to Dallas and Houston were relatively comparable, but still a little higher to the former. In this universe of twenty gateways, Dallas generated 50% more enplanements then Houston. The ratio of Dallas/Houston enplanements from the 20 top gateways was higher than the same ratio from all the other 389 destinations (1.50 and 1.40, respectively), one additional evidence that Dallas had relatively better linkages to larger gateways.

These differences in hierarchy and passenger enplanements between the two main Texas urban areas also reflect the contrasted sizes of their major economic areas (FCC 1997). In area Dallas' MEA covers an area comparable to France, and about 4.5 times larger than Houston's. The contrast in population was also significant, as the former was estimated to be the fifth largest in the nation by population, with close to 13 million inhabitants in 2006, while the latter ranked 13th nationally and had a population close to 7.5 million (USBC 2007).

The six major urban regions discussed in Chapter VI generated the highest proportion of domestic air traffic – in 2005 two out of three passengers (66%) were enplaned in one of them. Considering only their metropolitan areas with one million or more inhabitants, in aggregate the Northeast accounted for 17.0% of all domestic enplanements, California for 12.0%, the Great Lakes for 11.2%, the TUT for 8.7%, the Piedmont for 8.4%, and Florida for 8.2%.

Table 7.9. Total ticketed passengers enplaned in Dallas and Houston traveling to the top 20 domestic destinations, 2005

destinations	*from Dallas*	*from Houston*	*ratio D/H*
Atlanta	1,105,382	723,451	1.53
Boston	377,285	189,414	1.99
Charlotte	335,147	178,758	1.87
Chicago	1,124,904	700,052	1.61
Cincinnati	185,516	101,304	1.83
Denver	796,084	529,832	1.50
Detroit	344,151	323,055	1.07
Las Vegas	820,509	572,097	1.43
Los Angeles	1,951,506	1,012,599	1.93
Miami	864,823	659,457	1.31
Minneapolis	422,426	250,801	1.68
New York	1,069,268	795,929	1.34
Orlando	609,394	474,551	1.28
Philadelphia	377,911	331,346	1.14
Phoenix	652,604	566,192	1.15
Salt Lake City	341,488	228,584	1.49
San Diego	461,022	312,243	1.48
San Francisco	910,834	567,709	1.60
Seattle	461,799	304,466	1.52
Washington	1,074,358	700,613	1.53
sub-total (20 destinations)	*14,286,411*	*9,522,453*	*1.50*
% of all enplanements	*50.9 %*	*49.2 %*	
all other destinations	*13,783,317*	*9,820,216*	*1.40*

Notes: Figures for revenue ticketed passenger enplaned.

Source: Bureau of Transportation Statistics and author's calculations.

This exercise demonstrated the national relevance of the TUT, and especially of Dallas, in domestic air transportation. It is the center of one of the five major subsystems identified in the contiguous states, one serving an area extending well beyond the borders of Texas.

7.5 Air linkages in Texas

In year 2005 a total of 59.7 million ticketed passengers (9.6%) were enplaned in 36 airports located in 25 urban areas totally or partially in Texas (the airport of Texarkana, AR, was included since most of the population in the urban area lives in the Texas side). Of these passengers, 54.9 million (92.0%) were enplaned within the TUT, and 47.4 million (79.4%, or about four out of five) in either Dallas or Houston (BTS 2007).

The twenty largest airports in Texas by total number of domestic enplanements in 2005 are listed in Table 7.10. It was immediately apparent the contrasted figures, and a clear grouping emerged in four classes with large gaps in between:

- firstly, the international airports of Dallas and Houston clearly stood out, together generating 68% of all domestic enplanements in the state;
- secondly, Austin and San Antonio but also the second airports of the two larger urban areas (Hobby in Houston, Love Field in Dallas) and El Paso, the most relevant airport outside the TUT, with enplanements well below the previous four, but still about three times larger than the next ranked airport;
- thirdly, a group of six sub-regional airports (Lubbock, Amarillo, Midland, Harlingen, Corpus Christi and McAllen), all outside the TUT; behind them, Killeen stood like a transition between this group and the next; and
- finally, smaller airports with less than a hundred thousand enplanements (i.e. averaging less than 300 a day).

The top six airports in Texas were all within the TUT. Enplanements in the next ranked airport in the Triangle, Killeen, were almost negligible – totaling about as many as 1% of Houston's Bush International. College Station, within and close to the center of the Triangle generated a relatively small number of passengers (BTS 2007) and had regular daily flights only to the two largest Texas metropolises (OAG 2005).

If only intra-state air transportation was considered, i.e. only passengers both enplaned and deplaned in Texas, the aggregate number of enplanements in 2005 was reduced to 16.3 million (just 27.4% of all enplanements in the state); and once more most passengers enplanements occurred in the TUT (77.6% of the total). Of all in-state passenger trips, 55.8% were between places within the TUT, 43.9% between one place in the TUT and another in another part of the state, and a mere 0.4% (60 thousand enplanements) between places outside the TUT (BTS 2007). It became obvious that practically all in-state air passenger traffic was organized around the TUT.

These figures emphasized the fundamental role played by TUT gateways, but could not express variations in the proportion of in-state and out-of-state destinations in each gateway. Only a small proportion of all enplanements in Dallas and Houston were bound to destinations in the state (18.4% and 20.8%, respectively). The proportion of Texas-bound enplanements was higher, but still a minority, in another three gateways, Austin (42.7%), San Antonio (45.9%) and El Paso (49.7%). In all other gateways in-state trips were the clear majority, between 75% and 90% in four gateways (Amarillo, Beaumont, Lubbock, and Midland), and above 90% in the other 16 gateways.

Table 7.10. Texas airports with higher domestic passenger traffic, 2005

rank	*city*	*airport*	*code*	*passengers*
1	**Dallas**	**Dallas/Fort Worth Int'l**	**DFW**	**28,079,147**
2	**Houston**	**George Bush Intercontinental**	**IAH**	**19,032,196**
3	**Houston**	**William P Hobby**	**HOU**	**3,961,642**
4	**Austin**	**Austin-Bergstrom Int'l**	**AUS**	**3,645,956**
5	**San Antonio**	**San Antonio International**	**SAT**	**3,604,665**
6	**Dallas**	**Dallas Love Field**	**DAL**	**2,949,256**
7	El Paso	El Paso International	ELP	1,638,242
8	Lubbock	Preston Smith International	LBB	552,023
9	Amarillo	Rick Husband International	AMA	446,395
10	Midland	Midland International	MAF	446,161
11	Harlingen	Valley International	HRL	429,396
12	Corpus Christi	Corpus Christi International	CRP	417,022
13	McAllen	McAllen Miller Int'l	MFE	352,216
14	**Killeen**	**Robert Gray AAF**	**GRK**	**192,887**
15	Laredo	Laredo International	LRD	92,316
16	**College Station**	**Easterwood Field**	**CLL**	**87,484**
17	Tyler	Tyler Pounds Regional	TYR	85,997
18	Abilene	Abilene Regional	ABI	78,269
19	Brownsville	Brownsville/Sth. Padre Island	BRO	76,573
20	**Waco**	**Waco Regional**	**ACT**	**71,684**

Notes: Figures for ticketed enplaned passengers; airports in the TUT shown in bold.
Source: Bureau of Transportation Statistics.

Connectivity scores applied to the Texas air passenger network, only in-state linkages considered, well illustrated the sheer dominance of Dallas and Houston. But since distance and number of linkages were now being considered, the relative position of other gateways changed considerably (see Table 7.11). Some gateways outside the TUT became more relevant, and in the cases of El Paso and Lubbock even presented connectivity scores comparable to Austin and San Antonio. But more than expressing a significant role of some secondary regional centers, these figures better showed the small role played by both Austin and San Antonio in the in-state air transportation network. Dallas and Houston had scores above 90, while Austin, San Antonio, like every other Texas gateway, had scores below 50.

All top upward linkages initiated in 24 gateways (all but Dallas, the place with highest connectivity and therefore without top upward linkage) were summarized in exhibits 7.13 and 7.14 of the Appendix. The major conclusions from this set of data were the following:

- all top upward linkages within the state had either Dallas or Houston as destination;
- Dallas was the destination of the three out four of this type of linkages (18, versus 6 to Houston);
- in most gateways enplanements in the top upward linkage represented at least one half of all state-bound enplanements; Houston (34.3%) was the sole exception;
- in about one half of gateways, enplanements in the top upward linkage represented 70% or more of all state-bound enplanements.

Table 7.11. Texas gateways with largest connectivity scores for in-state flights

urban area	*passengers*	*links*	*passenger miles*	*score*
Dallas	**5,177,859**	**22**	**1,412,370,956**	**100.0**
Houston	**4,030,238**	**21**	**1,043,799,337**	**93.6**
El Paso	803,654	10	452,122,574	42.0
Austin	**1,551,933**	**10**	**305,520,246**	**40.9**
Lubbock	473,103	10	156,677,144	38.9
San Antonio	**1,612,637**	**9**	**385,644,161**	**37.4**
Midland	365,436	9	131,187,501	34.5
Brownsville	487,557	8	147,027,992	30.9
Corpus Christi	384,114	8	101,102,968	30.0
Amarillo	349,101	6	129,426,847	23.0
Abilene	75,902	6	14,315,584	19.0
Waco	**67,791**	**5**	**7,256,985**	**14.8**
Killeen	**158,326**	**4**	**22,884,328**	**13.2**
College Station	**84,878**	**4**	**10,560,627**	**12.3**
Mcallen	328,101	3	122,181,635	11.4
Beaumont	40,756	4	3,419,313	11.0
Laredo	82,814	3	29,718,662	10.2
San Angelo	63,719	3	15,765,527	9.6
Tyler	85,980	3	10,310,869	9.2
Texarkana	33,947	3	6,823,467	8.8

Notes: Passengers refer to all enplanements of any type; links refer to final destination of passengers.

Source: United States Department of Transportation and author's calculations.

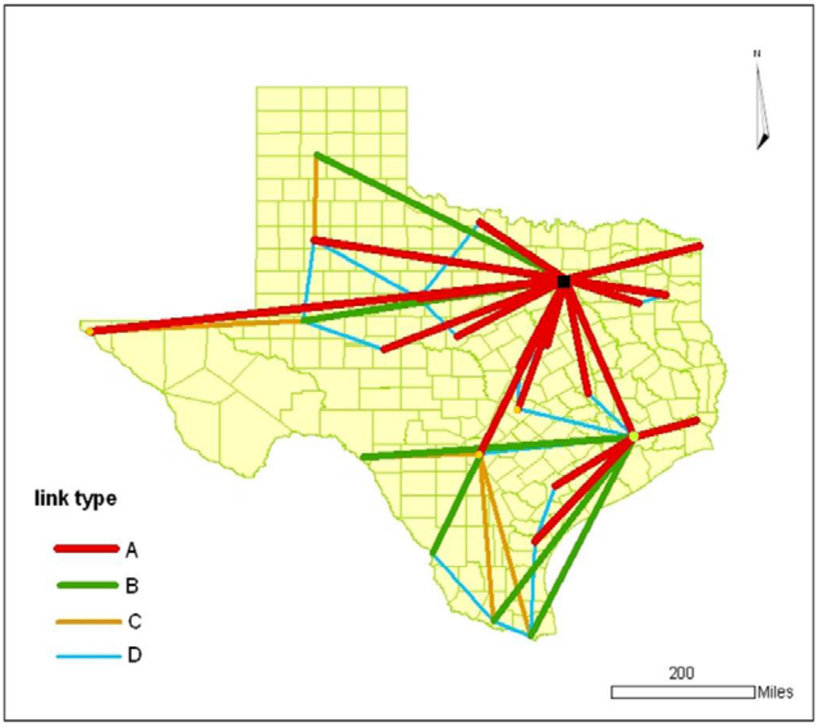
The analysis of top upward linkages within Texas only reinforced previous conclusions about the dominance of the top two urban areas, but also showed the little relevance of any other gateway, Austin and San Antonio included, in the in-state passenger air transportation network. The map in Figure 7.2 graphically represents the hierarchical organization of this network, based on the same 4 types of linkages discussed in the previous section. It should be mentioned that the relative spatial alignment of the trios Laredo-San Antonio-Dallas and Del Rio-San Antonio-Houston created the false impression that San Antonio was the destination of two Type B linkages, while actually those lines corresponded to Type B linkages from Del Rio to Houston and from Laredo to Dallas. The following were the most relevant conclusions:

- the spatial pattern of Type A and B linkages within Texas was identical to that previously identified at the national level: linkages from the center, north and west of the state went to Dallas, from the coastal areas to Houston;
- all Type A and B linkages were bound to Dallas (14 Type A, 3 Type B) or Houston (3 Type A, 3 Type B);
- the roles of Austin (one Type D linkage) and San Antonio (one Type C) were of little relevance;
- Laredo and Del Rio were two small exceptions to the general pattern, but of little relevance considering the small number of enplanements (especially in the latter).

Wrapping up all the previous discussions on air passenger linkages within Texas in this section, five major conclusions emerged:

- most of enplanements and deplanements in Texas occurred in the TUT; Dallas was the most important air passenger gateway and destination in the state, and Houston the only relevant regional center, commanding traffic along the Gulf Coast;
- in the largest gateways, especially Dallas and Houston but also Austin, San Antonio and El Paso, enplanements to destinations outside the state outnumbered those to destinations within Texas;
- Austin, San Antonio, and El Paso enplaned more passengers to destinations outside the state, but they had relatively little relevance in in-state passenger traffic and weak connections to smaller destinations; total enplanements to the 20 smaller Texas destinations (all but Dallas, Houston and these three) represented just 6.4%, 3.4% and 3.1%, respectively, of all their state-bound enplanements;
- in all the smaller 20 gateways more than 50% of Texas-bound enplanements and 40% of all enplanements corresponded to the top upward linkage, all of them bound to either Dallas or Houston;

- the hierarchical organization of the network was relatively unbalanced, with two strong nodes at the top, no significant nodes in middle levels, and all the other poorly interconnected at the bottom.



7.2. Top upward linkages and close alternatives for domestic air traffic gateways in Texas, 2005

It was beyond the scope of this study to perform a detailed comparison between the internal arrangements of the TUT air nodes and comparable arrangements in other major urban regions of the nation. But from a quick overview of Table 7.8 and Figure 7.2 it was apparent that all urban regions discussed in the previous chapter also had a dual structure at the top, with one national and at least one sub-national centers (New York-Washington in the Northeast; Chicago-Detroit in the Great Lakes; Atlanta-Charlotte in the Piedmont; Miami-Orlando in Florida; and Los Angeles-San Francisco in California).

7.6 Air linkages and time-space compression in Texas

Contrasts in flight availability may lead customer to consider to drive-and-fly options, especially when the local supply does not provide significant time gains or cost reduction. In the case of Texas the both Dallas and Houston had high connectivity indexes, and their link generated a disproportional passenger volume, if compared to their populations. To investigate the consequences of supply contrasts in a time-space context, data on all intra-Texas flights over a week (April 24-30, 2005, selected due to the lack of holidays) was obtained from the corresponding OAG Flight Guide (OAG 2005); this publication lists all scheduled flight, with information about departure and arrival time, frequency, and characteristics of the plane and route. They were used to identify linkages with schedule flights over the study period (involving 27 airports in 25 cities) and their duration (see exhibit 7.15 in the Appendix), from which the average flying time and average waiting and flying time (the probability of waiting duration, based on the number of flights supplied) were calculated.

A Visual Basics Applications routine was created to estimate driving times in the sections of major road represented in a shapefile map of Texas. This routine also incorporated matrices of flying times between the 27 airports (with and without waiting time) and the location of the city centers of the cities involves (a detailed discussion is provided in Chapter IV). By calculating the travel time from each node in the road network to a selected city considering different alternatives and subsequent interpolation (IDW) it was possible to generate a set of maps expressing driving distance, combination of road and fly minimizing travel time (with and without waiting time). Different runs were made considering Austin, College Station, Dallas, Houston and San Antonio as the travel destination.

Figure 7.3 represents the results of the exercise for Dallas and Houston, the two major air nodes in the TUT, expressed in hours of travel. By comparing each top map (travel by road) with the corresponding bottom map (fastest combination of travel by road and air) it was possible to identify in which areas air travel allowed significant travel time reductions. From this outcome, the travel time gains standing out were the following:

- travel time between Dallas and Houston was reduced by more than one hour;
- travel time from/to Austin or San Antonio and Dallas was also significantly reduced; but from/to Austin or San Antonio and Houston time gains were less significant; and
- beyond the TUT, travel gains were only relevant in medium-haul flights from/to the most distant parts of the state (Western Texas and the lower Rio Grande).

Comparing travel time gains in connections involving Dallas or Houston and the other two main cities in the TUT (please also refer to exhibit 7.16 in the Appendix), the relatively smaller gains between Houston and Austin or San Antonio reflected a substantial difference in flight availability in the study period when compared to Dallas (from Austin, 187 flights a week to Dallas, and 135 to Houston; from San Antonio, 199 and 135, respectively). The same conclusion was valid for travel from/to major airports in Western Texas (for instance, from El Paso, 86 flights a week to Dallas and 79 to Houston; from Lubbock, 118 and 51, and from Amarillo, 112 and 55, respectively). The major exception in flight availability was the Brownsville area, with 127 weekly flights to Houston and 78 to Dallas.

Austin and San Antonio were represented separately (Figure 7.4) considering their relatively smaller role in in-state air transportation, as previously discussed. The pattern of time gains related to scheduled air transportation was, to a certain extent, similar to those observed for Dallas and Houston but less marked:

- the most noticeable travel time reductions were from/to Austin or San Antonio to the other vertices of the TUT – Dallas and Houston; there were no travel gains from/to other places located as far as these two cities;
- beyond the TUT, there were some travel gains from/to cities in more distant areas of Western Texas (El Paso, Lubbock, Amarillo), but travel time was still considerable.

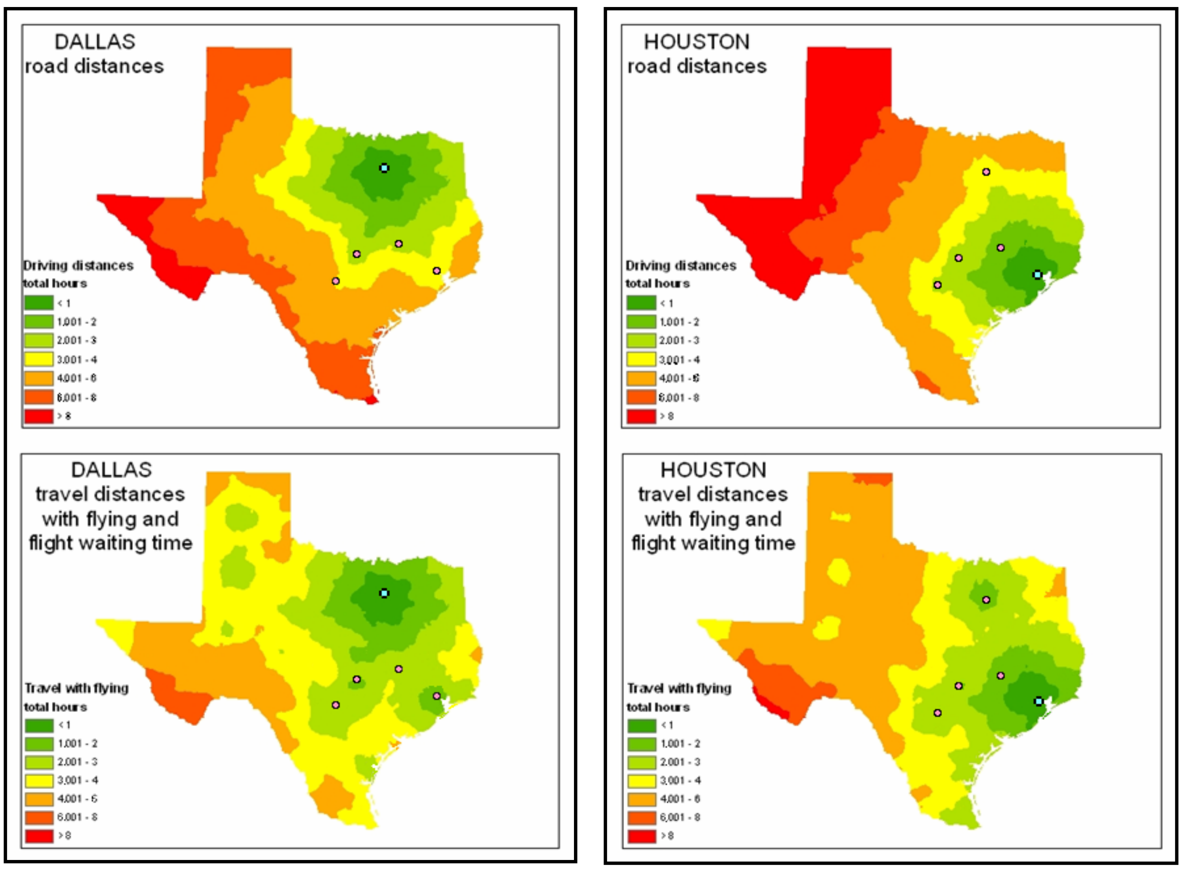


Figure 7.3. Lowest travel times from/to Dallas and Houston
by road and combining road and air (average waiting time considered), 2005

All this data showed the existence of a significant convergence between the four key components of the TUT. In spite of the relatively small distances (Dallas-San Antonio, the longest side of the triangle, is just 243 miles long) there was a significant market for air transportation allowing a significant space-compression along the primary axes of the TUT.

But when we deal with places inside the TUT, where College Station was the largest but also the only gateway with scheduled flights, the results were quite different. In this case, travel time gains related to commercial air flights were observable only beyond the TUT, for linkages with a few distant cities in Western Texas and lower Rio Grande (Figure 7.5). College Station had, during the study period, regular air links with only Dallas and Houston. The number of weekly flights, 48 and 37 respectively, was insufficient to cause to any travel time gains. Time-space compression directly related to air transportation was not present inside the TUT, and driving to a major gateway and starting the flight from there is an important alternative.

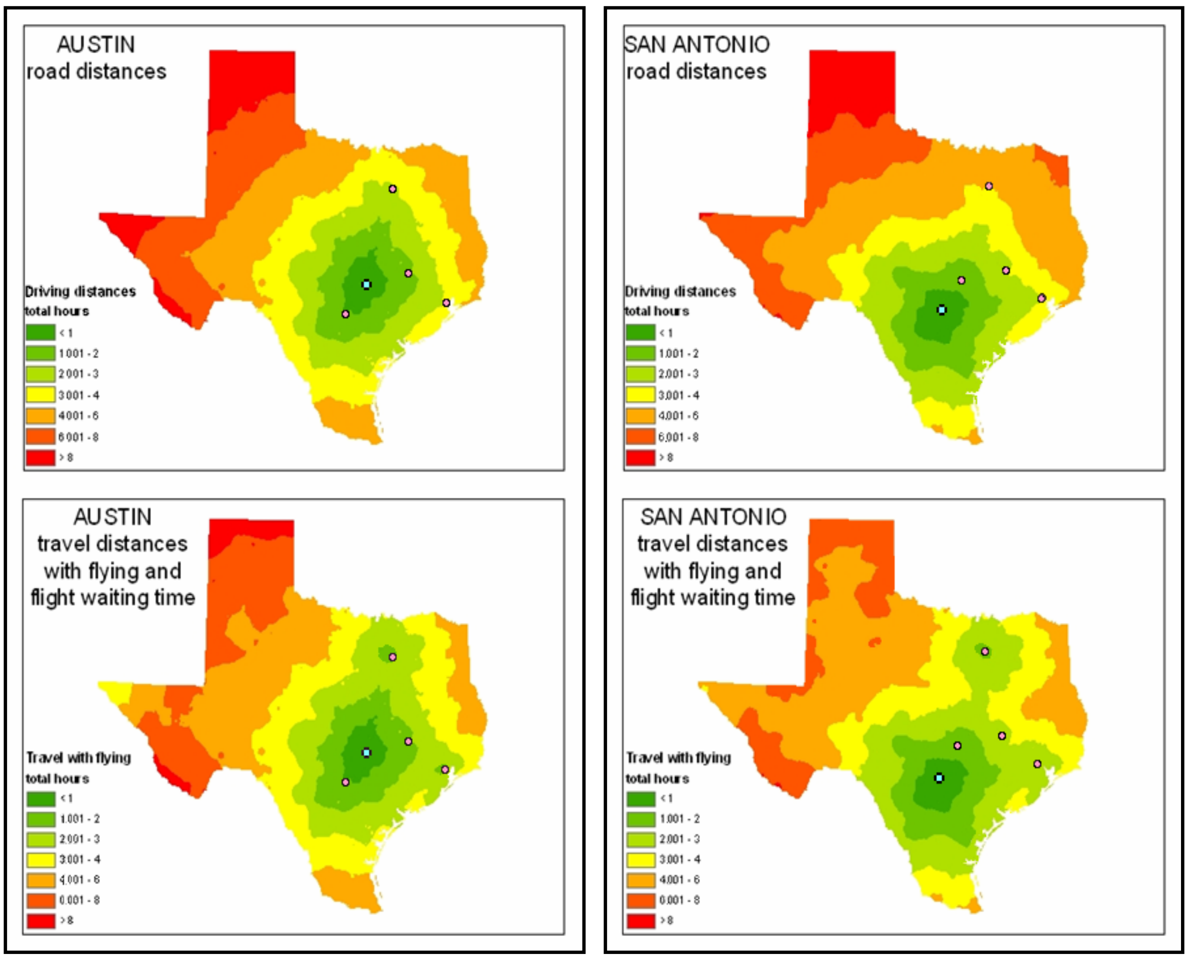


Figure 7.4. Lowest travel times from/to Austin and San Antonio by road and combining road and air (average waiting time considered), 2005

The roles played by Dallas and Houston (illustrated by the number and type of linkages, passenger flows and travel time gains) were disproportionate if their population and economic output was compared to those of other cities like Austin and San Antonio, but even with smaller cities like El

Paso, Killeen and Corpus Christi. The reinforcement of vertical hierarchies in air transportation, especially at the top ranks, was a most evident conclusion of this exercise, and was consistent with previous more general findings (Pred 1976; Berry and Parr 1988) showing that urban hierarchies and interdependencies between cities tended to persist and even being reinforced over time.

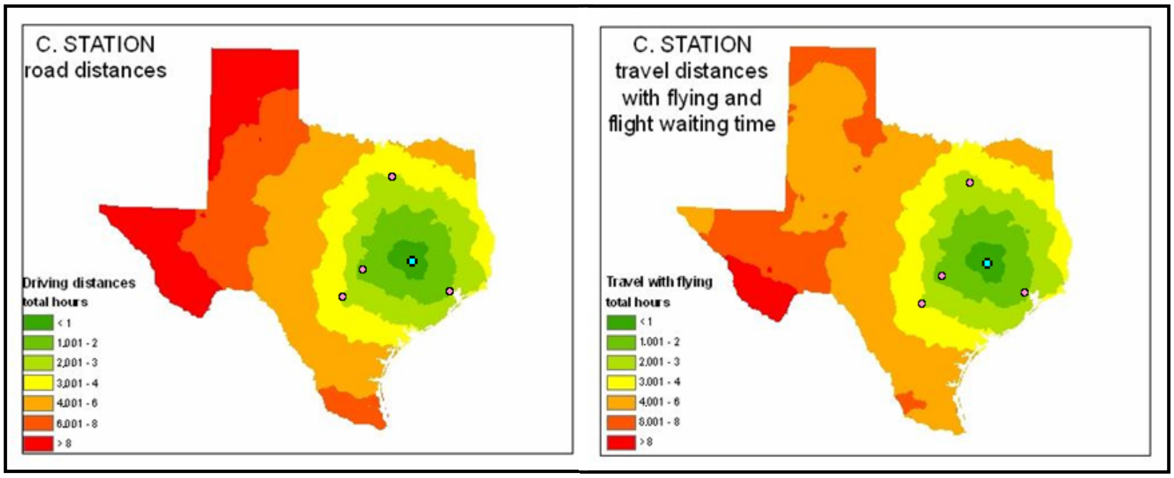


Figure 7.5. Lowest travel times from/to College Station by road and combining road and air (average waiting time considered), 2005

In this sense, the more expensive and sophisticated the technology used for transportation (and communications at large,) the more likely small- and even medium-sized urban areas will tend to be bypassed and their future rely on the proximity of a large center that can provide better accessibility.

7.7 Summary

The TUT is the location of two of the busiest airports and the head office of two of the leading airlines in the world. The importance of Dallas and Houston as major nodes in air transportation was well illustrated by large passenger flows and variety of linkages. But their roles were different, much contrasted when analyzed separately at the international, national and state levels.

At the international level Houston and Dallas, the only relevant Texas gateways, had a more important role in short- and medium-haul linkages then in long-haul. For the former type of flights, Houston was only surpassed by three American gateways – New York, Los Angeles and Miami – in terms of passenger flows and connectivity scores, and Dallas by those four plus Chicago. From Houston, most enplanements were in commercial flights, while from Dallas there was a substantial amount in charter flights. The share of American passengers was very high (over 80%) in both airports, and most enplanements were to/from vacation destinations in Mexico, and especially Cancun.

In terms of long-haul air traffic, Houston and Dallas had very similar number of enplanements and connectivity scores. Both ranked lower than major American gateways, but also lower than several gateways with much smaller overall passenger traffic like Washington, Boston, Detroit and Miami. There was some spatial specialization, with Houston having the majority of enplanements to Europe and northern Latin America, and Dallas to East Asia and southern Latin America.

The role of the TUT was much more relevant at the national level. Dallas was the center of one of the top five subsystems for domestic flights, and ranked among the top gateways in the nation in enplanements, number of linkages and connectivity scores. It was also the top destination from most gateways in Texas, but also from Oklahoma and parts of Louisiana, Arkansas, Missouri, Colorado, New Mexico and Arizona. Houston was the next node in the subsystem, an important sub-national center immediately below Dallas, and also the top destination from coastal gateways between New Orleans and the Rio Grande. The number of enplanements from Austin and San Antonio was higher, together over 7 million enplanements (about one fourth of the traffic from Dallas), but most of them to the top two Texas destinations.

The dominance of Dallas, and to a lesser extent Houston, at the state level was quite noticeable. Dallas was the top destination for inland gateways and Houston for coastal ones. The role of these two cities as rotating plates between Texas and the rest of the country was emphasized by their relatively small Texas-bound traffic, less than a quarter of their domestic enplanements. In all other gateways more than a half of enplanements were bound to one of those two cities. The proportion of state-bound traffic in each gateway increased as passenger air traffic decreased, being higher than 75% in all but five gateways. Air traffic outside the TUT was practically irrelevant, as only 0.4% of all enplanements involved both a Texas gateway and destination outside the TUT.

CHAPTER VIII

DISCUSSION AND CONCLUSIONS

I fought against age, I fought against men,
I fought against God, I fought against myself.
I have one consolation: although defeated,
I was able to reach the end of the adventure
in the spirit with which I entered it.

Miguel Torga, Portuguese writer

8.1 Introduction

This study addressed the role and relative hierarchical position of both the Texas Urban Triangle (TUT) and its major components in the context of the ongoing economic globalization. Its findings contribute to the existing literature in six major ways. Firstly, it identified the existence of phases throughout the processes of economic globalization, with major segments of the economy having changing roles and relevance in each of them. Secondly, it found that city hierarchies, when evaluated through the concentration of major corporation headquarters, have changed significantly over time, with both a weakening in the dominance of the places at the very top, a growing share of middle-level places in some parts of the world (including the TUT), and a decreasing relevance of smaller places. Thirdly, it showed that employment composition in the TUT and its cities presented a degree of diversity comparable to other American metropolises and urban regions, characterized by intra- and inter-regional specialization. Fourthly, it investigated the pronounced hierarchy of American gateways in air passenger travel, where it was apparent the importance hub functions have been having in the reinforcement of the positions of larger urban areas. Fifthly, by showing that wide availability of air connections within urban regions, more frequent between larger markets, significantly increased time-space convergence along more traveled routes. And finally, it introduced two new alternative ways to measure regional economic convergence (or divergence) towards a national average, and to measure connectivity in an airline network.

The following sections of this chapter discuss the most relevant findings of this study and its implications from different perspectives. The final segments elaborate on the most important general conclusions, discuss the limitations of the results, and present directions for future research.

8.2 Discussion

This section is organized in four broad themes, the first briefly presenting the findings of previous analytical chapters, and the following discussing the major methodological, theoretical, and policy and research implications of the study.

Major analytical findings

Answer to the first question was pursued by analyzing corporation data, especially total sales and headquarters location, over a period of twenty years. Data showed significant temporal changes in the role of different sectors of the economy, supporting the hypothesis that globalization is neither a homogeneous, regular and unidirectional set of processes, but actually showed contrasted phases. It also showed that the traditional distinction between ‘old’ and ‘new economy’ sectors is of limited use, since some ‘old’ have been able to bounce back (like oil-related activities) or never lost their relevance (like the automobile industry) despite their internal re-structuration.

Major concentrations of corporation headquarters also have been through important changes, the most obvious being the movement away from the two largest dominant centers (New York and Tokyo), who have been negatively affected by relocations or economic crises. Some new centers have emerged (especially in East Asia and the American South) or reinforced (in Western Europe). But the most significant finding was the relative diversity from place to place, expressed by varying combinations of corporations of different types, and lack of convergence toward the top of the hierarchy.

In regard to the role of Texas cities, two major conclusions stood out. Firstly, their progressive rise in global ranking, a consequence of the relocation of corporations previously based elsewhere, and to a lesser extent the growth of local economic activities. By year 2004, both Dallas and Houston ranked among the top 20 headquarters cities measured by corporation sales; San Antonio and Austin have also appeared in recent lists, and moved up. And secondly, the Texas Urban Triangle was found to have one of the major headquarters concentrations of oil-related activities (one of the top two) and the computer industry (one of the top four); conversely, some key economic sectors such as banking, insurance and automotive were not significantly represented in the TUT, and reinforced the previous evaluations placing Texas metropolises in secondary levels of the global urban hierarchy.

The second question required a comparison between the TUT and its cities, and comparable units across the country. Standardized employment data by sector in metropolitan areas was analyzed through a principal components analysis in order to identify statistical regularities in the data set. Seven components of relevance were found, the first and most important was primarily related to construction and real estate activities, a finding consistent with recent analyses of the recent trends in the U.S. economy. Components showed contrasted patterns, with scores varying in some cases according to geographical direction (north-south, east-west), but also scale (larger versus smaller places); in general they identified Florida and the Midwest as being the areas going through stronger and weaker economic cycles. But the most interesting general finding was the unique combinations of strengths and weaknesses from city to city, each with its own specializations; even though, overall, larger places tended to show higher degrees of diversity, they did not show any trend toward economic convergence.

Texas cities had, in general, positive scores in most components associated with current economic growth; but each one had stronger similarities with cities in other parts of the country, especially the west and Southeast, than with other ones in the state. Especially strong was the correlation between Dallas and Atlanta, two cities that showed indications of competing in several areas. The TUT also showed the same degree of intra-regional diversity found in other American urban regions. Findings also confirmed previous conclusions on the relative strength of oil- and information-related activities, along with construction, and weaker scores in components linked to finance and corporate management.

In order to tackle the third question, traffic and air linkages in Texas cities were analyzed and compared with other American gateways. Dallas and Houston have been major nodes in global air transportation, with very important roles as transit hubs for domestic (the former) and shorter international (the latter) flights. For long-haul international traffic the two cities showed to have comparable importance, but also to be less relevant than major American gateways in more peripheral locations (closer to the East and West coasts); Houston mobilized more passengers to Western Europe and Mesoamerica, and Dallas to South America and East Asia. Their central location contributed for a larger role in the domestic market, where Dallas stood out as the center of one of the five main subsystems in the country (with New York, Los Angeles, Chicago and Atlanta) and one of the top gateways in the country in enplanements, number of linkages and connectivity measures. Dallas organized commercial traffic from most gateways in Texas and Oklahoma, and parts of Louisiana, Arkansas, Missouri, Colorado, New Mexico and Arizona, while Houston was identified as an important sub-national center immediately below Dallas, and also the hub for coastal gateways between New Orleans and the Rio Grande. Both San Antonio and Austin had relatively irrelevant roles, especially in international traffic.

At the state scale the dominant role of Dallas, with Houston at the next level, was even more noticeable. The Texas air travel network hierarchical organization was relatively unbalanced, with two strong nodes at the top, three little relevant middle nodes, and all other gateways very poorly interconnected at the bottom. The proportion of state-bound traffic enplaned in each Texas gateway tended to increase as number of passengers decreased, being higher than 75% in all but the five largest gateways; the number of in-state passengers in flights outside the TUT represented a mere 0.4% of in-state air travel in 2005. Finally, the high supply of regional flights between primary destinations, namely Dallas and Houston, resulted in significant effects of time-space convergence, with combinations of driving and flying providing the faster alternatives; but these effects were only found between major gateways, and completely bypassed other places, independently of their relative location.

Methodological implications

The core theme of this study revolved around the role of Texas Urban Triangle in a globalizing world economy. Each of the three research questions was approached from different methodological perspectives, while keeping complementary goals. Among the analytical tools used in the study were descriptive time series, algebraic matrix operations, principal component analysis, network connectivity measurements, geographic information systems operations, and a Visual Basic Applications routine applied in a GIS environment.

In the first question, a functionalist approach based on measuring types of headquarters location frequencies along a time series, complemented by comparative analyses of matrices, provided conclusive evidence on the existence of a major temporal dimension in economic globalization processes over the 20-year study period. The methodology did not require highly sophisticated operations to identify contrasted and non-linear trends in the role of the most relevant economic segments, significant changes in the size and composition of major headquarters clusters, and the slow rise of new alternative centers in North America, Europe and

Asia. In the case of monetary values, the use of shares provided a quick and reliable way to compare figures for different years without the need to convert figures to current or past values, to reflect inflation and depreciation.

To answer the second question it was used an empiric, more inclusive, approach where all the elements of metropolitan economies were taken into account. The data set expressed the relative size of metropolitan employment, disaggregated by economic segments. A principal component analysis (PCA) evidenced major differences in the composition of employment across cities and urban regions. By giving relevance to unrelated trends (components) to explain local variations, the PCA revealed a primary pattern of both inter- and intra-regional diversity, and beyond a secondary pattern were a few cases of strong regional specialization were evident. The method identified the most contrasted patterns in smaller places, while larger cities tended to stay closer to average values and display less evident specialization; this contrasted diversity would likely be a consequence of the relationship between diversity and scale, where increases in one direction corresponded to reductions in the other one.

The third question was approached by identifying and classifying linkages within air travel networks. In the first part of the exercise, the use of connectivity indexes based on passenger flows, distance and linkages provided a useful way to identify hierarchies of nodes (gateways), and advance a hypothesis of their regional organization in the 48 contiguous states of the U.S. primarily based on demand. The second part extended this approach, and through a combination of GIS operations, including a VBA routine embedded in GIS, compared changes in travel time at the inter-regional level resulting from the alternative use of short-haul air connections. By contrasting travel times between city centers, either by driving or by a combination of driving and flying (including the average waiting time for each air link to reflect major differences in flight supply), it was possible to identify the fastest route and the situations where adding flying created significant time gains. By mapping travel times to specific TUT destinations it was possible to identify significant time-space convergence effects along some high-supply air routes, but none due solely to geographic centrality.

A final methodological comment must be made on the frequent use of rankings and hierarchies through this dissertation. Numerical measures and classifications provide objective data, but should be used with caution because can only be interpreted in relative contexts and often represent very abstract concepts. But rankings and hierarchies can be found around us with far more frequency than in academic literature: ranking students for entry or fellowships, ranking TV shows to estimate the value of time for commercials, ranking priorities for job application, for leisure time, for budgeting, for action. Despite its current unpopularity in geographic academic research, the consequences of decision-making using ranks and hierarchies deserve more attention, especially in identifying the contexts where they are most helpful and present major limitations.

Theoretical implications

The transposition of the findings of this study into a theoretical context identified four areas requiring were additional work, but also the persistence, even if in disguised forms, of two quite old geographical concepts.

The first area relates to the urgent need to clarify empirically, or at least to refine several of the major concepts being used on world/global city studies. As already emphasized in the literature review, it is frequent to find concepts like world city, global city, globalizing city, informational city, treated as very comparable, if not interchangeable; but their differences run much deeper, and the lack of better ontological boundaries clouds every discussion. The globalizing cities proposed by Stefan Krätke (2004), perhaps the most flexible and encompassing of all these concepts by asserting that all cities (in different extent) are going through unique and evolving globalizing processes, did not contribute to clarify the issue – if globalization is continuous and has no clear end, then no city will ever be completely and all partially will always be global or globalized. Although Krätke was right when stressing the need to consider different levels of adaptation and a permanent redefinition, but without objective terms of reference, the concept has limited use: if all are globalizing cities, where is the need for the word 'globalizing'? Castells' informational city (1989, 1996) also incorporated a temporal dimension, following the implicit need to re-identify the 'new technologies' and their level of absorption at every point in time; but here the idea of 'global' is linked to the dissemination of what is 'technologically new;' especially in the information sector. The relevance of cities is assessed by their capacity to both innovate and quickly incorporate innovations, in large measure an expression of dynamism and selective adaptation, and in this sense more restrictive. Actually, it presents a technocratic approach to globalization: the top of the urban hierarchy relates more to innovation than to economic relationships; but other fundamental issues, like how likely is having high-tech generated in one place and its dissemination controlled from another, or how it leads to a general converge or divergence among all places and social groups, have been insufficiently discussed. Peter Hall's world city (1966) and Saskia Sassen's global city (1991/2001) have significant differences, already approached in Chapter II; when compared to the previous two concepts, it is noticeable their more static nature, the lack of substitution rules, and the narrowing towards the top (where only a few cities, per definition, could be located). Actually, since their lists are not substantially different from any city list from the age of imperialism about one hundred of years ago, it is tempting to ask how much is old and how much is really new in their constructs.

The second area is associated to the need for a temporal dimension in the analyses of globalization processes. Data on large corporations' sales allowed identifying clear phases over the last two decades, each characterized by different combinations of expanding or receding segments. The late 1980s and early 1990s were characterized by the quick raise and dominance of giant Japanese conglomerates, which from the mid-1990s declined as fast as they had emerged to become of little relevance. The 1990s there was a tremendous growth in insurance and, in lesser extent, banking, a trend consistent with most of the literature produced in the period, including the use of advanced business services as surrogate for inter-city relationships. In the early 2000s we assisted to the resurgence of oil and mining activities, which after a long decline rose regained a leading position in the global economy. And during the whole period some sectors, especially Motor Vehicles and Parts, maintained their relevance despite the decline of their old cores. These changes were signs of economic structural readjustments, and proved that globalization has been neither homogeneous nor unidirectional. Similarly to economic sectors, the relevance and economic orientation of each city has been changing, combining trends for an increasing diversification and the goal of finding a highly-profitable niches for specialization; the varying global sales shares of large companies based in Tokyo (from 26% in 1994 to 10% in 2004) or in New York (from 16% in 1984 to 9% in 2004) provided conclusive illustration on how drastic these changes can be.

The third area is the emergence of urban regions, a new development on the old and evolving problem of how to define urban units. The use of official national definitions does not offer an acceptable solution and only muddles the topic: contrasts in the average size of single administrative units are enormous (e.g. French municipalities have about 6 square miles, South Korean 170, South African 9,000), almost as large as those of metropolitan areas (e.g. in Germany, Cologne and Düsseldorf, just 15 miles apart, are each the center of a metro area reaching no further than 25 miles away; in Brazil, Rio's includes some places 50 miles away; in the U.S. Los Angeles' includes most of the Mojave Desert and even places on the right bank of the Colorado, at more than 200 miles). The concept of urban region proposed by Scott (1996, 2001) has the potential of providing a useful core for further elaboration. But it must be stressed that, and most authors agree, the new urban units of the 21st century should no longer be defined solely through physical criteria, like population density and the continuity of built-up areas. The case of Dallas and Houston, two places having to an intense interaction (and complementing roles) despite the lack of any town of substantial size in the route linking them, was illustrated in previous chapters and provides good indication that places physically disconnected may be well connected in other ways. Peter Hall (2002) made the case that time-space convergence provoked by the dissemination of the automobile was the primary cause for the obsolescence (and tendency to disappear) of the small market towns. Perhaps the regional plane is provoking further convergence of time and space in a tri-dimensional context, completely bypassing those areas it flies over.

The fourth area relates to the influence of large transportation options to generate what Graham and Marvin (1996) called 'tunnel effects,' where new and very intense time-space convergence effects can take place. The study of flight availability in the TUT showed that convergence is not significant only at larger distances; it can also be quite important along major short-haul corridors supplied with very frequent air connections, like in the case of Dallas and Houston. These effects can make air a very competitive alternative to land transportation, making inter-city travel times comparable to some intra-city travel times (e.g. from the city center to outer suburbs), and even regular commuting possible when costs are not a major factor.

The first of the two enduring old concepts was Christaller work on central place theory. It is not difficult to make a parallel between his ideas of a pyramidal hierarchy of places, where the higher-level centers provided a wider quantity and variety of services, and the most specialized services were only available at the top of the hierarchy, with Saskia Sassen's (1991/2001) theoretical approach to global cities through the provision of advanced business services, or even Peter Taylor's more operational measurements of world cities through hierarchical networks of international corporation offices. And if to them is added the administrative principle, little developed by Christaller, we may be close to the world city of Peter Hall (1966.)

The second concept is far more illusive. In discussions about the reach of an urban area or about the areas using a major air gateway, the idea of the city hinterland, the area of influence of a settlement appears embedded. Despite all the advances in information technology, people, their food, their clothes, their shelters can not travel, at least for some time, through the *I-bahn*, and require very material forms of transportation. Many unthinkable things are already possible, but we still a long way to go. Perhaps the new fashionable shirt can be idealized in Italy, require materials produced in Egypt and Brazil, assembled in Bangladesh, presented in Paris, and distributed through New York, but it still needs to be physically shipped to a consumer in Tokyo or Los Angeles; but in our world, we still can not, in one single day, for instance wake up in Bali, have breakfast in Grand Cayman, spend the morning sunbathing in a urban beach of Rio, have lunch by the Sydney harbor, visit the Hermitage in the afternoon, dine in Hong Kong, listening to a concert in New York, and spend the night in Venice. It would be too good, but not even the wealthiest person in the world can do it (for now). We have our limitations, in energy, in time, in movement, not to say in money. Thus our large cities have a hinterland, which includes those places where we can escape in the weekend, produce some of our fresh food, read the same local newspapers and watch the same TV channels we do, have their folks invading our town for any major sports event or coming to take a flight, see a specialist, or indulge in more diverse shopping. It is not a fashionable topic, is almost an obsolete concept, but never goes away.

In the new age of information technology the idea of hinterland should be juxtaposed to the concept of hinterworld proposed by Peter Taylor (2001b, 2004a), made of those places we are in constant contact with; or, in the context of global cities, linked to us through very intense information flows, including those of an economic nature. Contrasting with the hinterland, there is no physical continuity, no roads to the hinterworld; most of the links are electronic or, at the most aerial; its pieces can be spread allover the world in every possible combination, reflecting the most important activities happening in each place. If we take the case of Dallas and Houston, perhaps we are in the boundaries of both, the new disconnected urban regions being at the intersection of the hinterland and the hinterworld of every city.

Policy and research implications

The findings of this study raise a number of policy issues seldom discussed in a Texas context. The general belief that no or very little public policy in the state is a more a myth than an undisputable fact, like well illustrated by Richard Hill and Joe Feagin for the case of Houston, a place whose development benefited from “tremendous federal expenditures on infrastructure facilities (e.g. highways) and high-technology defense industries” (1989: 168). Similar arguments could be made about Austin successful bids for MCC and Sematech facilities in the 1980s (Tu 2004), strengthened by benefit packages offered by the state government, continuous federal spending in the port of Houston, or the relevance of military infrastructure (and related contracts) in San Antonio. And the little progress in the state government high-speed corridors or the new Austin public transportation system is openly linked to the lack of federal money (Letton 2004). There is a lot of public policy in the TUT, but under varied labels.

Following the findings of this study there are four key policy issues to be considered: the economic diversification of urban economies, development of most promising sectors, regional competition versus complementarity, and external (national or global) competition. Hill and Feagin (1989) described in detail the negative consequences of economic recessions in highly specialized cities, and the oil crisis of 1982-1987 clearly showed. Insufficient diversification is a problem in the TUT, especially in Houston and Austin; this problem has been complicated, in the first case by an orientation to short-term gains, as historically "(w)ith the sharp rise in the oil price, oil companies and allied bankers moved away from diversification to a heavier emphasis on investments in oil projects (*idem, ibidem*: 189)," in the second by real estates increases, and in both by a trend to sprawl. Investing in high-tech and other sectors of increasing economic relevance is fundamental, but if it is done without a parallel diversification, only means postponing the same type of problems.

Perhaps the big question in the TUT lies on which option would better serve the region, increasing internal competition, or internal complementarity. As Neil Brenner (2004b) illustrated in the European context, some countries like the United Kingdom have prioritized the growth of its major city, other like The Netherlands the growth of its major urban region in order to better compete globally; empirical evidence discussed in Chapter V indicated better results in the second case, but data is insufficient to strongly make the case. In this type of problem, policy decisions should be made having in context the areas where the TUT has higher potential to successfully compete at national and international scales; in those cases, internal competition (and duplication of infrastructure) may hamper materializing that potential by divesting important resources to respond to internal rivalries. But in those sectors whose market is primarily local or regional, no doubt that intra-regional competition should be pursued with minimal interference.

8.3 Conclusions

Despite important differences in the scale and nature of data sets (global data was used only the first question; attribute data in questions 1 and 2, relational data in the third), and methodologies, the findings were highly consistent.

The answer to the first question was two fold. Firstly, it was possible to illustrate the evolving nature of globalization processes by identifying two different phases in the expansion of world's largest corporations in the period 1984-2004. The first one (1984-1994) was characterized by the sharp decline of activities related to mining and oil contrasting by strong growth of insurance; after a transitional period, the second one (1999-2004) was marked by the recovering of oil and mining activities and the sharp decline of wholesale, especially in Asia. Like the major trends changed, it also changed the roles of cities; overall, considering either the number or sales shares of the largest 500 global corporations, the dominance of New York and Tokyo has been declining over time, being paralleled by smaller but regular gains in several Western European cities, and signs of the emergence of new centers in East and South Asia. Secondly, Texas cities (especially Dallas, and to a lesser extent Houston) have been emerging as important second-level centers, especially in two fundamental sectors (Mining and Oil Production & Refining, and Computers), but have no meaningful role in other major sectors like Banking, Insurance, and Motor Vehicles and Parts.

Dealing with the second question it was possible to notice that the Texas metropolises presented a diversity in the composition of employment similar to other American metropolises of over one million inhabitants. Each one also presented a higher degree of resemblance (measured by correlation coefficients) with cities outside than inside Texas, but TUT centers had much contrasted patterns of similarity, each with stronger correlations with cities of a different part of the country; for instance the highest correlations for Austin, Dallas, Houston and San Antonio were, respectively, with San Francisco, Atlanta, Salt Lake City and Tampa. The TUT as a whole, when compared to other five urban regions in the U.S., also showed the same characteristics of intra-regional contrasts and inter-regional specialization; results also confirmed strengths in oil- and information-related segments, and weaknesses in finance. Dallas was the most diversified city, San Antonio the least (but with a strong combination of fewer sectors). Overall, the findings reinforced the conclusion that internal specialization and complementarity have been more significant than regional competition, despite some areas of overlapping between Austin and Dallas and, to a lesser extent, Dallas and Houston.

In the third question flows of commercial air passengers were used to identify preferential links and signs of a hierarchical organization of urban centers in the U.S. and in Texas. Data showed different patterns for international and domestic flights, where peripheral locations have a comparative advantage (and higher traffic) for the former, and central locations for the latter; only two Texas gateways (Dallas and Houston) were relevant, especially the first in the domestic context. International flows out of the TUT showed very interesting contrasts: for medium haul destinations (Mexico, Central America, and Caribbean nations) Houston generated higher and more diversified volume of passengers (with a significant hub role), while in Dallas the most relevant flow involved U.S. national traveling in charter flights to Cancun; for long-haul destinations both gateways mobilized a comparable number of passengers, but Dallas had stronger links with South America and East Asia, and Houston with Europe. In domestic air travel Dallas had a more important role, heading one of the five major regional units in the country, with Houston one level below, and with very high-traffic between the two of them. Outside Texas, the most traveled route was Dallas-Los Angeles. These findings were complemented by an analysis of air flight supply, and flight and driving times being either contrasted or combined to identify the fastest linkages in a GIS environment; the exercise identified a significant time-space convergence between TUT vertices, especially the Dallas-Houston link; considering flight frequency and travel time, their time distance was comparable to the travel time to the center and outer suburbs of each one, a conclusion reinforcing the case for treating the TUT as a functional unit.

8.4 Limitations of the study

The present study, despite the broadness of the topic, had to be taken with caution, because it was based on a few datasets representing three areas considered by mainstream authors as highly representative of the ongoing economic globalization. In this aspect the study followed a relatively traditional approach, cautiously using data and methodologies already tested in different contexts.

But at this point we still don’t know a lot about globalization, alternative definitions go from the narrowest (few very dynamic sectors) to practically everything (globalizing places). And most empirical studies did not provide many new findings, as the elements of the core or world/global cities at the top of the hierarchy have been the same dominant units for at least a good century. The lack of clear conceptual definitions (what global cities or global processes specifically are?) makes very difficult to link any empirical study within a specific theoretical approach.

The limited pool of data available, especial on flows and temporal sets, was a limitation in this study, like in practically all literature in similar themes; and the little data available also presents limitations of its own. If different standards and procedures change from place to place should take part of the blame, recent improvements in data collection also make almost impossible to expand study periods many years into the past. The most valuable data in the field, and some is collected like flows through optic fiber segments or satellites, would be information flows; but at this point aggregate figures of bytes are of little relevance, since it is impossible to differentiate what type of exchanges they represented.

Air travel still provides the most comprehensive and reliable source of data on global flows between urban centers. But it also has some important limitations: first, total passenger counts can not be used to analyze specific trip purposes, and tend to overemphasize tourist and family over business; secondly, air travel is not deregulated globally (and even in the U.S. deregulation occurred within a legal framework), and since many links have to be approved by public authorities, the existing network also expresses other types of priorities, including the protection of flag carriers; thirdly, the hub-related policies of major carriers have distorted the supply by changing routes and making entry in some markets extremely difficult for other carriers; fourthly, currently technology still limits the range of flights and makes long-haul routes pricier, and thus less affordable; and last but not least, long-haul flight technology has been developed in the west (Boeing in the U.S. and Airbus in France), and western carriers have benefited from both public subsidies indirectly benefiting national carriers, and the earlier dissemination of innovations in countries involved in the development of the technology. Consequently, air travel data is far from perfect, but comparatively the most reliable dataset at the current time.

8.5 Future research agenda

This study dealt with the need of alternative definitions for the concepts of globalization and city/urban area. Both are topics extremely wide, and have been generating literature for decades, but their resilience is proof of their dynamic nature, and consequently of continuous opportunities for new research. Among many options, there are three preferential areas for continuing these topics.

The first deals with ways to approach global/globalizing urban areas in more encompassing ways, identifying areas where cities in other parts of the world, especially in the BRIC and the Middle East, are finding important economic niches and extending their economic connections with other parts of the world. Urban regions are becoming more complex, but are also overlapping over pre-existing structures; their economies are increasingly complex, their population growing. One of the possible approaches is studying the development of regional public transportation systems, with information available through schedules and sometimes traffic; an alternative is the implementation of new road and rail networks.

The second research area relates to reverse flows of investment. For a long time Middle East and Asian wealthy have been investing in the developed world, sometimes in physical goods like real estate, in other cases in stock portfolios, at times buying part or the totality of a company. In some cases individuals move and re-establish in developed countries and are among their richest residents (for instance, Lakshmi Mittal, Roman Abramovich and Mohammed al-Fayad in Britain, often in the news for very different reasons). In other cases they make highly significant investments, like the recent acquisition of 24% of the London Stock Exchange shares by the Qatar Investment Authority and another 28% by Borse Dubai, giving them joint control of the organization (YahooNews 2007). According to figures in the 2007 United States budget (White House 2007) the net U.S. foreign indebtedness has been growing considerably, and amounting to about 5% of all assets in the country and 45% of the annual GDP. While there are a good number of studies about first-world investment patterns overseas or even expatriates living abroad, there is still very little about reverse trends, and their repercussions in the economic policies of the host countries and in capital flows between the new and old homelands.

And the third area deals with the new types of relationships between a major city and surrounding areas that have been emerging in the developing world when rural populations are displaced my more competitive, and generally capital-intensive, economic practices and move to large and generally poor urban neighborhoods. In the developed world there signs that some areas have been ‘retaken’ by more affluent urbanites, and revitalized through tourism or secondary residences, while other fall in a long and lethargic decline; the internal core of the TUT and the ‘re-colonization’ of the Hill Country provide enough evidence for reflection. But, in the developing world, it is not clear what is happening, what type of changes, in land ownership, production, environment, and population are occurring around and beyond the booming cities of China, India or Brazil.

REFERENCES

Abbott, C. 1981. *The new urban America: Growth and policies in sunbelt cities*. Chapel Hill, NC: University of North Carolina Press.

Abdi, H, and D. Valentin. 2007. Multiple correspondence analysis. In *Encyclopedia of measurement and statistics*, ed. N.J. Salkind, 651-657. Thousand Oaks, CA: Sage.

Abler, R.F. 1991. Hardware, software, and brainware: Mapping and understanding communications technologies. In *Collapsing space and time: Geographic aspects of communication and information*, eds. S.D. Brunn and T.R. Leinbach, 31-48. London, UK: Harper Collins.

Abler, R.F. 1971. Distance, intercommunications and geography. *Proceedings of the Association of American Geographers* 3:1-4.

Abler, R.F., J.S. Adams, and P. Gould. 1971. *Spatial organization: The geographer's view of the world*. Englewood Cliffs, NJ: Prentice Hall.

Abu-Lughod, J.L. 1999. *New York, Los Angeles, Chicago: America's global cities*. Minneapolis, MN: University of Minnesota Press.

Abu-Lughod, J.L. 1995. Comparing Chicago, New York and Los Angeles: Testing some world cities hypotheses. In *World cities in a world system*, eds. P.L. Knox and P.J. Taylor, 31-48. Cambridge, UK: Cambridge University Press.

ACI (Airports Council International). 2006. *Passenger traffic 2005, final*. Geneva, Switzerland. http://www.airports.org/cda/aci_common/display/main/aci_content07_c.jsp?zn=aci&cp=1-5-54-55-2812_666_2; last accessed: July 12, 2006.

ACI (Airports Council International). 2001. *Passenger traffic 2000, final*. Geneva, Switzerland. http://www.airports.org/cda/aci/display/main/; last accessed: July 12, 2006.

Adamic, L.A. 1999. The small world web. *Proceedings of the ECDL '99 Conference*. Berlin, Germany: Springer.

Adams, J. 1971. London's third airport: From TLA to airstrip one. *Geographical Journal* 137(4):468–493.

Adams, P.C. 1995. A reconsideration of personal boundaries in space-time. *Annals of the Association of American Geographers* 85:267-285.

Adorno, T.W. 1990. Culture industry reconsidered. In *Culture and society: Contemporary debates*, eds. J. Alexander and S. Seidman. New York: Cambridge University Press.

Agnew, J. 2001. The new global economy: Time-space compression, geopolitics, and global uneven development. *Journal of World-Systems Research* 7(2):133-154.

Agnew, J. 1979. Instrumentalism, realism and research on diffusion of innovation. *Professional Geographer* 31:364-370.

Alderighi, M., A. Cento, P. Nijkamp, and P. Rietveld. 2005. Network competition – the coexistence of hub-and-spoke and point-to-point systems. *Journal of Air Transport Management* 11:328-334.

Alderson, A.S., and J. Beckfield. 2004. Power and position in the world city system. *American Journal of Sociology* 109(4):811-851.

Amin, A. 2002. Spatialities of globalisation. *Environment and Planning A* 34:385-399.

Amin, A. 1999. An institutionalist perspective on regional economic development. *International Journal of Urban and Regional Research* 23(2):365-378.

Amin, A., and S. Graham. 1997. The ordinary city. *Transactions of the Institute of British Geographers NS* 22:411-429.

Amin, S. 1992. *La déconnexion (Pour sortir du système mondial)*. Paris, France: La Découverte.

Amin, S. 1976. *Unequal development: An essay on the social formations of peripheral capitalism*. New York: Monthly Review.

Arimah B. 2003. Measuring and explaining the provision of infrastructure in African cities. *International Planning Studies* 8(3):225-240.

Arrighi, G. 1994. The long twentieth century: Money, power, and the origins of our times. London, UK: Verso.

Aslund, A. 2002. *Building capitalism: The transformation of the former Soviet Bloc*. New York: Cambridge University Press.

Atkinson, R. D., and P. D. Gottlieb. 2001. *The metropolitan new economy index: Benchmarking economic transformation in the nation's metropolitan areas*. Washington, DC: Progressive Policy Institute. http://www.neweconomyindex.org/metro/; last accessed: May 4, 2007.

Bagwell, K., and R.W. Staiger. 2002. *The economics of the world trading system*. Cambridge, MA and London, UK: MIT Press.

Bailey, E. E., D. R. Graham, and D.P. Kaplan. 1985. *Deregulating the airlines*. Cambridge, MA: MIT Press.

Barnet, R.J., and R.E. Muller. 1974. *Global reach: The power of the multinational corporations*. London, UK: Jonathan Cape.

Batten, D.F. 1995. Network cities: Creative urban agglomerations for the 21st century. *Urban Studies* 32(2):313-327.

Bayne, N. 2000. *Hanging in there: The G7 and G8 summit in maturity and renewal.* Aldershot, UK: Ashgate.

Bayne, N. 1995. The G7 Summit and the reform of global institutions. *Government and Opposition* 30(4):492-509.

BBC News. 2007a. Brazilian firm buys coal producer. *BBC News*, February 26, 2007. http://news.bbc.co.uk/2/hi/business/6398061.stm; last accessed: March 30, 2007.

BBC News. 2007b. India's Tata wins race for Corus. *BBC News*, January 31, 2007. http://news.bbc.co.uk/2/hi/business/6315823.stm; last accessed: April 28, 2007.

BBC News. 2007c. Wealth gap 'spreads across Asia'. *BBC News*, August 8, 2007. http://news.bbc.co.uk/2/hi/business/6936525.stm; last accessed: August 8, 2007.

BBC News 2006a. Brazilian miner buys Canadian rival. *BBC News*, October 24, 2006. http://news.bbc.co.uk/2/hi/business/6081390.stm; last accessed: April 28, 2007.

BBC News. 2006b. Caught in the Enron collapse. *BBC News*, January 27, 2006. http://news.bbc.co.uk/2/hi/americas/4652322.stm; last accessed: July 07, 2006.

Beaverstock, J.V. 2005. Editorial: Global cities. *Journal of Contemporary European Studies* 13(2):141-142.

Beaverstock, J.V. 1996. Sub-contracting the accountant! Professional labour markets, migration and organizational networks in the global accountancy industry. *Environment and Planning A* 28:303-327.

Beaverstock, J.V. 1994. Re-thinking skilled international labour migration: World cities and banking organizations. *Geoforum* 25:323-338.

Beaverstock, J.V., P.J. Taylor and R.G. Smith. 1999. A roster of world cities. *Cities* 16:445-458.

Beaverstock, J.V., R.G. Smith and P.J. Taylor. 2000a. World city network: A new metageography. *Annals of the American Association of Geographers* 90(1):123-135.

Beaverstock, J.V., R.G. Smith, P.J. Taylor, D.R.F. Walker and H. Lorimer. 2000b. Globalization and world cities: Some measurement methodologies. *Applied Geography* 20(1):43-63.

Becker, G.S., K.M. Murphy and R. Tamura. 1990. Human capital, fertility, and economic growth. *Journal of Political Economy* 98(5):12-37.

Beetham, D. 1995. What future for economic and social rights? *Political Studies* 43:41-60.

Bell, D. 1989. *The Romantic ethic and the spirit of modern consumerism*. Oxford, UK: Blackwell Publishers.

Bell, D. 1980. The social framework of the information society. In *The microelectronics revolution*, ed. T. Forrester. Oxford, UK: Blackwell Publishers.

Bell, D. 1978. *The cultural consequences of capitalism*. New York: Basic Books.

Bell, D. 1973. *The coming of the post-industrial society: A venture in social forecasting*. New York: Basic Books.

Beninger, J.R. 1986. *The control revolution: Technological and economic origins of the information society*. Cambridge, MA: Harvard University Press.

Benjamin, J.D., P. Chinloy, and G.D. Jud. 2004. Real estate versus financial wealth in consumption. *The Journal of Real Estate Finance and Economics* 29(3):341-354.

Benko, G., and A.J. Scott. 2004. Economic geography: Tradition and turbulence. In *Human geography: A history for the 21st century*, eds. G. Benko and U. Strohmayer. London, UK: Edward Arnold.

Berry, B.J.L., ed. 1976. *Urbanization and counterurbanization*. Beverly Hills, CA: Sage Publications.

Berry, B.J.L., and J.B. Parr. 1988. *Market centers and retail location: Theory and applications*. Englewood Cliffs, NJ: Prentice-Hall.

Bertin, J. 1967/1983. *Semiology of graphics*. Madison, WI: University of Wisconsin Press.

Birdsall, N. 1998. Life is unfair: Inequality in the world. *Foreign Policy* 111:76-93.

Bishop C. 1995. *Neural networks for pattern recognition*. Oxford, UK: Oxford University Press.

Blake, R. 1969. The impact of airfields on the British landscape . *Geographical Journal* 135(4): 508–528.

Blaut, J. 1977. Two views of diffusion. *Annals of the Association of American Geographers* 67: 343-349.

Blaut, J. 1961. Space and process. *Professional Geographer* 13:1-7.

Blustein, P. 2001. *The chastening: Inside the crisis that rocked the global financial system and humbled the IMF*. New York: Public Affairs.

Boggs, S.W. 1941. Mapping the changing world: Suggested developments in maps. *Annals of the Association of American Geographers* 31:119-128.

Borenstein, S. 1989. Hubs and high fares: Dominance and market power in the U.S. airline industry. *Rand Journal of Economics* 20(3):344-368.

Bottomore, T. 1985. *Theories of modern capitalism*. London, UK: Allen and Unwin.

Bourne, L.S. 2002. Metropolitan growth and change: International perspectives. In N.J. Smelser and P.B. Baltes, eds. *International encyclopedia of the social and behavioral sciences*. Amsterdam, The Netherlands: Elsevier.

Bourne, L.S. 1974. *Urban systems: Strategies for regulation*. Oxford, UK: Clarendon.

Bourne, L.S., R. Sinclair, and K. Dziewonski, eds. 1984. *Urbanization and settlement systems: International perspectives*. Oxford, UK: Oxford University Press.

Bowen, J. 2002. Network change, deregulation, and access in the global airline industry. *Economic Geography* 78(4):425–39.

Bowen, J. 2000. Airline hubs in Southeast Asia: National economic development and nodal accessibility. *Journal of Transport Geography* 8:25-41.

Bowen, J., and T. Leinbach. 1995. The state and liberalization: The airline industry in the East Asian NICs. *Annals of the Association of American Geographers* 85:468-93.

Bradford, M.G., and W.A. Kent. 1977. *Human geography: Theories and their applications*. Oxford, UK: Oxford University Press.

Braudel, F. 1985. *La dynamique du capitalisme*. Paris, France: Flammarion.

Braudel, F. 1966/1984. *The structures of everyday life. Civilization and capitalism: 15th–18th century, volume 3: The perspective of the world*. New York: Harper and Row.

Brenner, N. 2004a. *New state spaces: Urban governance and the rescaling of statehood*. Oxford, UK and New York: Oxford University Press.

Brenner, N. 2004b. Glocalization as a state spatial strategy: Urban entrepreneurialism and the new politics of uneven development in western Europe. In *Remaking the global economy: Economic-geographical perspectives*, eds. J. Peck and H. Yeung, 197-215. Thousand Oaks, CA: Sage.

Brenner, N. 1998. Global cities, glocal states: Global city formation and the state territorial restructuring in contemporary Europe. *Review of International Political Economy* 5(1):1-37.

Bridgman, P.W. 1963/2002. *A sophisticate's primer to relativity*. Mineola, NY: Dover.

Brockman, J. 1995. *The third culture: Beyond the scientific revolution*. New York: Simon & Schuster.

Brooker-Gross, S.R. 1980. Usages of communication technology and urban growth. In *The American metropolitan system: Present and future*, eds. S.D. Brunn and J.O. Wheeler, 145-160. New York: Halsted Press.

Brotchie, J., M. Batty, E. Blakely, P. Hall, and P. Newton, eds. 1995. *Cities in competition*. Melbourne, Australia: Longman.

Browning, H.L. and J.P. Gibbs. 1961. Some measures of demographic and spatial relationships among cities. In *Urban Research Methods*, ed. J.P. Gibbs, 436-459. Princeton, NJ: Van Nostrand.

Brueckner, J.K. 1985. A note on the determinants of metropolitan airline traffic. *International Journal of Transport Economics* 12:175-184.

Brummer, A. 1977/1999. Globalization. In *The new Fontana dictionary of modern thought*, eds. A. Bullock and S. Trombley. London, UK: HarperCollins.

Brunn, S.D. and R. Ghose. 1983/2003. Cities of the future. In *Cities of the world: World regional urban development*, 489-519, eds. S. D. Brunn, J. F. Williams and D. J. Zeigler. Oxford, UK: Rowman & Littlefield.

BTS (United States Bureau of Transportation Statistics). 2007. *Air carriers: T-100 domestic market (All Carriers) 2005*. Washington, DC: BTS. http://www.transtats.bts.gov/DL_SelectFields.asp?Table_ID=310&DB_Short_Name=Air%20 Carriers; last accessed: January 20, 2007.

BTS (United States Bureau of Transportation Statistics). 2000. *National transportation atlas databases: State and federal highways in Texas*. Washington, DC: BTS. http://www.glo.state.tx.us/gisdata/gisdata.html; last accessed: May 1, 2007.

Budds, J., and G. McGranahan. 2003. Are the debates on water privatization missing the point? Experiences from Africa, Asia and Latin America. *Environment & Urbanization* 15(2):87-113.

Bunge, W. 1962. *Theoretical geography*. Lund, Sweden: Gleerup.

Burghouwt, G., J.R. Hakfoort, and J.F.R. van Eck. 2003. The spatial configuration of airline networks in Europe. *Journal of Air Transport Management* 9(5):309-23.

Burke, J., Jr. 1878. *Burke's Texas almanac, and immigrant's hand book*. Houston, TX: J. Burke, Jr.

Buttimer, A. 1976. Grasping the dynamism of the lifeworld. *Annals of the Association of American Geographers* 66:277-292.

Buttimer, A., ed. 1983. *The practice of geography*. Harlow, UK: Longman.

Button, K., and R. Stough. 2000. *Air transport networks: Theory and policy implications*. Northampton, MA: Edward Elgar.

Button, K., S. Lall, R. Stough, and R. Trice. 1999. High-technology employment and hub airports. *Journal of Air Transport Management* 5:53-59.

Camilleri, J.A., and J. Falk. 1992. *The end of sovereignty ? The politics of a shrinking and fragmenting world*. Aldershot, UK: Edward Elgar.

Capel, H. 2003. Redes, chabolas y rascacielos: Las transformaciones físicas y la planificación en las áreas metropolitanas. *Mediterráneo Económico* 3:199-238.

Capel, H. 1981. *Filosofía y ciencia en la geografía contemporánea*. Barcelona, Spain: Barcanova.

Carbonell, A., and R.D. Yaro. 2005. American spatial development and the new megalopolis. *Land Lines* 17(2):1-4.

Carlstein, T., D. Parkkes and N. Thrift, eds. 1978. *Time space and spacing time. Volume 2: Human activity and time-geography*. London, UK: Arnold.

Case, K. 2000. Real estate and the macroeconomy. *Brookings Papers on Economic Activity* 2:119-162.

Castells, M. 2002. Local and global: Cities in the network society. *Tijdschrift voor Economische en Sociale Geografie* 93(5):548-558.

Castells, M. 1996/2000. *The information age: Economy, society and culture. Volume I: The rise of the network society*. Malden, MA: Blackwell.

Castells, M. 1993. European cities, the informational society, and the global economy. *Tijdschrift voor Economische en Sociale Geografie* 84:247-257.

Castells, M. 1989. *The informational city*. Oxford, UK: Blackwell.

Castells, M. 1985. High technology, economic restructuring, and the urban-regional process in the United States. In *High technology, space and society*, ed. M. Castells, 11-40. Beverly Hills, CA: Sage.

Castells, M. 1983. *The city and the grassroots*. London, UK: Edward Arnold.

Castells, M., and P. Hall. 1994. *Technopoles of the world: The making of the 21st century industrial complexes*. London, UK: Routledge.

Cattan, N. 1995. Attractivity and internationalisation of major European cities: The example of air traffic. *Urban Studies* 32:303-312.

Chapple, K., A. Markusen, G. Schrock, D. Yamamoto, and P. Yu. 2004. Gauging metropolitan 'high-tech' and 'i-tech' activity. *Economic Development Quarterly* 18(1):10-29.

Chase-Dunn, C., and P. Grimes. 1995. World-systems analysis. *Annual Review of Sociology* 21:387-417.

Chew, S.C. 2002. Globalisation, ecological crisis, and dark ages. *Global Society* 16(4):333-356.

Chorley, R.J., ed. 1973. *Directions in geography*. London, UK: Methuen.

Christaller, W. 1933/1966. *Central places in southern Germany*. Englewood Cliffs, NJ: Prentice-Hall.

Christaller, W. 1950. *Das grundgerüst der raumlichen ordnung in Europa. Die systeme der Europaïschen zentralen orten*. Frankfurt, Germany: Frankfurter Geographische Hefte.

Claude, I.L., Jr. 1988. *States and the global system: Politics, law and organization*. London, UK: Macmillan.

Clayton, C. 1980. Interdependence in urban systems and its applications to political reorganization. *Geografiska Annaler* 62B(1):11-20.

Clayton, C. 1977. The structure of interstate and interregional migration: 1965-1970. *The Annals of Regional Science* 11(1):109-122.

Claval, P. 1993/1998. *An introduction to regional geography*. Oxford, UK and Malden, MA: Blackwell Publishers Inc.

Cohen, R.B. 1981. The new international division of labor, multinational corporations and urban hierarchy. In *Urbanization and urban planning in capitalist society*, eds. M. Dear and A. Scott, 287-315. London, UK: Methuen.

Cohn, T.H. 2000/2005. *Global political economy: Theory and practice*. New York: Longman.

Cox, K., ed. 1997a. *Spaces of globalization: Reasserting the power of the local*. New York: Guilford.

Cox, K. 1997b. Economic globalization and the limits to liberal democracy. In *The transformation of democracy? Globalization and territorial democracy*, ed. A. McGrew, 49-72. Cambridge, UK: Polity Press.

Cuadrado-Roura, J.R., and L. Rubalcaba-Bermejo. 1998. Specialization and competition amongst European cities: A new approach through fair and exhibition activities. *Regional Studies* 32(2):133-147.

Cumings, B. 1999. Still the American century. *Review of International Studies* 25:271-299.

Daniels, P.W. 2004. Reflections on the “old” economy, “new” economy, and services. *Growth and Change* 35(2):115-138.

Davidow, W.H., and M.S. Malone. 1992. *The virtual corporation: Structuring and revitalizing the corporation for the 21st Century*. New York: Harper Collins.

Debbage, K. 1994. The international airline industry: Globalization, regulation, and strategic alliances. *Journal of Transport Geography* 2:190-203.

De Groote, P. 2005. The success story of European low-cost carriers in a changing air world. *Research Bulletin* 174. Loughborough, UK: Globalization and World Cities Study Group and Network.

Derudder, B. and F. Witlox. 2005a. An appraisal of the use of airline data in assessing the world city network: A research note on data. *Urban Studies* 42(13):2371-2388.

Derudder, B. and F. Witlox. 2005b. On the use of inadequate airline data in mappings of a global urban system. *Journal of Air Transport Management* 11(4):231-237.

Derudder B., and F. Wilcox. 2004. Assessing central places in a global age: On the networked localization strategies of advanced producer services. *Journal of Retailing and Consumer Services* 11:171-180.

Derudder, B., L. Devriendt, and F. Witlox. 2007. Flying where you don't want to go: An empirical analysis of hubs in the global airline network. *Tijdschrift voor Economische en Sociale Geografie* 98(3):307-324.

De Vries, J. 1984. *European urbanization, 1500-1800*. London, UK: Methuen.

Di Biase, D., A.M. MacEachren, J.B. Krygier, and C. Reeves. 1992. Animation and the role of map design in scientific visualization. *Cartography and Geographic Information Systems* 19(4):201-214, 265-266.

Dicken, P. 1986/1992. *Global shift: The internationalization of economic activity*. New York: Guilford.

Dicken, P. 1998/2002. *Global shift: Reshaping the global economic map in the 21st century*. London, UK: Sage.

DMN (The Dallas Morning News). 2006. *Texas almanac 2006-2007: Sesquicentennial edition 1857-2007*. Dallas, TX: Dallas Morning News.

DMN (The Dallas Morning News). 2002. *Texas almanac 2002-2003*. Dallas, TX: Dallas Morning News.

DMN (The Dallas Morning News). 1998. *Texas almanac 1998-1999*. Dallas, TX: Dallas Morning News.

DMN (The Dallas Morning News). 1992. *Texas almanac 1992-1993*. Dallas, TX: Dallas Morning News.

DMN (The Dallas Morning News). 1987. *Texas almanac 1987*. Dallas, TX: Dallas Morning News.

Dor, D. 2004. From Englishization to imposed multilingualism: Globalization, the internet, and the political economy of the linguistic code. *Public Culture* 16(1):97-118.

DOT (United States Department of Transportation). 2007. DOT proposes to award new daily U.S.-China flight to United. *Office of Public Affairs press release DOT 6-07*, January 9, 2007. Washington, DC: DOT. http://www.dot.gov/affairs/dot0607.htm; last accessed: April 7, 2007.

DOT (United States Department of Transportation). 2006a. *Consumer airfare report, 2005,* First, Second, Third and Fourth Quarters. Washington, DC: DOT. http://ostpxweb.dot.gov/aviation/usstatreport.htm; last accessed: December 7, 2006.

DOT (United States Department of Transportation). 2006b. *U.S. international air passenger and freight statistics report: Year-to-date U.S. to international T-100 segment data, 2005*. Washington, DC: DOT. http://ostpxweb.dot.gov/aviation/usstatreport.htm; last accessed: December 7, 2006.

DOT (United States Department of Transportation). 2006c. *Year-to-date U.S. to international T-100 segment data, passengers 2005*. Washington, DC: DOT. http://ostpxweb.dot.gov/aviation/usstatreport.htm; last accessed: December 11, 2006.

Drainville, A.C. 2004. *Contesting globalization: Space and place in the world economy*. London, UK: Routledge, RIPE Series in Global Political Economy.

Drezner, T., and Z. Drezner. 2001. A note on applying the gravity rule to the airline hub problem. *Journal of Regional Science* 41:67-73.

Drucker, P.F. 1995. The network society. *Wall Street Journal*, March 29:12.

Dunn, K.M., P. Geeraert, and J. Forrest. 2006. Anti-racism for Australian cities: Toward a geography for tolerance building in Australian cities. *Social City* 08:1-12.

Dykes, J.A. 1997. Exploring spatial data representation with dynamic graphics. *Computers and Geosciences* 23(4):345-370.

Egelko, E., and M. Martin. 2004. Houston firm indicted for role in energy crisis: Reliant Energy is accused of forcing up electricity prices. *San Francisco Chronicle,* April 9, 2004. http://www.sfgate.com/cgi-bin/article.cgi?file=/c/a/2004/04/09/MNG2S62D4B22.DTL; last accessed: July 15, 2006.

Eldridge, D., and J. P. Jones. 1991. Warped space: A geography of distance decay. *Professional Geographer* 43(4):500-511.

Ellis, C.D. 2002. Solid waste management in the Texas Urban Triangle. Presentation to the *World Federation of Scientists International Seminars on Planetary Emergencies*, August 19-24, 2002. Erice, Italy.

Ellis, C.D., J. Evans, J. Hinojosa, and G.O. Rogers. 1999. Texas Urban Triangle: Working toward sustainable new communities. Presentation to the *National Federation of Scientists International Seminars on Planetary Emergencies*. August 19-24, 2000. Erice, Italy.

EMSNow (Electronics Manufacturing Sector Now). 2004. Indian firm outsourcing work to Northern Ireland. *EMSNow,* September 27, 2004.

http://www.emsnow.com/newsarchives/archivedetails.cfm?ID=6297; last accessed: April 28, 2007.

ESRI. 2001. *ArcObjects Online: Path Finder*. Redlands, CA: ESRI. http://edndoc.esri.com/arcobjects/8.3/default.asp?URL=/arcobjects/8.3/samples/network/path%20finder/path%20finder.htm; last accessed: May 11, 2007.

Exenberger, A. 2004. The cradle of globalization: Venice's and Portugal's contribution to a world becoming global. *Working Paper* 04/04. http://homepage.uibk.ac.at/~c43207/die/w0404.pdf; last accessed: June 10, 2005.

FAA (Federal Aviation Administration). 2007. *Passenger boarding and all-cargo data*. Washington, DC: FAA. http://www.faa.gov/airports_airtraffic/airports/planning_capacity/passenger_allcargo_stats/passenger/; last accessed: January 20, 2007.

Fainstein, S. 2001. Inequality in global city-regions. In *Global city-regions*, ed. A.J. Scott, 285-298. Oxford, UK: Oxford University Press.

Faludi, A., ed. 2002. *European spatial planning*. Cambridge, MA: Lincoln Institute of Land Policy.

Favel, A. 2001. Migration, mobility and globaloney: Metaphors and rhetoric in the sociology of globalization. *Global Networks* 1(4):389-398.

FCC (Federal Communications Commission). 1997. *Major economic areas delineated by the Federal Communications Commission*, 62 FR 9636 (March 3, 1997). Washington, DC: FCC. http://www.fcc.gov/oet/info/maps/areas/; last accessed: May 13, 2005.

FCC (Federal Communications Commission). 1994. *Major trading areas delineated by the Rand McNally 1992 commercial atlas & marketing guide, extended and excepted by the Federal Communications Commission*, 59 FR 14115 (March 25, 1994). Washington, DC: FCC. http://www.fcc.gov/oet/info/maps/areas/; last accessed: May 13, 2005.

FDD (Foundation for Defense of Democracies). 2006. *Biographies, board of directors – Steven Forbes*. Washington, DC: FDD. http://www.defenddemocracy.org/biographies/biographies_show.htm?doc_id=154774; last accessed: June 11, 2006.

Featherstone, M., ed. 1990. *Global culture*. London, UK: Sage.

Fehrenbach, T.R. 1983. *Lone star: A history of Texas and the Texans*. New York: American Legacy Press.

Feigenbaum, H.B. 2002. Globaloney: Economic versus cultural convergence under conditions of globalization. *Journal of Arts Management, Law & Society* 31(4):255-264.

Ferguson, N. 2005. Sinking globalization. *Foreign Affairs* 84(2):64-77.

Ferro, M. 1997. *Colonization: A global history*. London, UK: Routledge.

Flint, P. 2007. World airline report. *Air Transport World* 44(7):26-119.

Florida, R. 2006. The new megalopolis. *Newsweek* 148.1-2:62-63.

Forbes. 2005. The Forbes global 500. *Forbes* 175.8. http://www.forbes.com/2005/03/30/05f2000land.html; last accessed: April 28, 2006.

Forbes. 2000a. The Forbes sales 500. *Forbes* 165(9):268-308.

Forbes. 2000b. The 500 largest foreign companies. *Forbes* 166(2):318-365.

Forbes. 1995a. The Forbes sales 500. *Forbes* 155(9):218-381.

Forbes. 1995b. The Forbes foreign rankings. *Forbes* 156(2):232-258.

Forbes. 1990a. The Forbes sales 500. *Forbes* 145(9):230-434.

Forbes. 1990b. The Forbes foreign rankings. *Forbes* 146(2):318-345.

Forbes. 1985a. The Forbes sales 500. *Forbes* 135(9):162-364.

Forbes. 1985b. The Forbes foreign rankings. *Forbes* 136(3):161-176.

Forer, P. 1978. A place for plastic space? *Progress in Human Geography* 2:230-267.

Forer, P. 1974. Space through time. In *Space-time concepts in urban and regional models*, ed. E.L. Cripps, 22-45. London, UK: Pion.

Fortune. 2006a. *Fortune Press Room*. New York: Fortune. http://www.timeinc.net/fortune/information/Presscenter/0,,contacts,00.html; last accessed: June 09, 2006.

Fortune. 2006b. Fortune 500 largest U.S. corporations. *Fortune* 161(7): F1-F67.

Fortune. 2005a. Fortune 500 largest U.S. corporations. *Fortune* 151(8): F1-F74.

Fortune. 2005b. Fortune global 500. *Fortune* 152(2):97-142.

Fortune. 2000a. Fortune 500 largest U.S. corporations. *Fortune* 141(8): F1-F82.

Fortune. 2000b. Fortune global 500. *Fortune* 142(2): F1-F21.

Fortune. 1995a. Fortune 500 largest U.S. corporations. *Fortune* 131(9): F1-F64.

Fortune. 1995b. Fortune global 500. *Fortune* 132(3): F1-F42.

Fortune. 1990a. The Fortune 500. *Fortune* 121(9):337-396.

Fortune. 1990b. The global 500. *Fortune* 122(3):264-328.

Fortune. 1985a. *The 1985 directory of U.S. corporations: The Fortune 500, the largest industrials*. New York: Fortune.

Fortune. 1985b. The global 500. *Fortune* 112(4):182-217.

Fournier, G.M., M.E. Hartmann, and T. Zuehlke. 2005. New carrier entry and airport substitution by travelers: Why do we have to drive to fly? Paper presented to the *International Industrial Organization Conference*, Atlanta, GA, April 8-9, 2005.

Francis, G., I. Humphreys, S. Ison, and M. Aicken. 2006. Where next for low cost airlines? A spatial and temporal comparative study. *Journal of Transport Geography* 14:83-94.

Frank, A.G. 1989. The development of underdevelopment. *Monthly Review* 41:37-51.

Frank, A.G. 1980. *In the world economy*. London, UK: Heinemann.

Frankel, J.A. 2000. Globalization of the economy. *NBER Working Papers* 7858. Cambridge, MA: National Bureau of Economic Research.

Freeman, L. 1979. Centrality in social networks I: Conceptual clarification. *Social Networks* 1:215-239.

Friedmann, J. 2001. World cities revisited: A comment. *Urban Studies* 38(13):2535-2536.

Friedmann, J. 1995. Where we stand: A decade of world city research. In *World cities in a world-system*, eds. P.L. Knox and P.J. Taylor, 21-47. New York: Cambridge University Press.

Friedmann, J. 1986. The world city hypothesis. *Development and Change* 17:69-83.

Friedmann, J. 1972. A generalized theory of polarized development. In *Growth centers in regional economic development*, ed. N. Hansen, 82-107. New York: Free Press.

Friedmann, J., and G. Wolff. 1982. World city formation: An agenda for research and action. *International Journal of Urban and Regional Research* 3(2):309-344.

Friedmann, J., and J. Miller. 1965. The urban field. *Journal of the American Institute of Planners* 31:312-320.

Fuelhart, K. 2003. Inter-metropolitan airport substitution by consumers in an asymmetrical airfare environment: Harrisburg, Philadelphia and Baltimore. *Journal of Transport Geography* 11(4):285-296.

Fuguitt, G.V. 1985. The nonmetropolitan population turnaround. *Annual Review of Sociology* 11:259-280.

Galor, O., and D.N. Weil. 2000. Population, technology, and growth: From Malthusian stagnation to the demographic transition and beyond. *The American Economic Review* 90(4):806-828.

Garreau, J. 1991. *Edge city: Life on the new frontier*. New York: Doubleday.

GaWC (Global and World Cities Study Group and Network). 2006. *GaWC Study Group and Network*. Loughborough, UK: Loughborough University, Geography Department. http://www.lboro.ac.uk/gawc/group.html; last accessed: September 4, 2006.

Geddes, P. 1915. *Cities in evolution*. London, UK: Benn.

Geyer, H.S. 2002. On urban systems evolution. In *International Handbook of Urban Systems*, ed. H.S. Geyer, 39-66. Cheltenham, UK: Edward Elgar.

Geyer, M. and T.M. Kontuly. 1996. *Differential urbanization: Integrating spatial models*. London, UK and New York: Arnold.

Gibson, C. 1998. Population of the 100 largest cities and other urban places in the United States:1790 to 1990. *Population Division Working Paper* 27. Washington, DC: U.S. Bureau of the Census, Population Division.

http://www.census.gov/population/www/documentation/twps0027.html; last accessed: June 11, 2006.

Giddens, A. 1984. *The constitution of society*. Cambridge, UK: Polity.

Giddens, A. 1981. *A contemporary critique of historical materialism, volume 1: Power, property and the state*. London, UK: Macmillan.

Gilmer, R.W. 2004a. The simple economics of the Texas Triangle. *Houston Business*, January 2004. Houston, TX: Federal Reserve Bank of Dallas, Houston Branch.

Gilmer, R.W. 2004b. The Texas Triangle as megalopolis. *Houston Business,* April 2004. Houston, TX: Federal Reserve Bank of Dallas, Houston Branch.

Gilmer, R.W. 2003. Economic progress in the Texas economy, 1969-2001. *Houston Business*, November 2003. Houston, TX: Federal Reserve Bank of Dallas, Houston Branch.

Gittell, R., A. Kaufman, M. Karson, and R. McChesney. 2000. The new economic geography of the states. *Economic Development Quarterly* 14(2):182-193.

Glückler, J. 2007. Economic geography and the evolution of networks. *Journal of Economic Geography* 7(5):619-634.

Goetz, A. R. 2002. Deregulation, competition, and antitrust implications in the US airline industry. *Journal of Transport Geography* 10:1-19.

Goetz, A. R. 1994. Geographic patterns of air service frequencies and pricing at US cities. *Journal of the Transportation Research F* 33:56-72.

Goetz, A. R. 1992. Air passenger transportation and growth in the US urban system, 1950-1987. *Growth and Change* 23(2):217-238.

Goetz, A. R., and C. J. Sutton. 1997. The geography of deregulation in the U.S. airline industry. *Annals of the Association of American Geographers* 87:238–263.

Gordon, D. 1988. The global economy: New edifice or crumbling foundations? *New Left Review* 168:24-64.

Goto, J.H., M.E. Lewis and M.L. Puterman. 2004. Coffee, tea, or..?: A Markov decision process model for airline meal provisioning. *Transportation Science* 38(1):107-118.

Gottman, J. 1977/1999. Megalopolis. In *The new Fontana dictionary of modern thought*, eds. A. Bullock and S. Trombley. London, UK: Harper Collins.

Gottman, J. 1961. *Megalopolis: The urbanized northeastern seabord of the United States*. New York: The Twentieth Century Fund.

Gow, G. 2005. Rubbing shoulders in the global city: Refugees, citizenship and multicultural alliances in Fairfield, Sydney. *Ethnicities* 5(3):386-405.

Graham, S. 2004. Beyond the 'dazzling light': From dreams of transcendence to the 'remedition' of urban life. *New Media and Society* 6:16-26.

Graham, S. 1999. Towards urban cyberspace planning. In *Technocities*, eds. J. Downey and J. McGuigan, 9-33. London, UK: Sage.

Graham, S., and S. Marvin. 2001. *Splintering urbanism: Networked infrastructures, technological mobilities and the urban condition*. London, UK: Routledge.

Graham, S., and S. Marvin. 1996. *Telecommunications and the City. Electronic spaces, urban spaces*. London, UK, and New York: Routledge.

Grais, R., J. Ellis, and G. Glass. 2003a. Assessing the impact of airline travel on the geographic spread of pandemic influenza. *European Journal of Epidemiology* 18:1065-1072.

Grais, R., J. Ellis, and G. Glass. 2003b. Forecasting the geographical spread of smallpox cases by air travel. *Epidemiology & Infections* 131:849-857.

Gregory, D. 1981/2000. Time-geography. In *The dictionary of human geography*, eds. R.J. Johnston, D. Gregory, G. Pratt and M. Watts, 830-832. Oxford, UK and Malden, MA: Blackwell.

Gregory, D. 1994. *Geographical imaginations*. Oxford, UK: Blackwell.

Greenhouse, S., and D. Leonhardt. 2006. Corporate profits rise as workers' pay stalls. *Pittsburgh Post Gazette* August 28, 2006, A1.

Hägerstrand, T. 1976. Geography and the study of interaction between society and nature. *Geoforum* 7:329-334.

Hägerstrand, T. 1975. Space, time and human conditions. In *Dynamic allocations of urban space*, eds. A. Karlqvist. L. Lundqvist and F. Snickars, 3-14. Farnborough, UK: Saxon House.

Hägerstrand, T. 1973. The domain of human geography. In *Directions in geography*, ed. R.J. Chorley, 67-87. London, UK: Methuen.

Hägerstrand, T. 1953/1968. *Innovation diffusion as a spatial process*. Chicago, IL: University of Chicago Press.

Haggett, P. 2001. *Geography: A global synthesis*. Harlow, UK: Prentice Hall.

Haggett, P., A.D. Cliff, and A.E. Frey. 1977. *Locational analysis in human geography*. London, UK: Edward Arnold.

Hahn, B. 2004. New York, Chicago, Los Angeles: Global cities im wettbewerb. *Geographische Rundschau* 56(4):12-18.

Hall, P. 2002. Christaller for a global age: Redrawing the urban hierarchy. In *Stadt und region: Dynamik von lebenswelten*, eds. A. Mayr, M. Meurer and J. Vogt, 110-128. Leipzig, Germany: Deutsche Gesellschaft für Geographie.

Hall, P. 2001. Global city-regions in the twenty-first century. In *Global city-regions: Trends, theory, policy*, ed. A.J. Scott, 59-77. Oxford, UK: Oxford University Press.

Hall, P. 1999. The future of cities. *Computers, Environment and Urban Systems* 23:173–185.

Hall, P. 1966. *The world cities*. New York: McGraw-Hill.

Hardt, M., and A. Negri. 2000. *Empire*. Cambridge, MA and London, UK: Harvard University Press.

Hartshorne, R. 1939. *The nature of geography: A critical survey of current thought in the light of the past*. Lancaster, PA: Association of American Geographers.

Harvey, D. 1996. *Justice, nature and the geography of difference*. Oxford, UK and Cambridge, MA: Blackwell.

Harvey, D. 1990. Between space and time: Reflections on the geographical imagination. *Annals of the Association of American Geographers* 80:418-434.

Harvey, D. 1989. *The condition of postmodernity: An enquiry into the origins of cultural change*. Oxford, UK: Blackwell.

Heenan, D. A. 1977. Global cities of tomorrow. *Harvard Business Review* 55:79-92.

Heidenrich, M. 1998. The changing system of European cities and regions. *European Planning Studies* 6(3):315-332.

Held, D. 1995. *Democracy and the global order: From the modern state to cosmopolitan governance*. Cambridge, UK: Polity.

Held, D., and A. McGrew. 2001/2003. The great globalization debate: An introduction. In *The global transformation reader: An introduction to the globalization debate*, eds. D. Held and A. McGrew, 1-45. Cambridge, UK: Polity Press.

Held, D., and A. McGrew, eds. 2002. *Globalization/Anti-globalization*. Cambridge, UK: Polity Press.

Hennessy, H. 2005. Dubai's relentless construction boom. *BBC News*, December 7, 2005. http://news.bbc.co.uk/2/hi/business/4506512.stm; last accessed: May 24, 2007.

Higham, R. 1960. *British imperial air routes 1918 to 1939*. London, UK: Foulis.

Hill, R. C., and J. R. Feagin. 1989. Detroit and Houston: Two cities in global perspective. In *The capitalist city*, eds. M. P. Smith and J. R. Feagin, 155-177. Cambridge, MA: Blackwell.

Hilsenrath, J.E. 2002. Globalization gets mixed report in U.S. universities. *Wall Street Journal* December 2, 2002.

Hirst, P., and G. Thompson. 1996/1999. *Globalization in question: The international economy and the possibilities of governance.* Cambridge, UK: Polity Press.

Hoare, A. 1974. International airports as growth poles: A case study of Heathrow Airport. *Transactions of the Institute of British Geographers* 63:75–96.

Hofmeister, H.-G. 2002. *Mexico-City: Eine metropole des südens im globalen restrukturierungsprozess*. Kassel, Germany: Kassel University Press.

Hogendijk, J.P., and A.I. Sabra, eds. 2003. *The enterprise of science in Islam: New perspectives*. Cambridge, MA: MIT Press.

Holloway, S.R., and J.O. Wheeler. 1991. Corporate headquarters relocation and changes in metropolitan corporate dominance, 1980-1987. *Economic Geography* 67(1):54-74.

Holm, H.-H., and G. Sørensen, eds. 1995 *Whose world order? Uneven globalization and the end of the Cold War*. Boulder, CO: Westview Press.

Hoogvelt, A. 1997. *Globalization and the postcolonial world: The new political economy of development*. London, UK: Macmillan.

Hoppe, G., and J. Langton. 1994. *Peasantry to capitalism: Western Östergötland in the nineteenth century*. Cambridge, UK: Cambridge University Press.

Horner, M.W., and M.E. O'Kelly. 2001. Embedding economies of scale concepts for hub network design. *Journal of Transport Geography* 9:255-265.

Hoyt, H. 1941. Forces of urban centralization and decentralization. *American Journal of Sociology* 46:843-852.

Hudson, R. 1999. The learning economy, the learning firm and the learning region: A sympathetic critique of the limits to learning. *European Urban and Regional Studies* 6(1):59-72.

Huggett, R.J. 1980. *Systems analysis in geography*. Oxford, UK: Clarendon Press.

Hugill, P.J. 1993. *World trade since 1431: Geography, technology, and capitalism*. Baltimore, MD: John Hopkins University Press.

Hymer, S. 1972. The multinational corporation and the law of uneven development. In *Economics and world order*, ed. J.W. Bhagwati, 80-106. New York: Macmillan.

Ianni, O. 1996. *Teorías de la globalización*. Ciudad de México, Mexico: Siglo Veintiuno Editores.

Ianni, O. 1994a. Metáforas da globalização. *Idéias* 1.1. Campinas, Brazil: Unicamp.

Ingimundarson, V., K. Loftsdóttir, and I. Erlingsdóttir, eds. 2004. *Topographies of globalization: Politics, culture, language*. Reykjavík, Iceland: University of Iceland Press.

Ingram, G.K., and A. Carroll. 1981. The spatial structure of Latin American cities. *Journal of Urban Economics* 9(2):257-273.

Isidore, C. 2005. More airline turbulence ahead: Record high jet fuel could spur more losses, bankruptcies as industry shakeout picks up steam. *Fortune* September 14, 2005. http://money.cnn.com/2005/09/13/news/fortune500/airlines_future/index.htm; last accessed: October 5, 2006.

Ivy, R.L. 1993. Variations in hub services in the US domestic air transportation network. *Journal of Transport Geography* 1:211-218.

Jackson, K.T. 1985. *Crabgrass frontier: The suburbanization of the United States*. New York: Oxford University Press.

Janelle, D.G. 2001. Time-space in geography. In *International encyclopedia of social and behavioural sciences*, eds. N.J. Smelser and P.B. Baltes, 15746-15749. Amsterdam, Netherlands: Pergamon-Elsevier Science.

Janelle, D.G. 1973. Measuring human extensibility in a shrinking world. *Journal of Geography* 72:8-15.

Janelle, D. G. 1969. Spatial reorganization: A model and concept. *Annals of the Association of American Geographers* 59:348-364.

Janelle, D. G. 1968. Central place development in a time-space framework. *Professional Geographer* 20:5-10.

Jayan, C.M. 2007. Reverse offshoring. Offshoring times June 20, 2007. http://offshore-outsourcing.org.uk/oftimes/Pages/2007/offshore_news1669.html; last accessed: June 29, 2007.

Jefferson, M. 1939. The law of the primate city. *Geographical Review* 29:226-232.

Jiang, B., and C. Claramunt. 2004. Topological analysis of urban street networks. *Environment and Planning B: Planning and Design* 31:151-162.

Johnston, R.J. 1971/1997. *Geography and geographers: Anglo-American human geography since 1945*. London, UK: Edward Arnold.

Johnston, R.J. 1979. *Multivariate statistical analysis in geography: A primer on the general linear model*. London, UK: Longman.

Jolliffe, I.T. 2002. *Principal component analysis*. Berlin, Germany: Springer.

Kanbur, R., and X. Zhang. 2005. Fifty years of regional inequality in China: A journey through central planning, reform, and openness. *Review of Development Economics* 9(1):87-106.

Kang, N.-H., and K. Sakai. 2001. *New patterns of industrial globalisation, cross-border mergers and acquisitions and strategic alliances*. Paris, France: OECD.

Kantor, P. 2007. Globalization and the American model of urban development: Making the market. *Métropoles* 1:31-68.

Keeling, D. J. 1995. Transportation and the world city paradigm. In *World cities in a world system*, eds. P. L. Knox, and P. J. Taylor, 115-131. Cambridge, UK: Cambridge University Press.

Kelly, C. J., Jr. 1963. *The sky's the limit: The history of the airlines*. New York: Arno Press.

Kelly, J. 1998. No free ride for free trade. *Pittsburgh Post Gazette* May 17, 1998.

Kelly, K. 1998. *New rules for the new economy: Ten ways the network economy is changing everything*. London, UK: Fourth Estate.

Kelly, P.F. 1999. The geographies and politics of globalization. *Progress in Human Geography* 23(3):379-400.

Kelly, S. 2005. Portal race goes local and global. *BBC News*, August 19, 2005. http://news.bbc.co.uk/2/hi/programmes/click_online/4166212.stm; last accessed: August 21, 2005.

Keohane, R.O. 2003. Ironies of sovereignty: The European Union and the United States. *Journal of Common Market Studies* 40(4):743-765.

Keohane, R.O. 1984. *After hegemony*. Princeton, NJ: Princeton University Press.

King, A.D. 1990. *Global cities: Post-imperialism and the internationalization of London*. London, UK: Routledge.

Kirk, D. 1996. Demographic transition theory. *Population Studies* 50(3):361-387.

Kirkland, R. 2007. The greatest economic boom ever. *Fortune* 156(2):121-128.

Kitchen P. 2002. Identifying dimensions of urban social change in Dublin – 1986 to 1996. *Irish Geography* 35(2):156-174.

Klier, T., and W. Testa. 2002. Location trends of large company headquarters during the 1990s. *Economic Perspectives* 2Q/2002. Chicago, IL: Federal Reserve Bank of Chicago.

Kloosterman, R.C., and S. Musterd. 2001. The polycentric urban region: Towards a research agenda. *Urban Studies* 38(4):623-633.

Knox, P.J., and J. Agnew. 1994. *The geography of the world economy*. London, UK: Edward Arnold.

Koolhaas, R., S. Boeri, and S. Kwinter. 2001. Gross product of cities. In *Mutations*, eds. R. Koolhaas, S. Boeri, S. Kwinter, and N. Tzi. Bordeaux, France: ACTAR, 51.

Kosslyn, S.M. 1985. Graphics and human information processing. *Journal of the American Statistical Association* 80:499-512.

Krätke, S. 2004. Berlin, stadt im globalisierungsprozess. *Geographische Rundschau* 56(4):20-25.

Krätke, S. 2001. Strengthening the polycentric urban system in Europe: Conclusions from the ESDP. *European Planning Studies* 9(1):105-116.

Kristiansen, K. 1993. The emergence of the European world system in the Bronze Age: Divergence, convergence, and social evolution during the first and second millennia B.C. in Europe. *Sheffield Archaeological Monographs* No. 6. Sheffield, UK: JR Collis Publications.

Krugman, P. 2006. Left-behind economics. *Pittsburgh Post Gazette* July 15, 2006.

Kuby, M., and R. Gray. 1993. The hub network design problem with stopovers and feeders: The case of Federal Express. *Transportation Research A* 27:1-12.

Kunzmann, K. R. 1998. World city regions in Europe: Structural change and future challenges. In *Globalization and the world of large cities*, eds. F.-C. Lo and Y.-M. Yeung, 37-75. Tokyo, Japan: United Nations University Press.

Lai, S., and L. Whei-Li. 2005. Impact analysis of September 11 on air travel demand in the USA. *Journal of Air Transport Management* 11:455-458.

Lajugie, J., P. Delfaud, and C. Lacour. 1986. *Espace régional et aménagement du territoire*. Paris, France: Dalloz.

Lang, R.E. 2005. US Cities in the World City Network. Presentation to the *Inter-city relations within contemporary globalization* conference. Ghent, Belgium, January 13-14, 2005. http://www.mi.vt.edu/index.asp?page=23&id=50; last accessed: November 24, 2005.

Lang, R.E. 2004. The megapolitan South: Comparing Atlanta, Dallas and Miami. Presentation to the *Association of Collegiate Schools of Planning* conference. Portland, OR, October 22, 2004. http://www.mi.vt.edu/index.asp?page=23&id=50; last accessed: November 22, 2005.

Lang, R.E., and D. Dhavale. 2005. Beyond Megalopolis: Exploring America's new "megapolitan" geography. *Census Report* 05.01. Alexandria, VA: Metropolitan Institute at Virginia Tech.

Lang, R.E., and J. LeFurgy. 2003. Edgeless cities: Examining the noncentered metropolis. *Housing Policy Debate* 14(3):427-460.

Lang, R.E., and P.E. Simmons. 2001. 'Boomburbs': The emergence of large, fast-growing suburban cities in the United States. *Fannie Mae Foundation Census Note* 06:1-36. Washington, DC: Fannie Mae Foundation.

Langran, G. 1992. *Time in geographic information systems*. London, UK: Taylor and Francis.

Lajugie, J., P. Delfaud, and C. Lacour. 1985. *Espace régional et aménagement du territoire*. Paris, France: Dalloz.

Lapré, M.A., and G.D. Scudder. 2004. Performance improvement paths in the U.S. airline industry: Linking trade-offs to asset frontiers. *Production and Operations Management* 13(2):123-124.

Lee, R.L.M. 2002. Globalization and mass society theory. *International Review of Sociology – Revue Internationale de Sociologie* 12(1):45-60.

Lee, Y.-S., and B. Yeoh. 2004. Introduction: Globalization and the politics of forgetting. *Urban Studies* 41(12):2295-2301.

Leigh, J. 2004. Reflections of Babylon: Intercultural communication and globalization in the new world order. *Globalization* 4.1. http://globalization.icaap.org/content/v4.1/leigh.html; last accessed: June 14, 2006.

Leigh, J. 1954. Innovation and area. *Geographical Review* 44:439-441.

Leitner, H. 1996. Reconfiguring the spatiality of power: The construction of a supranational migration framework for the European Union. *Political Geography* 16(2):145-169.

Leonhardt, D. 2005. Boom in jobs, not just houses, as real estate drives economy. *New York Times*, July 9, 2005. http://www.nytimes.com/2005/07/09/realestate/09complex.html; last accessed: June 10, 2007.

Letton L. 2004 *Referendum's passage sets Capital metro plans in motion* (Public Release). Austin, TX: Capital Metropolitan Transportation Authority. http://www.capmetro.org/news/news_detail.asp?id=205; last accessed: June 19, 2007.

Lewis, J.H. 2002. *Exploring edge cities: Report of a national survey of senior planners*. Chicago, IL: Institute for Metropolitan Affairs, Roosevelt University.

Light, R. 1935. Cruising by airplane: Narrative of a journey around the world. *Geographical Review* 25(4):565–600.

Lim, D. 2006. Asian-American film: Defying assumptions. *The New York Times*, April 27, 2006. http://www.iht.com/articles/2006/04/27/news/fmlede28.php; last accessed: May 26, 2006.

Lin, G.C.S. 2001. Evolving spatial form of urban rural interaction in the Pearl River delta, China. *Professional Geographer* 53(1):56-70.

Lipietz, A. 1983. *Le capital et son espace*. Paris, France: La Découverte-Maspero.

Liu, C.-M. 2006. *Entry behavior and financial distress: An empirical analysis of the U.S. domestic airline industry*. Doctoral dissertation presented to the Department of Economics, North Carolina State University. Raleigh, NC: NCSU.

Liu, X., and R.G. Lathrop, Jr. 2002. Urban change detection based on an artificial neural network. *International Journal of Remote Sensing* 23(12):2513-2518.

Logan, J.R., and T. Swanstrom, eds. 1990. *Beyond the city limits: Urban policy and economic restructuring in comparative perspective*. Philadelphia, PA: Temple University Press.

Lösch, A. 1939/1954. *The economics of location*. New Haven, CT: Yale University Press.

Lu, M., and E. Wang. 2002. Forging ahead and falling behind: Changing regional inequalities in post-reform China. *Growth and Change* 33(1):42-71.

Lustgarten, A. 2006. Big oil dominates. But old-economy companies aren't the only ones prospering this year. *Fortune* 154(2):95-98. http://money.cnn.com/2006/07/12/magazines/fortune/global500_intro.fortune/index.htm; last accessed: July 18, 2006.

Lyon, D. 2002. *Surveillance as social sorting: Privacy, risk and automated discrimination*. London, UK: Routledge.

Ma, L.J.C., and G. Cui. 1987. Administrative changes and urban population in China. *Annals of the Association of American Geographers* 77:373-395.

MacEachren, A.M., and M.-J. Kraak. 1997. Exploratory cartographic visualization: Advancing the agenda. *Computers & Geosciences* 23(4):335-343.

MacLeod, G. 2001. New regionalism reconsidered: Globalization and the remaking of political economic space. *International Journal of Urban and Regional Research* 25(4):804-829.

Maddison, A. 2003. *The world economy: Historical statistics*. Paris, France: OECD.

Malecki, E.J. 2002. The economic geography of the internet's infrastructure. *Economic Geography* 78:399-424.

Marcotullio, P.J. 2004. Globalisation, urban form and environmental conditions in Asia-Pacific cities. *Urban Studies* 40(2):219-247.

Marcuse, P., and R. van Kempen, eds. 2000. *Globalizing cities. A new spatial order ?* Oxford, UK: Blackwell.

Maskell, P. 1999. Globalisation and industrial competitiveness: The process and consequences of ubiquitification. In *Making connections: Technological learning and regional economic change*, eds. E. Malecki and P. Oinas, 35-60. Aldershot, UK: Ashgate.

Massey, D.S. 1999. Imagining globalization: Power-geometries of time-space. In *Global futures: Migration, environment and globalization*, eds. A. Brah, M. Hickman and M. Mac An Ghaill, 27-44. London, UK: Macmillan.

Massey, D.S. 1996. The age of extremes: Concentrated affluence and poverty in the twenty-first century. *Demography* 33(4):395-412.

Massey, D.S. 1993. Power-geometry and a progressive sense of place. In *Mapping the futures: Local cultures*, *global change*, eds. J. Bird, B. Curtis, T. Putnam, G. Roberston and L. Ticker, 59-69. London, UK: Routledge.

Masuda, Y. 1983. *The information society as post-industrial society*. Bethesda, MD: The World Future Society.

Mathews, J.A. 2002. *Dragon multinational: A new model of global growth*. New York: Oxford University Press.

Matsumoto, H. 2005 Effects of new airports on hub-ness of cities: A case of Osaka. *Journal of the Eastern Asia Society for Transportation* 6:648-663.

Matthiessen, C.W. 2004. International air traffic in the Baltic Sea area: Hub-gateway status and prospects; Copenhagen in focus. *Journal of Transport Geography* 12(3):197-206.

Mawhinney, H.B. 2004. Deliberative democracy in imagined communities: How the power geometry of globalization shapes local leadership praxis. *Educational Administration Quarterly* 40(2):192-221.

Mayer, G., and B. Wagner. 2002. HubLocator: An exact solution method for the multiple allocation hub location problem. *Computers & Operations Research* 29:715-739.

McCrone, G. 1969. *Regional policy in Britain*. London, UK: Allen and Unwin.

McGowan, F., and P. Seabright. 1989. Deregulating European airlines. *Economic Policy* 9:283-344.

McGregor, S., ed. 1936. *The Texas almanac and state industrial guide. The encyclopedia of Texas*. Dallas, TX: A.H. Belo Corporation.

McKenzie, R.D. 1927. The concept of dominance and world-organization. *American Journal of Sociology* 33:28-42.

McLuhan, M. 1964. *Understanding media*. New York: McGraw Hill.

McLuhan, M., and B.R. Powers. 1989. *The global village: Transformations in world life and media in the 21st century*. New York: Oxford University Press.

McLuhan, M., Q. Fiore and J. Agel. 1967/1997. *War and peace in the global village: An inventory of some of the current spastic situations that could be eliminated by more feed forward*. San Francisco, CA: Hardwired.

McQuade, L., ed. 1977. *East-west trade: Managing encounter and accommodation*. Boulder, CO: Westview.

Mead, G.H. 1932/2002. Emergence and identity. In *The philosophy of the present*, ed. A.E. Murphy. LaSalle, IL: Open Court.

Meinig, D.W. 1969. *Imperial Texas*. Austin, TX: University of Texas Press.

Meyer, D.R. 2003. The challenges of research on the global network of cities. *Urban Geography* 24(4):301-313.

Meyer, D.R. 1986. The world system of cities: Relations between international financial metropolises and South American cities. *Social Forces* 64(3):553-581.

Milanovic, B. 2005a. Half a world: Regional inequality in five great federations. *Journal of the Asia Pacific Economy* 10(4):408–445.

Milanovic, B. 2005b. Why did the poorest countries fail to catch up? *Carnegie Papers of the Carnegie Endowment for International Peace* 62. Washington, DC: Carnegie Foundation. http://www.carnegieendowment.org/files/CP62.Milanovic.FINAL.pdf; last accessed: April 12, 2007.

Miller, T., G.A, Lawrence, J. McKay, and D. Rowe. 2001. *Globalization and sport: Playing the world*. London, UK: Sage.

Mills, E.S., and J.F. McDonald, eds. 1992. *Sources of metropolitan growth*. New Brunswick, NJ: Center for Urban Policy Research.

Mitchell, W.J. 1995. *City of bits*. Cambridge, MA: MIT Press.

Mitchell, W.J. 1994. Building the bitsphere, or the kneebone's connected to the I-Bahn. *I.D. Magazine,* November 1994.

Mittelman, J.H. 2004. Globalization: An ascendant paradigm. In *Globalization and its outcomes*, eds. J. O'Loughlin, L. Staeheli and E. Greenberg, 25-44. New York, NY and London, UK: Guilford.

Modelski, G. 1999. Ancient world cities 4000-1000 B.C.: Center/hinterland in the world system. *Global Society: Journal of Interdisciplinary International Relations* 13(4):383-392.

Modelski, G. 1987. *Long cycles in world politics*. Seattle, WA: University of Washington Press.

Monmonier, M. 1992. Summary graphics for integrated visualization in dynamic cartography. *Cartography and Geographic Information Systems* 19(1):23-36.

Moore, K., and D. Lewis. 1999. *Birth of the multinational: 2000 years of ancient business history – from Ashur to Augustus*. Copenhagen, Denmark: Copenhagen Business School Press.

Morgensen, G. 2004. Just don't say 'synergy' to a Hewlett investor. *New York Times* August 15, 2004. http://www.nytimes.com/2004/08/15/business/yourmoney/15watch.html?ex=1250222400&en=60dde802afe1732c&ei=5090&partner=rssuserland; last accessed: July 05, 2006.

Morley, D. 2000. *Home territories: Media, mobility and identity*. London, UK: Routledge.

Mosley, P. and A. Suleiman. 2007. Aid, agriculture and poverty in developing countries. *Review of Development Economics* 11(1):139-158.

Moss, M.L. 1987. Telecommunications, world cities and urban policy. *Urban Studies* 24:534-546.

Moss, M.L., and A.M. Townsend. 2000. The internet backbone and the American metropolis. *The Information Society* 16:35-47.

Mote, F.W. 1999. *Imperial China, 900–1800*. Cambridge, MA and London, UK: Harvard University Press.

Munkirs, J.R. 1985. *The transformation of American capitalism: From competitive market structures to centralized private sector planning*. Armonk, NY: M.E. Sharpe.

Mumford, L. 1961. *The city in history: Its origins, its transformations, and its prospects*. New York: Harcourt, Brace & World.

NBHRMS (New Braunfels Historic Railroad and Modelers Society). 2006. *The history of the International and Great Northern Railway and the New Braunfels Museum*. New Braunfels, TX: NBHRMS. http://www.nbhrmsmuseum.org/history.htm; last accessed: January 13, 2006.

Neilson, W.A.W. 2003. Some legal badges of economic globalization: From Rome to the WTO and regional trade agreements. Paper presented on October 16, 2003 at the conference on *Participatory justice in a global economy: The new rule of law?*, organized by the Canadian Institute for the Administration of Justice, Banff, Canada.

Neuman, M. 2000. *Regional design of the Texas Urban Triangle*. Research project submitted to the College of Architecture Research Council, Texas A&M University, College Station TX, US.

Nijkamp, P. 1990. *Sustainability of urban systems: A cross-national evolutionary analysis of urban innovation*. Aldershot, UK: Avebury.

Nijman, J. 1996. Breaking the rules: Miami in the urban hierarchy. *Urban Geography* 17(1):5–22.

Norbäck, P.-J., and L. Persson. 2003. Privatization and foreign competition. *Journal of International Economics* 62(2):409-416.

Nordlund, C. 2004. A critical comment on the Taylor approach for measuring world city interlock linkages. *Geographical Analysis* 36(3):290-296.

Norris, G., and M. Wagner. 2005. *Airbus A380: Superjumbo of the 21st century*. Osceola, WI: Zenith Press.

OAG. 2006. *OAG airline alliance directory*. Downers Grove, IL: OAG Worldwide. http://www.oag.com/NorthAmerica/airlineandairport/alliances.asp; last accessed: December 11, 2006.

OAG. 2005. *Worldwide OAG flight guide, April 2005*. Downers Grove, IL: OAG Worldwide.

Obitsu, H. and I. Nagase. 1998. Japan's urban environment: The potential of technology in future city concepts. In *Japanese urban environment*, eds. G. Gloany, K. Hanaki, and O. Koide, 2324-336. Oxford, UK: Pergamon.

O'Brien, R. 1992. *Global financial integration: The end of geography*. London, UK: Pinter.

O'Connor, K. 2003. Global air travel: Toward concentration or dispersal? *Journal of Transport Geography* 11:83-92.

O'Connor, K. 1995. Change in the pattern of airline services and city development. In *Cities in competition*, eds. J. Brotchie, M. Batty, E. Blakely, P. Hall, and P.W. Newton, 88-104. Melbourne, Australia: Longman.

Ohmae, K. 1990/2002. *The borderless world: Power and strategy in the interlinked economy*. New York: Harper Collins.

Oinas, P. 2002. Competition and collaboration in interconnected places: Towards a research agenda. *Geografiska Annaler, Series B: Human Geography* 84(2):65–76.

Okada, B. 2005. D/FW loses its bet on airline industry recovery. *Fort-Worth Star-Telegram* January 30, 2005. http://forum.dallasmetropolis.com/showthread.php?t=3537; last accessed: June 27, 2006.

O'Kelly, M. E. 1998. A geographer's analysis of hub-and spoke networks. *Journal of Transport Geography* 6(3):171-86.

O'Kelly, M. E., and H. Miller. 1994. The hub network design problem: A review and synthesis. *Journal of Transport Geography* 2(1):31-40.

O'Kelly, M. E., D. L. Bryan, D. Skorin-Kapov, and J. Skorin-Kapov. 1996. Hub network design with single and multiple allocation: A computational study. *Location Science* 4: 125-138.

O'Loughlin, J., L. Staeheli, and E. Greenberg, eds. 2004. *Globalization and its outcomes*. New York, NY and London, UK: Guilford.

Oster, C.V., Jr., and J.S. Strong. 2001. *Predatory practices in the US airline industry*. Report submitted to the US Department of Transportation. Washington, DC: DOT. http://ostpxweb.dot.gov/aviation/domestic-competition/predpractices.pdf; last accessed: September 25, 2007.

Osterhammel, J., and N.P. Petersson. 2003/2005. *Globalization: A short history*. Princeton, NJ and Oxford, UK: Princeton University Press.

Ostry, S. 2002. Globalization and the G8: Could Kananaskis set a new direction? *O.D. Skelton Memorial Lecture* delivered at Queen's University, Kingston, Canada, on March, 2002. http://www.international.gc.ca/skelton/ostry-en.asp; last accessed: June 10, 2006.

OTTI (Office of Travel and Tourism Industries). 2007. *U.S. international air travel statistics (I-92 data) program*. http://www.tinet.ita.doc.gov/research/programs/i92/index.html; last accessed: January 20, 2007.

O'Tuathail, G. 2000. The postmodern geopolitical condition: States, statecraft, and security at the millennium. *Annals of the Association of American Geographers* 90:166-178.

O'Tuathail, G. 1996. *Critical geopolitics: The politics of writing global space*. Minneapolis, MN: University of Minnesota Press.

Pacione, M. 2001/2005. *Urban geography: A global perspective*. London, UK: Routledge.

Parnreiter, C. 2002. Ciudad de México: El camino hacia una ciudad global. *EURE, Revista Latinoamericana de Estudios Urbanos Regionales* 28(85):89-119.

Parnreiter, C., K. Fischer and K. Imhof. 2004. The missing link between global commodity chains and global cities: The financial service sector in Mexico City and Santiago de Chile. *Research Bulletin* 156. Loughborough, UK: Globalization and World Cities Study Group and Network.

Parr, J.B. 2004. The polycentric urban region: A closer inspection. *Regional Studies* 38(3):231–240.

Parr, J.B. 1973. Growth poles, regional development and central place theory. *Papers of the Regional Science Association* 31:173-212.

Parto S. 2005. Economic activity and institutions: Taking stock. *Journal of Economic Issues* 39(1):21-52.

Pearcy, G.E., and L.M. Alexander. 1951. Pattern of commercial air service availability in the western hemisphere. *Economic Geography* 27:316-320.

Pels, E., P. Nijkamp, and P. Rietveld. 2003. Access to and competition between airports: A case study for the San Francisco Bay area. *Transportation Research A* 37:71-83.

Pels, E., P. Nijkamp, and P. Rietveld. 2000. Airport and airline competition for passengers departing from a large metropolitan area. *Journal of Urban Economics* 48:29-45.

Perraton, J., D. Goldblatt, D. Held, and A. McGrew. 1997. The globalization of economic activity. *New Political Economy* 2(2):257-277.

Perroux, F. 1968. Grande firme et petite nation. *Economies et Societés* 2(9):1847-1867.

Petrella, R. 1993. Vers un “techno-apartheid” global. *Le Monde Diplomatique* 18(4):30-33.

Pettis, M. 2001. *The volatility machine: Emerging economies and the threat of financial collapse*. Oxford, UK: Oxford University Press.

Phillipson, R. 1992. *Linguistic imperialism*. Oxford, UK: Oxford University Press.

Piller, D. 2003. Power’s failure. *Star-Telegram* September 14, 2003. http://www.hjfinancialgroup.com/Star%20Telegram.htm; last accessed: July 08, 2006.

Pollog, C. 1937. Commercial aviation in the American Mediterranean. *Geographical Review* 27(2):255-268.

Poon, J. 2003. Hierarchical tendencies of capital markets among international financial centers. *Growth and Change* 34(2):135-156.

Porter, T. 2005. *Globalization and finance*. Cambridge, UK and Malden, MA: Polity.

Potter, D., D. Goldblatt, M. Kiloh, and P. Lewis, eds. 1997. *Democratization*. Cambridge, UK: Polity Press.

Pratt, J.A. 1980. *The growth of a refining region*. Greenwich, CT: JAI Press.

Pred, A.R. 1990. *Lost words and lost worlds: Modernity and the language of everyday life in late nineteenth-century Stockholm*. Cambridge, UK: Cambridge University Press.

Pred, A.R. 1986. *Place, practice and structure: Space and society in southern Sweden 1750-1850*. Cambridge, UK: Polity.

Pred, A.R. 1977. *City-systems in advanced economies: Past growth, present processes and future development options*. Cambridge, MA: Harvard University Press.

Pred, A.R. 1976. The interurban transmission of growth in advanced economies: Empirical findings versus regional-planning assumptions. *Regional Studies* 10(2):151-171.

Pred, A.R. 1973. *Urban growth and the circulation of information: The United States system of cities 1790-1840*. Cambridge, MA: MIT.

Priemus, H., and W. Zonneveld. 2004. Regional and transnational spatial planning 1: Problems today, perspectives for the future. *European Planning Studies* 12(3):283-297.

Prud'homme, R. 1996a. Le PIB des grandes villes du monde. In *Données urbaines*, ed. D. Pumain and F. Godard, 1:73-76. Paris, Anthropos.

Prud'homme, R. 1996b. Urban transport and economic development. *Revue Région et Développement* 5:1-14.

Purcell, M. 2003. Citizenship and the right to the global city: Reimagening the capitalist world order *International Journal of Urban and Regional Research* 27(3):564-590.

Raley, R. 2004. eEmpires. *Cultural Critique* 57:111-150.

Renner, G. 1942. *Human geography in the air age*. New York: Macmillan.

Rimmer, P. 1998. Transport and telecommunications among world cities. In *Globalization of the world of large cities*, eds. F.-C. Lo and Y.-M. Yeung, 433-470. Tokyo, Japan: United Nations University Press.

Robertson, R. 1995. Glocalization: Time-space and homogeneity-heterogeneity. In *Global modernities*, eds. M. Featherstone, S. Lash and R. Robertson, 25-44. London, UK: Sage Publications.

Robertson, R. 1992. *Globalisation*. London, UK: Sage.

Rodrigue, J.-P. 1999. Globalization and the synchronization of transport terminals. *Journal of Transport Geography* 7:255-261.

Rodríguez, N.P., and J.R. Feagin. 1986. Urban specialization in the world system. *Urban Affairs Quarterly* 22(2):187-220.

Rogers, G.O., and C.D. Ellis. 2001. Water resource management in the Texas megacity: A prima facie case for comprehensive resource management. In *Presentation to the International seminar on nuclear war and planetary emergencies. 25th Session*, August 19-24, 2001, ed. R. Raigani. Erice, Italy: E. Majorana Centre for Scientific Culture.

Rosenberg, B., and D.M. White. 1957/1964. *Mass culture: The popular arts in America*. New York: Free Press.

Ross, R., and K. Trachte. 1983. Global cities and global classes: The peripheralization of labor in New York City. *Review* 6(3): 393–431.

Ruigrok, W., and R.V. Tulder. 1995. *The logic of international restructuring*. London, UK: Routledge.

Rupert, M. 2000. *Ideologies of globalization*. London, UK: Routledge.

Sandercock, L. 1998. *Towards cosmopolis: Planning towards multicultural cities*. Chichester, UK: Wiley.

Sassen, S. 1994/2006. *Cities in a world economy*, 3rd edition. Thousand Oaks, CA: Pine Forge Press.

Sassen, S. 1994/2000. *Cities in a world economy*, 2nd edition. Thousand Oaks, CA: Pine Forge Press.

Sassen, S. 1991/2001. *The global city: New York, London, Tokyo*. Princeton, NJ: Princeton University Press.

Sassen, S. 1984. The new labor demand in global cities. *Urban Affairs Annual Reviews* 26:139-171.

Sauer, C. 1952. *Agricultural origins and dispersals*. New York: American Geographical Society.

Schaede, U. 1996. The 1995 financial crisis in Japan. *Working Paper* 85. Berkeley, CA: The Berkeley Roundtable on the International Economy.

Schaefer, F.K. 1953. Exceptionalism in geography: A methodological examination. *Annals of the Association of American Geographers* 43:226–249.

Schepp, D. 2002. Houston feels pangs of Enron's collapse. *BBC News*, May 24, 2002. http://news.bbc.co.uk/2/hi/business/2007255.stm; last accessed: January 07, 2006.

Schifferes, S. 2007a. China’s drive to expand overseas. *BBC News*, May 23, 2007. http://news.bbc.co.uk/2/hi/business/6675739.stm; last accessed: May 24, 2007.

Schifferes, S. 2007b. Hong Kong v Shanghai: Global rivals. *BBC News*, June 27, 2007. http://news.bbc.co.uk/2/hi/business/6240994.stm; last accessed: June 28, 2007.

Schifferes, S. 2007c. Shanghai: Creating a global city. *BBC News*, May 7, 2007. http://news.bbc.co.uk/2/hi/business/6618163.stm; last accessed: May 24, 2007.

Scholz, F. 2003. Die megacity Karachi – ein “globalisierter ort.” *Geographische Rundschau* 55(11):20-26.

Scholz, F. 2001. Dhaka, Bangladesh: Stadtstruktur und lebensqualität in einem globalisierten ort. *Geographische Rundschau* 53(12):56-64.

Scholz, F. 2000. Globalisierung versus fragmentierung: Eine regionalwissenschaftliche herausforderung? *Nord-Süd Aktuell* 14(2):255-271.

Schutz, E. 1995. Markets and power. *Journal of Economic Issues* 29:1147-1170.

Sclar, E. 1997. *The privatization of public service: Lessons from case studies*. Washington, DC: Economic Policy Institute.

Scott, A. J., ed. 2001. *Global city-regions*. Oxford, UK: Oxford University Press.

Scott, A. J. 1996. Regional motors of the global economy. *Futures* 28(5):391-411.

Scott, A.J. 1988. *New industrial spaces: Flexible production, organization and regional development in North America and Western Europe*. London, UK: Pion.

Scott, A.J., and M. Storper. 2003. Regions, globalization, development. *Regional Studies* 37(6-7):579-593.

Sealy, K.R. 1967. The siting and development of British airports. *Geographical Journal* 133:148-171.

Sealy, K.R. 1957/1966. *The geography of air transport*. London, UK: Hutchinson University Library.

Sharp, J. 1993. *Force of change: Shaping the future of Texas*, Volume II, Part 1. Austin, TX: Texas Comptroller of Public Accounts.

Shaw, S.L. 1993. Hub structure of major US passenger airlines. *Journal of Transport Geography* 1:47-58.

Shaw, S. L., and R.L. Ivy. 1994. Airline mergers and their effect on network structure. *Journal of Transport Geography* 2:234-246.

Sheppard, E. 2002. The spaces and times of globalization: Place, scale, networks, and positionality. *Economic Geography* 78(3):307-330.

Shin, K.-H., and M. Timberlake. 2000. World cities in Asia: Cliques, centrality and connectedness. *Urban Studies* 37(12):2257-2285.

Short, J. R. 2004. *Global metropolitan: Globalizing cities in a capitalist world*. London, UK: Routledge, Questioning Cities Series.

Short, J. R., and Y.-H. Kim. 1999. *Globalization and the city*. Harlow, UK: Longman, and New York: Addison Wesley Longman.

Short, J.R., C. Breitbach, S. Buckman, and J. Essex. 2000. From world cities to gateway cities: Extending the boundaries of globalization theory. *City* 4(3):317-340.

Short, J.R., Y. Kim, M. Kuus, and H. Wells. 1996. The dirty little secret of world cities research: Data problems in comparative analysis. *International Journal of Urban and Regional Research* 20(4):697-717.

Simon, D. 1995. The world city hypothesis: Reflections from the periphery. In *World cities in a world-system*, eds. P. Knox and P. Taylor, 132-155. New York: Cambridge University Press.

Sinha, D. 1999. The regulation and deregulation of US airlines (privatisation and deregulation strand). The *Journal of Transport History* 20(1):46-64.

Slater, E. 2004. The flickering global city. *Journal of World-Systems Research* 10(3):591-608.

Smith, D.A., and M. Timberlake. 2002. Cross-border air traffic patterned networks. In *Global networks/linked cities*, ed. S. Sassen. London, UK: Routledge.

Smith, D.A., and M. Timberlake. 2001. World city networks and hierarchies, 1977-1997: An empirical analysis of global air travel links. *American Behavioral Scientist* 44.10:1656-1678.

Smith, D.A., and M. Timberlake. 1995. Conceptualising and mapping the structure of the world system's city system. *Urban Studies* 32(2):287-302.

Smith, D.M. 2005. *On the margins of inclusion: Changing labour markets and social exclusion in London.* Bristol, UK: Policy Press.

Smith, D.M. 1971/1981. *Industrial location: An economic geographical analysis*. New York: John Wiley.

Smith, N. 1992. Geography, difference and the politics of scale. In *Postmodernism and the social sciences*, eds. J. Doherty, E. Graham and M. Malek, 57-79. London, UK: Macmillan.

Smith, R. 1993. The Chinese road to capitalism. *New Left Review* 199:55-99.

Song, W. 2006. Analysis of aggregate passenger routes in air travel: An Atlanta-based study. *Southeastern Geographer* 46(1):139-160.

Sorenson, N. 1991. The impact of geographic scale and traffic density of airline production costs: The decline of the no-frills airlines. *Economic Geography* 67(4):333-345.

Sparke, M. 2003. American empire and globalisation: Postcolonial speculations on neocolonial enframing. *Singapore Journal of Tropical Geography* 24(3):373-389.

SPSS. 2004. *SPSS 13.0 for Windows, release 13.0*. Chicago, IL: SPSS Inc.

Steger, M. 2003. *Globalization: A very short introduction*. Oxford, UK: Oxford University Press.

Stewart, C.T., Jr. 1958. The size and spacing of cities. *Geographical Review* 48:222–245.

Strange, S. 1995. The limits of politics. *Government and Opposition* 30:291-311.

Sudjic, D. 1992, ed. *The 100 mile city*. San Diego, CA: Harcourt Brace.

Sui, D.Z. 2004a. GIS, cartography, and the "third culture": Geographic imaginations in the computer age. *The Professional Geographer* 56(1):62-72.

Sui, D.Z. 2004b. Tobler's first law of geography: A big idea for a small world ? *Annals of the Association of American Geographers* 94(2):269-277.

Sui, D.Z. 2003. GIS-based urban modeling and global poverty/food insecurity mapping. *Communication to the Department of Geography, Environment and Resources*, University of Taiwan. September 29, 2003, Taipei, Taiwan.

Sui, D.Z., and J.O. Wheeler. 1993. The location of office space in the metropolitan service economy of the United States, 1985-1990. *The Professional Geographer* 45(1):33-43.

Swatridge, L.A. 1971. *The Bosnywash megalopolis: A region of great cities*. Toronto, Canada: McGraw Hill of Canada.

Sweezy, P.M. 1994. The triumph of financial capital. *Monthly Review* 46(2):9-10.

Swyngedouw, E. 2004. Globalisation or 'glocalisation'? Networks, territories and re-scaling. *Cambridge Review of International Affairs* 17(1):25-48.

Swyngedouw, E. 1997. Neither global nor local: Glocalisation and the politics of place. In *Spaces of globalization: Reasserting the power of the local*, ed. K. Cox, 115-136. New York: Guilford.

Swyngedouw, E. 1996. Producing futures: International finance as a geographical project. In *The global economy in transition*, eds. P. Daniels and W. Lever, 135-163. Harlow, UK: Longman.

Taaffe, E. 1962. The urban hierarchy: An air passenger definition. *Economic Geography* 38(1):1-14.

Taaffe, E. 1959. Trends in airline passenger traffic: A geographic case study. *Annals of the Association of American Geographers* 49:393–408.

Taaffe, E. 1956. Air transportation and United States urban distribution. *Geographical Review* 46(2):219–38.

Taylor, P.J. 2004a. *Atlas of Hinterworlds*. Loughborough, UK: University of Loughborough and GaWC. http://www.lboro.ac.uk/gawc/visual/hwatlas.html; last accessed: March 12, 2006.

Taylor, P.J. 2004b. Regionality in the world city network. *International Social Science Journal* 56(181):361-372.

Taylor, P.J. 2003. *World city network: A global urban analysis*. London, UK and New York: Routledge.

Taylor, P.J. 2001a. Specification of the world city network. *Geographical Analysis* 33(2):181-194.

Taylor, P.J. 2001b. Urban hinterworlds: Geographies of corporate service provision under conditions of contemporary globalization. *Geography* 86(1):51-60.

Taylor, P.J. 2000a. Izations of the world: Americanization, modernization and globalization. In C. Hay and D. Marsh, eds. *Demystifying globalization*. London, UK: Macmillan.

Taylor, P.J. 2000b. World cities and territorial states under conditions of contemporary globalization. *Political Geography* 19(1):5-32.

Taylor, P.J. 1997. Hierarchical tendencies amongst world cities: A global research proposal. *Cities* 14(6):323-332.

Taylor, P.J., and R.E. Lang. 2005. U.S. cities in the ‘world city network’. *Survey Series*, February 2005. Washington, DC: The Brookings Institution.

Taylor, P.J., G. Catalana, and D.R.F. Walker. 2004. Multiple globalisations: Regional, hierarchical and sectoral articulations of global business services through world cities. *The Service Industries Journal* 24(3):63-81.

Taylor, P.J., G. Catalano, and D.R.F. Walker. 2002b. Exploratory analysis of the world city network. *Urban Studies* 39(13):2377-2394.

Taylor, P.J., G. Catalano, and D.R.F. Walker. 2002d. Measurement of the world city network. *Urban Studies* 39(13):2367-2376.

Taylor, P.J., J.V. Beaverstock, and D.R.F. Walker. 2002c. Introducing GaWC: Researching world city network formation. In *Global networks/linked cities*, ed. S. Sassen. London, UK: Routledge.

Taylor, P.J., B. Derudder, C.G. García, and F. Witlox. 2006. From north-south to global south: A geohistorical investigation using airline routes and travel, 1970-2005. *Research Bulletin* 209. Loughborough, UK: Globalization and World Cities Study Group and Network.

Taylor, P.J., M. Hoyler, D.R.F. Walker, and M.J. Szegner. 2001. A new mapping of the world for a new millennium. *The Geographical Journal* 167(3):213-222.

Taylor, P.J., D.R.F. Walker, G. Catalano, and M. Hoyler. 2002a. Diversity and power in the world city network. *Research Bulletin* 56. Loughborough, UK: Globalization and World Cities Study Group and Network.

The Economist. 2006. *Pocket world in figures, 2007 Edition*. London, UK: Profile Books.

The Economist. 1998. A survey of international financial centres – Capitals of capitals. *The Economist*, 346(8066):3-46, May 7.

Thomas, S., D. Hall, and V. Corral. 2004. *Electricity privatisation and restructuring in Asia-Pacific*. Report presented at the Asia-Pacific meeting of Public Services International in Chiang Mai, Thailand, December 2004. http://www.psiru.org/reports/2004-12-E-Asia.doc. April 22, 2006.

Thrift, N.J. 1997. New urban eras and old technological fears: Reconfiguring the good will of electronic things. In *Money/space: Geographies of monetary transformation*, eds. A. Leyshon and N.J. Thrift, 323-354. London, UK: Routledge.

Thrift, N.J. 1989. The geography of international economic disorder. In *A World in crisis? Geographical perspectives*, eds. R.J. Johnston and P.J. Taylor, 12-67. Oxford, UK: Blackwell.

Thrift, N.J. 1983. On the determination of social action in space and time. *Environment and Planning D: Society and Space* 1:23-57.

Toffler, A. 1980. *The third wave*. New York: Morrow.

Townsend, A.M. 2001a. Network cities and the global structure of the internet. *American Behavioral Scientist* 44(10):1697-1716.

Townsend, A.M. 2001b. The internet and the rise of the new network cities, 1969-1999. *Environment and Planning B: Planning and Design* 28:39-58.

Townshend I.J. 1999. Monitoring community dimensions: City-wide characteristics and differentiation by social area type. In *Monitoring cities: International perspectives*, eds. W.K.D. Davies and I.J. Townshend, 435-459. Berlin, Germany, and Calgary, Canada: International Geographical Union.

Tu, W. 2004. *Environmental impacts of the digital economy: The case of Austin, Texas, 1990-2008*. Unpublished doctoral dissertation. College Station, TX: Texas A&M University.

Turner, B.S. 1990. The two faces of sociology: Global or national ? In *Global culture: Nationalism, globalization and modernity*, ed. M. Featherstone. London, UK: Sage.

UNCTAD (United Nations Conference on Trade and Development). 2005a. *World investment report 2005: Transnational corporations and the internationalization of R & D*. Geneva, Switzerland: UNCTAD.

UNCTAD (United Nations Conference on Trade and Development). 2005b. *Mergers & acquisitions (M&A), by country and region*. Geneva, Switzerland: UNCTAD. http://stats.unctad.org/FDI/TableViewer/tableView.aspx?ReportId=8; last accessed: June 30, 2006.

UNCTAD (United Nations Conference on Trade and Development). 2002. *World investment report 2002*. Geneva, Switzerland: UNCTAD.

UN-Habitat (United Nations Human Settlement Program). 2003. *The challenge of the slums: Global report on human settlements, 2003*. London, UK: UN-Habitat.

USBC (United States Bureau of Census). 2007. *2006 population estimates*. Washington, DC: United States Bureau of Census. http://factfinder.census.gov/servlet/DCGeoSelectServlet?ds_name=PEP_2006_EST&_ts=194954329971; last accessed: April 12, 2007.

USBC (United States Bureau of Census). 2006a. *CenStats databases*. Washington, DC: United States Bureau of Census. http://censtats.census.gov/; last accessed: May 27, 2006.

USBC (United States Bureau of Census). 2006b. *Metropolitan and micropolitan statistical area definitions*. Washington, DC: United States Bureau of Census. http://www.census.gov/population/www/estimates/metrodef.html; last accessed: March 4, 2006.

USBC (United States Bureau of Census). 2006c. *The statistical abstract of the United States, 2006*. Washington, DC: United States Bureau of Census.

USBC (United States Bureau of Census). 2005. *Historical metropolitan area definitions*. Washington, DC: United States Bureau of Census. http://www.census.gov/population/www/estimates/pastmetro.html; last accessed: September 22, 2005.

USBC (United States Bureau of Census). 2002. *Projections of the population of the U.S., by age, sex, and race:1995 to 2050*. Washington, DC: United States Bureau of Census.

USBC (United States Bureau of Census). 2001. *NAICS implementation for the principal economic indicators*. Washington, DC: United States Bureau of Census. (http://www.census.gov/econ/www/indinaics.html; last accessed: June 2, 2005.

USBC (United States Bureau of Census). 1998. *How to interpret NAICS correspondence tables*. Washington, DC: United States Bureau of Census. (http://www.census.gov/epcd/www/naicshow.htm; last accessed: June 2, 2005.

USBEA (United States Bureau of Economic Analysis). 2006a. *Gross state product data tables*. Washington, DC: United States Bureau of Economic Analysis. http://www.bea.gov/bea/regional/gsp/; last accessed: May 13, 2006.

USBEA (United States Bureau of Economic Analysis). 2006b. *Sales of services to foreign persons by U.S. MNCs through their nonbank MOFAs and to U.S. persons by foreign MNCs through their nonbank MOUSAs, by country, 1989-2003*. Washington, DC: United States Bureau of Economic Analysis. http://www.bea.gov/bea/di/1001serv/intlserv.htm; last accessed: May 27, 2006.

USBEA (United States Bureau of Economic Analysis). 2005. *GDP and other major NIPA series, 1929–2005: II*. Washington, DC: United States Bureau of Economic Analysis. http://www.bea.gov/bea/ARTICLES/2005/08August/0805_GDP_NIPAs.pdf; last accessed: January 20, 2007.

van der Heyden, J. 2007. *GeoHive: Global statistics*. http://www.xist.org/default1.aspx; last accessed: July 26, 2007.

van Hulton, M. 1969. Plan and reality in the Ijsselmeerpolders. *Tijdschrift voor Economische en Sociale Geografie* 60:67-76.

Van Zandt, J. 1944. *The geography of world air transport*. Washington, DC: The Brookings Institution.

Veseth, M. 2005. *Globaloney: Unraveling the myths of globalization*. Lanham, MD: Rowman & Littlefield.

Vowles, T. 2000. The effect of low fare air carriers on airfares in the US. *Journal of Transport Geography* 8(2):121-128.

Wallerstein, I. 1992. America and the world: Today, yesterday and tomorrow. *Theory and Society* 21:1-27.

Wallerstein, I. 1984. *The politics of the world economy: The states, the movements and the civilizations*. Cambridge, UK: Cambridge University Press.

Wallerstein, I. 1979. *The capitalist world economy*. Cambridge, UK: Cambridge University Press.

Wallerstein, I. 1974. *The modern world system: Capitalist agriculture and the origins of the European world-economy in the sixteenth century*. New York: Academic Press.

Wal-Mart. 2007. *2006 annual report: Building smiles*. Bentonville, AR: Wal-Mart Stores.

Walton, J. 1982. The international economy and peripheral urbanization. In *Urban policy under capitalism,* eds. I. Norman and S. Fainstein, 119-135. Beverly Hills, CA: Sage.

Ward, R.G. 1989. Earth's empty quarter: The Pacific Islands in a Pacific century. *Geographical Journal* 155:235-246.

Ward, S.V. 1998. *Selling places: The marketing and promotion of towns and cities, 1885-2000*. London, UK: Spon Press.

Warf, B., and R. Erickson. 1996. Introduction: Globalisation and the US city system. *Urban Geography* 17:1-4.

Warntz, W. 1968. Global science and the tyranny of space. *Papers of the Regional Science Association* 20: 7-19.

Warntz, W. 1961. Transatlantic flights and pressure patterns. *Geographical Review* 51(2):187-212.

Waters, M. 1995. *Globalization*. London, UK: Routledge.

Weber, M. 1914/1978. *Economy and society: An outline of interpretive sociology*, volume 1. Berkeley, CA: University of California Press.

Weinberger, D. 2002. *Small pieces loosely joined: A unified theory of the web*. Cambridge, MA: Perseus.

Wellman, B. 2002. Little Boxes, glocalization, and networked individualism. In *Digital cities II: Second Kyoto workshop on digital cities*, eds. M. Tanabe, P. van den Besselaar, and T. Ishida, 10-25. Heidelberg, Germany: Springer-Verlag.

White House. 2007. *Analytical perspectives, budget of the United States government, fiscal year 2008*. Washington, DC: US Government Printing Office.

Whithouse, M. 2006. As rates climb, U.S. foreign debt shows its teeth. *Wall Street Journal*, September 25, 2006, A1.

Williamson, H.F., R.L. Andreano, A.R. Daum, and G.C. Klose. 1963. *The American petroleum industry, volume 2: The age of energy, 1879-1959*. Evanston, IL: Northwestern University Press.

WISERTrade (World Institute for Strategic Economic Research, Trade Data Series). 2006a. *State exports by HS database: All states*. Holyoke, MA: WISERTrade, Holyoke Community College. http://www.wisertrade.org/home/data/export/mass/strank.html; last accessed: May 18, 2006.

WISERTrade (World Institute for Strategic Economic Research, Trade Data Series). 2006b. *State exports by NAICS database: Texas, exports by NAICS*. Holyoke, MA: WISERTrade, Holyoke Community College. http://www.bidc.state.tx.us/overview/2005TXExportsbyNAICS.xls; last accessed: May 19, 2006.

WISERTrade (World Institute for Strategic Economic Research, Trade Data Series). 2006c. *State exports by NAICS database: Texas, exports by Country*. Holyoke, MA: WISERTrade, Holyoke Community College. http://www.bidc.state.tx.us/overview/2005TXExportsbyCountry.xls; last accessed: May 19, 2006.

Wolf, H. 2002. Globalization and the convergence of social expenditure in the European Union. *Occasional Paper Series* 02-02. Washington, DC: The George Washington Center for the Study of Globalization.

Woods, G.P. 2005. In aging Japan, young slackers stir up concern. *Wall Street Journal* December 29, 2005, A1.

World Bank. 2006. *World development indicators*. Washington, DC: World Bank. http://devdata.worldbank.org/data-query/; last accessed: May 22, 2006.

WorldCity. 2007a. Annual statistics: Houston moves up to no. 4 ranked Customs district. *WorldCity* 162 (February 13, 2007).

http://www.worldcityweb.com/home/HOU/statistics/view/162/; last accessed: March 20, 2007.

WorldCity. 2007b. Annual statistics: Dallas among nation's fastest-growing districts. *WorldCity* 166 (February 14, 2007). http://www.worldcityweb.com/home/USA/statistics/view/166/; last accessed: March 20, 2007.

WorldCity. 2007b. Annual statistics: A quick review of the top 10 U.S. trade partners. *WorldCity* 171 (February 24, 2007). http://www.worldcityweb.com/home/USA/statistics/view/171/; last accessed: March 20, 2007.

Wright, G. 1990. The origins of American industrial success, 1879-1940. *The American Economic Review* 80(4):651-652.

YahooNews. 2007. Qatar ups stake in London Stock Exchange. *YahooNews*, September 23, 2007. http://news.yahoo.com/s/afp/20070923/wl_mideast_afp/britainqatardubaimarketsinvestcompanylse; last accessed: September 24, 2007.

Yaro, R.D., A. Carbonell, and J. Barnett. 2004. Planning for America in a global economy. *City Planning Studio Report*. Philadelphia, PA: University of Pennsylvania School of Design.

Yemma, J. 1987. Texas hopes "fourth economy" will cushion future oil shocks. *The Christian Science Monitor* August 6:11.

Zachary, G.P., and B. Ortega. 1993. Workplace revolution boosts productivity at cost of job security. *Wall Street Journal* March 10, 1993.

Zhu J. 1998. Data envelopment analysis vs. principal component analysis: An illustrative study of economic performance of Chinese cities. *European Journal of Operational Research* 111(1):50-61.

Zipf, G. 1949/1969. *Human behavior and the principle of least effort*. Cambridge, MA: M.I.T. Press.

Zook, M.A. 2003. Underground globalization: Mapping the space of flows of the internet adult industry. *Environment and Planning A* 35(7):1261-1286.

Zook, M.A., and S.D. Brunn. 2006. From podes to antipodes: Positionalities and global airline hierarchy. *Annals of the Association of American Geographers* 96(3):471-490.

Zook, M.A., and S.D. Brunn. 2005. Regions, hierarchies and legacies: European cities and global air travel. *Journal of Contemporary European Studies* 13(2):203-20.

APPENDIX

Note: first number in each exhibit refers to the dissertation chapter where is mentioned.

3.1. Population of Texas counties, 1900-2000

county	area	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000
Anderson	2,791.9	28,015	29,650	34,318	34,643	37,092	31,875	28,162	27,789	38,381	48,024	55,109
Andrews	3,887.6	87	975	350	736	1,277	5,002	13,450	10,372	13,323	14,338	13,004
Angelina	2,238.9	13,481	17,705	22,287	27,803	32,201	36,032	39,814	49,349	64,172	69,884	80,130
Aransas	1,367.4	1,716	2,106	2,064	2,219	3,469	4,252	7,006	8,902	14,260	17,892	22,497
Archer	2,397.8	2,508	6,525	5,254	9,684	7,599	6,816	6,110	5,759	7,266	7,973	8,854
Armstrong	2,366.8	1,205	2,682	2,816	3,329	2,495	2,215	1,966	1,895	1,994	2,021	2,148
Atascosa	3,200.2	7,143	10,004	12,702	15,654	19,275	20,048	18,828	18,696	25,055	30,533	38,628
Austin	1,700.0	20,676	17,699	18,874	18,860	17,384	14,663	13,777	13,831	17,726	19,832	23,590
Bailey	2,142.9	4	312	517	5,186	6,318	7,592	9,090	8,487	8,168	7,064	6,594
Bandera	2,065.6	*3,952*	*4,180*	4,001	3,784	4,234	4,410	3,892	4,747	7,084	10,562	17,645
Bastrop	2,320.4	26,845	25,344	26,649	23,888	21,610	19,622	16,925	17,297	24,726	38,263	57,733
Baylor	2,333.6	3,052	8,411	7,027	7,418	7,755	6,875	5,893	5,221	4,919	4,385	4,093
Bee	2,280.0	7,720	12,090	12,137	15,721	16,481	18,174	23,755	22,737	26,030	25,135	32,359
Bell	2,817.7	45,535	49,186	46,412	50,030	44,863	73,824	94,097	124,483	157,889	191,073	237,974
Bexar	3,254.7	69,422	119,676	202,096	292,533	338,176	500,460	687,151	830,460	988,800	1,185,394	1,392,931
Blanco	1,847.7	4,703	4,311	4,063	3,842	4,264	3,780	3,657	3,567	4,681	5,972	8,418
Borden	2,346.6	776	1,386	965	1,505	1,396	1,106	1,076	888	859	799	729
Bosque	2,596.8	17,390	19,013	18,032	15,750	15,761	11,836	10,809	10,966	13,401	15,125	17,204
Bowie	2,390.0	26,676	34,827	39,472	48,563	50,208	61,966	59,971	67,813	75,301	81,665	89,306
Brazoria	4,137.3	14,861	13,299	20,614	23,054	27,069	46,549	76,204	108,312	169,587	191,707	241,767
Brazos	1,528.9	18,859	18,919	21,975	21,835	26,977	38,390	44,895	57,978	93,588	121,862	152,415
Brewster	16,039.2	2,356	5,220	4,822	6,624	6,478	7,309	6,434	7,780	7,573	8,653	8,866
Briscoe	2,335.1	1,253	2,162	2,948	5,590	4,056	3,528	3,577	2,794	2,579	1,971	1,790
Brooks	2,443.9	*2,078*	*2,914*	4,560	5,901	6,362	9,195	8,609	8,005	8,428	8,204	7,976
Brown	2,478.5	16,019	22,935	21,682	26,382	25,924	28,607	24,728	25,877	33,057	34,371	37,674
Burleson	1,755.4	18,367	18,687	16,855	19,848	18,334	13,000	11,177	9,999	12,313	13,625	16,470
Burnet	2,644.3	10,528	10,755	9,499	10,355	10,771	10,356	9,265	11,420	17,803	22,677	34,147
Caldwell	1,417.8	21,765	24,237	25,160	31,397	24,893	19,350	17,222	21,178	23,637	26,392	32,194
Calhoun	2,673.3	2,395	3,635	4,700	5,385	5,911	9,222	16,592	17,831	19,574	19,053	20,647
Callahan	2,334.3	8,768	12,973	11,844	12,785	11,568	9,087	7,929	8,205	10,992	11,859	12,905
Cameron	3,305.7	*14,207*	*23,973*	*35,130*	77,540	83,202	125,170	151,098	140,368	209,727	260,120	335,227
Camp	526.3	9,146	9,551	11,103	10,063	10,285	8,740	7,849	8,005	9,275	9,904	11,549
Carson	2,393.4	469	2,127	3,078	7,745	6,624	6,852	7,781	6,358	6,672	6,576	6,516
Cass	2,487.3	22,841	27,587	30,041	30,030	33,496	26,732	23,496	24,133	29,430	29,982	30,438
Castro	2,329.2	400	1,850	1,948	4,720	4,631	5,417	8,923	10,394	10,556	9,070	8,285
Chambers	2,258.5	3,046	4,234	4,162	5,710	7,511	7,871	10,379	12,187	18,538	20,088	26,031
Cherokee	2,750.4	25,154	29,038	37,633	43,180	43,970	38,694	33,120	32,008	38,127	41,049	46,659

county	area	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000
Childress	1,848.2	2,138	9,538	10,933	16,044	12,149	12,123	8,421	6,605	6,950	5,953	7,688
Clay	2,890.9	9,231	17,043	16,864	14,545	12,524	9,896	8,351	8,079	9,582	10,024	11,006
Cochran	2,008.0	25	65	67	1,963	3,735	5,928	6,417	5,326	4,825	4,377	3,730
Coke	2,403.4	3,430	6,412	4,557	5,253	4,590	4,045	3,589	3,087	3,196	3,424	3,864
Coleman	3,319.0	10,077	22,618	18,805	23,669	20,571	15,503	12,458	10,288	10,439	9,710	9,235
Collin	2,294.3	50,087	49,021	49,609	46,180	47,190	41,692	41,247	66,920	144,576	264,036	491,675
Collingsworth	2,381.3	1,233	5,224	9,154	14,461	10,331	9,139	6,276	4,755	4,648	3,573	3,206
Colorado	2,521.6	22,203	18,897	19,013	19,129	17,812	17,576	18,463	17,638	18,823	18,383	20,390
Comal	1,488.2	7,008	8,434	8,824	11,984	12,321	16,357	19,844	24,165	36,446	51,832	78,021
Comanche	2,454.5	23,009	27,186	25,748	18,430	19,245	15,516	11,865	11,898	12,617	13,381	14,026
Concho	2,573.6	1,427	6,654	5,847	7,645	6,192	5,078	3,672	2,937	2,915	3,044	3,966
Cooke	2,327.9	27,494	26,603	25,667	24,136	24,909	22,146	22,560	23,471	27,656	30,777	36,363
Coryell	2,736.9	21,308	21,703	20,601	19,999	20,226	16,284	23,961	35,311	56,767	64,226	74,978
Cottle	2,335.1	1,002	4,396	6,901	9,395	7,079	6,099	4,207	3,204	2,947	2,247	1,904
Crane	2,034.7	51	331	37	2,221	2,841	3,965	4,699	4,172	4,600	4,652	3,996
Crockett	7,271.2	1,591	1,296	1,500	2,590	2,809	3,981	4,209	3,885	4,608	4,078	4,099
Crosby	2,335.4	788	1,765	6,084	11,023	10,046	9,582	10,347	9,085	8,859	7,304	7,072
Culberson	9,874.9	*219*	*462*	912	1,228	1,653	1,825	2,794	3,429	3,315	3,407	2,975
Dallam	3,898.6	146	4,001	4,528	7,830	6,494	7,640	6,302	6,012	6,531	5,461	6,222
Dallas	2,353.2	82,726	135,748	210,551	325,691	398,564	614,799	951,527	1,327,321	1,556,390	1,852,810	2,218,899
Dawson	2,336.5	37	2,320	4,309	13,573	15,367	19,113	19,185	16,604	16,184	14,349	14,985
Deaf Smith	3,880.5	843	3,942	3,747	5,979	6,056	9,111	13,187	18,999	21,165	19,153	18,561
Delta	719.8	15,249	14,566	15,887	13,138	12,858	8,964	5,860	4,927	4,839	4,857	5,327
Denton	2,480.9	28,318	31,258	35,355	32,822	33,658	41,365	47,432	75,633	143,126	273,525	432,976
DeWitt	2,358.1	21,311	23,501	27,971	27,441	24,935	22,973	20,683	18,660	18,903	18,840	20,013
Dickens	2,344.5	1,151	3,092	5,876	8,601	7,847	7,177	4,963	3,737	3,539	2,571	2,762
Dimmit	3,456.3	1,106	3,460	5,296	8,828	8,542	10,654	10,095	9,039	11,367	10,433	10,248
Donley	2,416.6	2,756	5,284	8,035	10,262	7,487	6,216	4,449	3,641	4,075	3,696	3,828
Duval	4,650.8	*7,488*	*7,912*	8,251	12,191	20,565	15,643	13,398	11,722	12,517	12,918	13,120
Eastland	2,413.6	17,971	23,421	58,505	34,156	30,345	23,942	19,526	18,092	19,480	18,488	18,297
Ector	2,335.3	381	1,178	760	3,958	15,051	42,102	90,995	91,805	115,374	118,934	121,123
Edwards	5,490.6	*3,200*	*3,385*	2,283	2,764	2,933	2,908	2,317	2,107	2,033	2,266	2,162
Ellis	2,464.8	50,059	53,629	55,700	53,936	47,733	45,645	43,395	46,638	59,743	85,167	111,360
El Paso	2,628.0	*24,436*	*51,649*	101,877	131,597	131,067	194,968	314,070	359,291	479,899	591,610	679,622
Erath	2,822.6	29,966	32,095	28,385	20,804	20,760	18,434	16,236	18,141	22,560	27,991	33,001
Falls	2,004.2	33,342	35,649	36,217	38,771	35,984	26,724	21,263	17,300	17,946	17,712	18,576
Fannin	2,328.8	51,793	44,801	48,186	41,163	41,064	31,253	23,880	22,705	24,285	24,804	31,242
Fayette	2,486.0	36,542	29,796	29,965	30,708	29,246	24,176	20,384	17,650	18,832	20,095	21,804
Fisher	2,335.5	3,708	12,596	11,009	13,563	12,932	11,023	7,865	6,344	5,891	4,842	4,344
Floyd	2,570.6	2,020	4,638	9,758	12,409	10,659	10,535	12,369	11,044	9,834	8,497	7,771
Foard	1,832.9	1,568	5,726	4,747	6,315	5,237	4,216	3,125	2,211	2,158	1,794	1,622
Fort Bend	2,294.9	16,538	18,168	22,931	29,718	32,963	31,056	40,527	52,314	130,846	225,421	354,452
Franklin	763.5	8,674	9,331	9,304	8,494	8,378	6,257	5,101	5,291	6,893	7,802	9,458
Freestone	2,310.6	18,910	20,557	23,264	22,589	21,138	15,696	12,525	11,116	14,830	15,818	17,867
Frio	2,937.8	4,200	8,895	9,296	9,411	9,207	10,357	10,112	11,159	13,785	13,472	16,252
Gaines	3,892.3	55	1,255	1,018	2,800	8,136	8,909	12,267	11,593	13,150	14,123	14,467

county	area	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000
Galveston	2,260.9	44,116	44,479	53,150	64,401	81,173	113,066	140,364	169,812	195,940	217,396	250,158
Garza	2,321.1	185	1,995	4,253	5,586	5,678	6,281	6,611	5,289	5,336	5,143	4,872
Gillespie	2,749.2	8,229	9,447	10,015	11,020	10,670	10,520	10,048	10,553	13,532	17,204	20,814
Glasscock	2,333.4	286	1,143	555	1,263	1,193	1,089	1,118	1,155	1,304	1,447	1,406
Goliad	2,225.7	8,310	9,909	9,348	10,093	8,798	6,219	5,429	4,869	5,193	5,980	6,928
Gonzales	2,770.8	28,882	28,055	28,438	28,337	26,075	21,164	17,845	16,375	16,883	17,205	18,628
Gray	2,406.7	480	3,405	4,663	22,090	23,911	24,728	31,535	26,949	26,386	23,967	22,744
Grayson	2,536.1	63,661	65,996	74,165	65,843	69,499	70,467	73,043	83,225	89,796	95,019	110,595
Gregg	715.8	12,343	14,140	16,767	15,778	58,027	61,258	69,436	75,929	99,487	104,948	111,379
Grimes	2,075.0	26,106	21,205	23,101	22,642	21,960	15,135	12,709	11,855	13,580	18,828	23,552
Guadalupe	1,849.7	21,385	24,913	27,719	28,925	25,596	25,392	29,017	33,554	46,708	64,873	89,023
Hale	2,602.3	1,680	7,566	10,104	20,189	18,813	28,211	36,798	34,137	37,592	34,671	36,602
Hall	2,341.5	1,670	8,279	11,137	16,966	12,117	10,930	7,322	6,015	5,594	3,905	3,782
Hamilton	2,166.2	13,520	15,315	14,676	13,523	13,303	10,660	8,488	7,198	8,297	7,733	8,229
Hansford	2,383.8	167	935	1,354	3,548	2,783	4,202	6,208	6,351	6,209	5,848	5,369
Hardeman	1,805.2	3,634	11,213	12,487	14,532	11,073	10,212	8,275	6,795	6,368	5,283	4,724
Hardin	2,324.2	5,049	12,947	15,983	13,936	15,875	19,535	24,629	29,996	40,721	41,320	48,073
Harris	4,604.2	63,786	115,693	186,667	359,328	528,961	806,701	1,243,158	1,741,912	2,409,547	2,818,101	3,400,578
Harrison	2,370.1	31,878	37,243	43,565	48,937	50,900	47,745	45,594	44,841	52,265	57,483	62,110
Hartley	3,789.7	377	1,298	1,109	2,185	1,873	1,913	2,171	2,782	3,987	3,634	5,537
Haskell	2,357.5	2,637	16,249	14,193	16,669	14,905	13,736	11,174	8,512	7,725	6,820	6,093
Hays	1,760.7	14,142	15,518	15,920	14,915	15,349	17,840	19,934	27,642	40,594	65,614	97,589
Hemphill	2,362.2	815	3,170	4,280	4,637	4,170	4,123	3,185	3,084	5,304	3,720	3,351
Henderson	2,457.9	19,970	20,131	28,327	30,583	31,822	23,405	21,786	26,466	42,606	58,543	73,277
Hidalgo	4,099.1	*6,035*	*12,118*	*34,886*	77,004	106,059	160,446	180,904	181,535	283,229	383,545	569,463
Hill	2,552.8	41,355	46,760	43,332	43,036	38,355	31,282	23,650	22,596	25,024	27,146	32,321
Hockley	2,353.1	44	137	137	9,298	12,693	20,407	22,340	20,396	23,230	24,199	22,716
Hood	1,131.3	9,146	10,008	8,759	6,779	6,674	5,287	5,443	6,368	17,714	28,981	41,100
Hopkins	2,053.2	27,950	31,038	34,791	29,410	30,274	23,490	18,594	20,710	25,247	28,833	31,960
Houston	3,203.4	25,452	29,564	28,601	30,017	31,137	22,825	19,376	17,855	22,299	21,375	23,185
Howard	2,341.9	2,528	8,881	6,962	22,888	20,990	26,722	40,139	37,796	33,142	32,343	33,627
Hudspeth	11,841.2	*231*	*488*	962	3,728	3,149	4,298	3,343	2,392	2,728	2,915	3,344
Hunt	2,284.4	47,295	48,116	50,350	49,016	48,793	42,731	39,399	47,948	55,248	64,343	76,596
Hutchinson	2,317.9	303	892	721	14,848	19,069	31,580	34,419	24,443	26,304	25,689	23,857
Irion	2,723.6	848	1,283	1,610	2,049	1,963	1,590	1,183	1,070	1,386	1,629	1,771
Jack	2,383.1	10,224	11,817	9,863	9,046	10,206	7,755	7,418	6,711	7,408	6,981	8,763
Jackson	2,219.7	6,094	6,471	11,244	10,980	11,720	12,916	14,040	12,975	13,352	13,039	14,391
Jasper	2,511.3	7,138	14,000	15,569	17,064	17,491	20,049	22,100	24,692	30,781	31,102	35,604
Jeff Davis	5,865.3	1,150	1,678	1,445	1,800	2,375	2,090	1,582	1,527	1,647	1,946	2,207
Jefferson	2,878.1	14,239	38,182	73,120	133,391	145,329	195,083	245,659	244,773	250,938	239,389	252,051
Jim Hogg	2,942.7	*872*	*1,223*	1,914	4,919	5,449	5,389	5,022	4,654	5,168	5,109	5,281
Jim Wells	2,248.7	*1,847*	*3,884*	6,587	13,456	20,239	27,991	34,548	33,032	36,498	37,679	39,326
Johnson	1,902.2	33,819	34,460	37,286	33,317	30,384	31,390	34,720	45,769	67,649	97,165	126,811
Jones	2,427.2	7,053	24,299	22,323	24,233	23,378	22,147	19,299	16,106	17,268	16,490	20,785
Karnes	1,951.8	8,681	14,942	19,049	23,316	19,248	17,139	14,995	13,462	13,593	12,455	15,446
Kaufman	2,089.6	33,376	35,323	41,276	40,905	38,308	31,170	29,931	32,392	39,015	52,220	71,313

county	area	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000
Kendall	1,717.3	4,103	4,517	4,779	4,970	5,080	5,423	5,889	6,964	10,635	14,589	23,743
Kenedy	5,039.1	*471*	*660*	1,033	701	700	632	884	678	543	460	414
Kent	2,338.5	899	2,655	3,335	3,851	3,413	2,249	1,727	1,434	1,145	1,010	859
Kerr	2,868.8	*4,825*	*5,103*	5,842	10,151	11,650	14,022	16,800	19,454	28,780	36,304	43,653
Kimble	3,239.9	2,503	3,261	3,581	4,119	5,064	4,619	3,943	3,904	4,063	4,122	4,468
King	2,365.5	490	810	655	1,193	1,066	870	640	464	425	354	356
Kinney	3,536.1	2,447	3,401	3,746	3,980	4,533	2,668	2,452	2,006	2,279	3,119	3,379
Kleberg	2,823.8	*2,197*	*4,621*	7,837	12,451	13,344	21,991	30,052	33,166	33,358	30,274	31,549
Knox	2,215.6	2,322	9,625	9,240	11,368	10,090	10,082	7,857	5,972	5,329	4,837	4,253
Lamar	2,415.1	48,627	46,544	55,742	48,529	50,425	43,033	34,234	36,062	42,156	43,949	48,499
Lamb	2,635.9	31	540	1,175	17,452	17,606	20,015	21,896	17,770	18,669	15,072	14,709
Lampasas	1,849.2	8,625	9,532	8,800	8,677	9,167	9,929	9,418	9,323	12,005	13,521	17,762
La Salle	3,870.0	2,303	4,747	4,821	8,228	8,003	7,485	5,972	5,014	5,514	5,254	5,866
Lavaca	2,513.2	28,121	26,418	28,964	27,550	25,485	22,159	20,174	17,903	19,004	18,690	19,210
Lee	1,642.1	14,595	13,132	14,014	13,390	12,751	10,144	8,949	8,048	10,952	12,854	15,657
Leon	2,798.2	18,072	16,583	18,286	19,898	17,733	12,024	9,951	8,738	9,594	12,665	15,335
Liberty	3,046.4	8,102	10,686	14,637	19,868	24,541	26,729	31,595	33,014	47,088	52,726	70,154
Limestone	2,416.8	32,573	34,621	33,283	39,497	33,781	25,251	20,413	18,100	20,224	20,946	22,051
Lipscomb	2,414.4	790	2,634	3,684	4,512	3,764	3,658	3,406	3,486	3,766	3,143	3,057
Live Oak	2,794.2	2,268	3,442	4,171	8,956	9,799	9,054	7,846	6,697	9,606	9,556	12,309
Llano	2,502.4	7,301	6,520	5,360	5,538	5,996	5,377	5,240	6,979	10,144	11,631	17,044
Loving	1,753.0	33	249	82	195	285	227	226	164	91	107	67
Lubbock	2,332.8	293	3,624	11,096	39,104	51,782	101,048	156,271	179,295	211,651	222,636	242,628
Lynn	2,314.0	17	1,713	4,751	12,372	11,931	11,030	10,914	9,107	8,605	6,758	6,550
Madison	1,223.6	10,432	10,318	11,956	12,227	12,029	7,996	6,749	7,693	10,649	10,931	12,940
Marion	1,088.7	10,754	10,472	10,886	10,371	11,457	10,172	8,049	8,517	10,360	9,984	10,941
Martin	2,371.5	332	1,549	1,146	5,785	5,556	5,541	5,068	4,774	4,684	4,956	4,746
Mason	2,414.3	5,573	5,683	4,824	5,511	5,378	4,945	3,780	3,356	3,683	3,423	3,738
Matagorda	4,175.6	6,097	13,594	16,589	17,678	20,066	21,559	25,744	27,913	37,828	36,928	37,957
Maverick	3,345.6	4,066	5,151	7,418	6,120	10,071	12,292	14,508	18,093	31,398	36,378	47,297
McCulloch	2,780.0	3,960	13,405	11,020	13,883	13,208	11,701	8,815	8,571	8,735	8,778	8,205
McLennan	2,746.0	59,772	73,250	82,921	98,682	101,898	130,194	150,091	147,553	170,755	189,123	213,517
McMullen	2,959.3	1,024	1,091	952	1,351	1,374	1,187	1,116	1,095	789	817	851
Medina	3,456.4	7,783	13,415	11,679	13,989	16,106	17,013	18,904	20,249	23,164	27,312	39,304
Menard	2,336.8	2,011	2,707	3,162	4,447	4,521	4,175	2,964	2,646	2,346	2,252	2,360
Midland	2,336.1	1,741	3,464	2,449	8,005	11,721	25,785	67,717	65,433	82,636	106,611	116,009
Milam	2,646.1	39,666	36,780	38,104	37,915	33,120	23,585	22,263	20,028	22,732	22,946	24,238
Mills	1,942.2	7,851	9,694	9,019	8,293	7,951	5,999	4,467	4,212	4,477	4,531	5,151
Mitchell	2,372.2	2,855	8,956	7,527	14,183	12,477	14,357	11,255	9,073	9,088	8,016	9,698
Montague	2,430.5	24,800	25,123	22,200	19,159	20,442	17,070	14,893	15,326	17,410	17,274	19,117
Montgomery	2,788.9	17,067	15,679	17,334	14,588	23,055	24,504	26,839	49,479	128,487	182,201	293,768
Moore	2,355.9	209	561	571	1,555	4,461	13,349	14,773	14,060	16,575	17,865	20,121
Morris	669.9	8,220	10,439	10,289	10,028	9,810	9,433	12,576	12,310	14,629	13,200	13,048
Motley	2,563.6	1,257	2,396	4,107	6,812	4,994	3,963	2,870	2,178	1,950	1,532	1,426
Nacogdoches	2,541.6	24,663	27,406	28,457	30,290	35,392	30,326	28,046	36,362	46,786	54,753	59,203
Navarro	2,813.2	43,374	47,070	50,624	60,507	51,308	39,916	34,423	31,150	35,323	39,926	45,124

county	area	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000
Newton	2,433.3	7,282	10,850	12,196	12,524	13,700	10,832	10,372	11,657	13,254	13,569	15,072
Nolan	2,367.1	2,611	11,999	10,868	19,323	17,309	19,808	18,963	16,220	17,359	16,594	15,802
Nueces	3,021.0	*6,395*	*13,449*	22,807	51,779	92,661	165,471	221,573	237,544	268,215	291,145	313,645
Ochiltree	2,377.8	267	1,602	2,331	5,224	4,213	6,024	9,380	9,704	9,588	9,128	9,006
Oldham	3,888.7	349	812	709	1,404	1,385	1,672	1,928	2,258	2,283	2,278	2,185
Orange	983.0	5,905	9,528	15,379	15,149	17,382	40,567	60,357	71,170	83,838	80,509	84,966
Palo Pinto	2,552.4	12,291	19,506	23,431	17,576	18,456	17,154	20,516	28,962	24,062	25,055	27,026
Panola	2,127.3	21,404	20,424	21,755	24,063	22,513	19,250	16,870	15,894	20,724	22,035	22,756
Parker	2,357.1	25,823	26,331	23,382	18,759	20,482	21,528	22,880	33,888	44,609	64,785	88,495
Parmer	2,292.6	34	1,555	1,699	5,869	5,890	5,787	9,583	10,509	11,038	9,863	10,016
Pecos	12,340.6	*1,396*	2,071	3,857	7,812	8,185	9,939	11,957	13,748	14,618	14,675	16,809
Polk	2,874.4	14,447	17,459	16,784	17,555	20,635	16,194	13,861	14,457	24,407	30,687	41,133
Potter	2,387.9	1,820	12,424	16,710	46,080	54,265	73,366	115,580	90,511	98,637	97,841	113,546
Presidio	9,987.7	3,673	5,218	12,202	10,154	10,925	7,354	5,460	4,842	5,188	6,637	7,304
Rains	670.5	6,127	6,787	8,099	7,114	7,334	4,266	2,993	3,752	4,839	6,715	9,139
Randall	2,389.1	963	3,312	3,675	7,071	7,185	13,774	33,913	53,885	75,062	89,673	104,312
Reagan	3,045.8	*146*	392	377	3,028	1,997	3,127	3,782	3,239	4,135	4,514	3,326
Real	1,813.1	*1,443*	*1,526*	1,461	2,197	2,420	2,479	2,079	2,013	2,469	2,412	3,047
Red River	2,739.2	29,893	28,564	35,829	30,923	29,769	21,851	15,682	14,298	16,101	14,317	14,314
Reeves	6,842.6	1,847	4,392	4,457	6,407	8,006	11,745	17,644	16,526	15,801	15,852	13,137
Refugio	2,120.3	1,641	2,814	4,050	7,691	10,383	10,113	10,975	9,494	9,289	7,976	7,828
Roberts	2,393.6	620	950	1,469	1,457	1,289	1,031	1,075	967	1,187	1,025	887
Robertson	2,242.1	31,480	27,454	27,933	27,240	25,710	19,908	16,157	14,389	14,653	15,511	16,000
Rockwall	385.1	8,531	8,072	8,591	7,658	7,051	6,156	5,878	7,046	14,528	25,604	43,080
Runnels	2,738.0	5,379	20,858	17,074	21,821	18,903	16,771	15,016	12,108	11,872	11,294	11,495
Rusk	2,431.0	26,099	26,946	31,689	32,484	51,023	42,348	36,421	34,102	41,382	43,735	47,372
Sabine	1,493.4	6,394	8,582	12,299	11,998	10,896	8,568	7,302	7,187	8,702	9,586	10,469
San Augustine	1,533.8	8,434	11,264	13,737	12,471	12,471	8,837	7,722	7,858	8,785	7,999	8,946
San Jacinto	1,626.3	10,277	9,542	9,867	9,711	9,056	7,172	6,153	6,702	11,434	16,372	22,246
San Patricio	1,831.3	2,372	7,307	11,386	23,836	28,871	35,842	45,021	47,288	58,013	58,749	67,138
San Saba	2,948.0	7,569	11,245	10,045	10,273	11,012	8,666	6,381	5,540	6,204	5,401	6,186
Schleicher	3,394.6	515	1,893	1,851	3,166	3,083	2,852	2,791	2,277	2,820	2,990	2,935
Scurry	2,350.5	4,158	10,924	9,003	12,188	11,545	22,779	20,369	15,760	18,192	18,634	16,361
Shackelford	2,371.2	2,461	4,201	4,960	6,695	6,211	5,001	3,990	3,323	3,915	3,316	3,302
Shelby	2,161.4	20,452	26,423	27,464	28,627	29,235	23,479	20,479	19,672	23,084	22,034	25,224
Sherman	2,391.1	104	1,376	1,473	2,314	2,026	2,443	2,605	3,657	3,174	2,858	3,186
Smith	2,459.1	37,370	41,746	46,769	53,123	69,090	74,701	86,350	97,096	128,366	151,309	174,706
Somervell	497.0	3,498	3,931	3,563	3,016	3,071	2,542	2,577	2,793	4,154	5,360	6,809
Starr	3,183.8	*10,124*	*11,608*	11,089	11,409	13,312	13,948	17,137	17,707	27,266	40,518	53,597
Stephens	2,386.6	6,466	7,980	15,403	16,560	12,356	10,597	8,885	8,414	9,926	9,010	9,674
Sterling	2,391.8	1,127	1,493	1,053	1,431	1,404	1,282	1,177	1,056	1,206	1,438	1,393
Stonewall	2,383.4	2,183	5,320	4,086	5,667	5,589	3,679	3,017	2,397	2,406	2,013	1,693
Sutton	3,766.9	1,727	1,569	1,598	2,807	3,977	3,746	3,738	3,175	5,130	4,135	4,077
Swisher	2,332.7	1,227	4,012	4,388	7,343	6,528	8,249	10,607	10,373	9,723	8,133	8,378
Tarrant	2,324.5	52,376	108,572	152,800	197,553	225,521	361,253	538,495	716,317	860,880	1,170,103	1,446,219
Taylor	2,380.9	10,499	26,293	24,081	41,023	44,147	63,370	101,078	97,853	110,932	119,655	126,555

county	area	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000
Terrell	6,106.6	*964*	1,430	1,595	2,660	2,952	3,189	2,600	1,940	1,595	1,410	1,081
Terry	2,307.5	48	1,474	2,236	8,883	11,160	13,107	16,286	14,118	14,581	13,218	12,761
Throckmorton	2,371.1	1,750	4,563	3,589	5,253	4,275	3,618	2,767	2,205	2,053	1,880	1,850
Titus	1,102.5	12,292	16,422	18,128	16,003	19,228	17,302	16,785	16,702	21,442	24,009	28,118
Tom Green	3,990.0	*6,658*	17,882	15,210	36,033	39,302	58,929	64,630	71,047	84,784	98,458	104,010
Travis	2,647.2	47,386	55,620	57,616	77,777	111,053	160,980	212,136	295,516	419,573	576,407	812,280
Trinity	1,849.3	10,976	12,768	13,623	13,637	13,705	10,040	7,539	7,628	9,450	11,445	13,779
Tyler	2,423.5	11,899	10,250	10,415	11,448	11,948	11,292	10,666	12,417	16,223	16,646	20,871
Upshur	1,535.0	16,266	19,960	22,472	22,297	26,178	20,822	19,793	20,976	28,595	31,370	35,291
Upton	3,216.3	48	501	253	5,968	4,297	5,307	6,239	4,697	4,619	4,447	3,404
Uvalde	4,036.8	4,647	11,233	10,769	12,945	13,246	16,015	16,814	17,348	22,441	23,340	25,926
Val Verde	8,371.9	5,263	8,613	12,706	14,924	15,453	16,635	24,461	27,471	35,910	38,721	44,856
Van Zandt	2,226.0	25,481	25,651	30,784	32,315	31,155	22,593	19,091	22,155	31,426	37,944	48,140
Victoria	2,301.8	13,678	14,990	18,271	20,048	23,741	31,241	46,475	53,766	68,807	74,361	84,088
Walker	2,075.7	15,813	16,061	18,556	18,528	19,868	20,163	21,475	27,680	41,789	50,917	61,758
Waller	1,342.9	14,246	12,138	10,292	10,014	10,280	11,961	12,071	14,285	19,798	23,389	32,663
Ward	2,164.6	1,451	2,389	2,615	4,599	9,575	13,346	14,917	13,019	13,976	13,115	10,909
Washington	1,609.3	32,931	25,561	26,624	25,394	25,387	20,542	19,145	18,842	21,998	26,154	30,373
Webb	8,742.6	21,851	22,503	29,152	42,128	45,916	56,141	64,791	72,859	99,258	133,239	193,117
Wharton	2,834.5	16,942	21,123	24,288	29,681	36,158	36,077	38,152	36,729	40,242	39,955	41,188
Wheeler	2,370.7	636	5,258	7,397	15,555	12,411	10,317	7,947	6,434	7,137	5,879	5,284
Wichita	1,639.5	5,806	16,094	72,911	74,416	73,604	98,493	123,528	121,862	121,082	122,378	131,664
Wilbarger	2,533.3	5,759	12,000	15,112	24,579	20,474	20,552	17,748	15,355	15,931	15,121	14,676
Willacy	2,031.1	*2,168*	*3,040*	*4,757*	10,499	13,230	20,920	20,084	15,570	17,495	17,705	20,082
Williamson	2,939.0	38,072	42,228	42,934	44,146	41,698	38,853	35,044	37,305	76,521	139,551	249,967
Wilson	2,094.2	13,961	17,066	17,289	17,606	17,066	14,672	13,267	13,041	16,756	22,650	32,408
Winkler	2,178.8	60	442	81	6,784	6,141	10,064	13,652	9,640	9,944	8,626	7,173
Wise	2,390.0	27,116	26,450	23,363	19,178	19,074	16,141	17,012	19,687	26,575	34,679	48,793
Wood	1,802.1	21,048	23,417	27,707	24,183	24,360	21,308	17,653	18,589	24,697	29,380	36,752
Yoakum	2,071.4	26	602	504	1,263	5,354	4,339	8,032	7,344	8,299	8,786	7,322
Young	2,410.9	6,540	13,657	13,379	20,128	19,004	16,810	17,254	15,400	19,083	18,126	17,943
Zapata	2,740.5	4,202	*3,362*	2,929	2,867	3,916	4,405	4,393	4,352	6,628	9,279	12,182
Zavala	3,371.4	792	1,889	3,108	10,349	11,603	11,201	12,696	11,370	11,666	12,162	11,600

Note: estimated figures for counties created after 1900 shown in italics.

Sources: U.S. Bureau of census and author's calculations.

3.2. Share of national GDP and Texas GSP by Sector, 1997 and 2004

Sector	US	TX	US	TX	TX/US	
	1997	1997	2004	2004	Is	Ic
Agriculture & related	*1.3*	1.1	*1.0*	0.9	0.1	3
Mining	*1.1*	5.7	*1.3*	6.4	0.1	(277)
Utilities	*2.2*	3.0	*2.1*	3.0	0.2	(14)
Construction	*4.1*	4.2	*4.6*	4.5	(0.3)	-
Manufacturing	*15.5*	15.4	*12.8*	12.1	(0.6)	(4)
Wholesale Trade	*6.3*	7.1	*5.9*	6.7	0.2	(3)
Retail Trade	*7.0*	7.3	*6.8*	6.9	(0.3)	2
Transportation & Warehousing	*3.1*	3.8	*2.9*	3.6	-	-
Information	*4.2*	4.6	*4.7*	4.6	(0.5)	3
Finance & Insurance	*7.2*	5.5	*8.3*	6.6	0.3	5
Real Estate	*12.1*	9.9	*12.4*	10.3	-	1
Prof. & Tech. Services	*6.3*	5.9	*6.8*	6.3	-	-
Management of Companies	*1.8*	0.4	*1.8*	1.6	1.1	102
Admin. & Waste Services	*2.8*	3.1	*2.9*	3.0	(0.2)	3
Educational Services	*0.8*	0.4	*0.9*	0.5	-	1
Health Care & Social Assistance	*6.2*	5.5	*6.9*	6.1	(0.1)	(2)
Arts, Entertainment & Recreation	*0.9*	0.6	*1.0*	0.6	-	(2)
Accommodation & Food Services	*2.6*	2.5	*2.6*	2.5	-	-
Other Services	*2.4*	2.4	*2.4*	2.3	(0.1)	-
Government	*12.0*	11.5	*11.9*	11.5	0.1	1

Notes: 'Agriculture & related' stands for Agriculture, Forestry, Fishing and Hunting; figures for Government include local, state and federal administration. 'Is' refers to shift-share changes and 'Ic' to the Index of Convergence for the period 1997-2004 (refer to Chapter 3 for details)

Sources: U.S. Bureau of Economic Analysis.

3.3. Total value of state exports in current dollars, 1997-2005

origin of exports	exports (million US$)				ranking				% share of total			
	2005	2003	2000	1997	2005	2003	2000	1997	2005	2003	2000	1997
UNITED STATES	890,577	711,577	770,509	687,598	-	-	-	-	100.0	100.0	100.0	100.0
Texas	128,761	98,846	103,866	76,184	1	1	2	2	15.3	14.9	14.8	12.4
California	116,819	93,995	119,640	99,161	2	2	1	1	13.9	14.2	17.0	16.1
New York	50,492	39,181	42,846	37,979	3	3	3	3	6.0	5.9	6.1	6.2
Washington	37,948	34,173	32,215	32,752	4	4	5	4	4.5	5.1	4.6	5.3
Michigan	37,584	32,941	33,845	32,253	5	5	4	5	4.5	5.0	4.8	5.2
Illinois	35,868	26,473	31,438	26,455	6	7	6	6	4.3	4.0	4.5	4.3
Ohio	34,801	29,764	26,322	24,903	7	6	8	7	4.1	4.5	3.7	4.0
Florida	33,377	24,953	26,543	23,234	8	8	7	8	4.0	3.8	3.8	3.8
Pennsylvania	22,271	16,299	18,792	16,069	9	13	10	12	2.7	2.5	2.7	2.6
Massachusetts	22,043	18,663	20,514	16,526	10	9	9	10	2.6	2.8	2.9	2.7
Indiana	21,476	16,402	15,386	12,028	11	12	14	17	2.6	2.5	2.2	2.0
New Jersey	21,080	16,818	18,638	15,167	12	11	11	13	2.5	2.5	2.7	2.5
Georgia	20,577	16,286	14,925	12,949	13	14	15	15	2.4	2.5	2.1	2.1
North Carolina	19,463	16,199	17,946	16,402	14	15	12	11	2.3	2.4	2.6	2.7
Louisiana	19,232	18,390	16,814	18,732	15	10	13	9	2.3	2.8	2.4	3.0
Tennessee	19,070	12,612	11,592	9,233	16	17	18	20	2.3	1.9	1.7	1.5
Arizona	14,950	13,323	14,334	13,820	17	16	16	14	1.8	2.0	2.0	2.2
Wisconsin	14,923	11,510	10,508	10,125	18	19	20	18	1.8	1.7	1.5	1.6
Kentucky	14,899	10,734	9,612	7,953	19	22	22	22	1.8	1.6	1.4	1.3
Minnesota	14,705	11,266	10,303	9,447	20	20	21	19	1.8	1.7	1.5	1.5
South Carolina	13,944	11,773	8,565	7,517	21	18	23	23	1.7	1.8	1.2	1.2
Oregon	12,381	10,357	11,441	9,151	22	23	19	21	1.5	1.6	1.6	1.5
Virginia	12,216	10,853	11,698	12,755	23	21	17	16	1.5	1.6	1.7	2.1
Alabama	10,796	8,340	7,317	5,932	24	24	25	26	1.3	1.3	1.0	1.0
Missouri	10,462	7,234	6,497	6,724	25	26	27	25	1.2	1.1	0.9	1.1
Connecticut	9,687	8,136	8,047	7,058	26	25	24	24	1.2	1.2	1.1	1.1
Iowa	7,348	5,236	4,465	5,118	27	28	30	29	0.9	0.8	0.6	0.8
Maryland	7,119	4,941	4,593	5,214	28	29	29	27	0.8	0.7	0.7	0.8
Colorado	6,784	6,109	6,593	5,120	29	27	26	28	0.8	0.9	0.9	0.8
Kansas	6,720	4,553	5,145	4,292	30	30	28	30	0.8	0.7	0.7	0.7
Utah	6,056	4,115	3,221	3,239	31	31	33	32	0.7	0.6	0.5	0.5
Oklahoma	4,314	2,660	3,072	2,728	32	35	34	33	0.5	0.4	0.4	0.4
Vermont	4,240	2,627	4,097	3,811	33	36	31	31	0.5	0.4	0.6	0.6
Mississippi	4,008	2,558	2,726	2,290	34	37	35	36	0.5	0.4	0.4	0.4
Nevada	3,937	2,033	1,482	1,075	35	42	44	45	0.5	0.3	0.2	0.2
Arkansas	3,862	2,962	2,599	2,305	36	32	36	35	0.5	0.4	0.4	0.4
Alaska	3,592	2,739	2,464	2,721	37	33	38	34	0.4	0.4	0.4	0.4
Idaho	3,260	2,096	3,559	1,664	38	41	32	42	0.4	0.3	0.5	0.3
West Virginia	3,147	2,380	2,219	2,276	39	38	41	37	0.4	0.4	0.3	0.4
Nebraska	3,004	2,724	2,511	1,971	40	34	37	39	0.4	0.4	0.4	0.3
New Hampshire	2,548	1,931	2,373	1,597	41	43	40	43	0.3	0.3	0.3	0.3
New Mexico	2,540	2,326	2,391	1,776	42	39	39	40	0.3	0.4	0.3	0.3
Delaware	2,525	1,886	2,197	2,067	43	44	42	38	0.3	0.3	0.3	0.3
Maine	2,310	2,188	1,779	1,723	44	40	43	41	0.3	0.3	0.3	0.3
Rhode Island	1,269	1,177	1,186	1,088	45	45	45	44	0.2	0.2	0.2	0.2
North Dakota	1,185	854	626	778	46	46	48	46	0.1	0.1	0.1	0.1
Hawaii	1,028	368	387	334	47	50	51	51	0.1	0.1	0.1	0.1
South Dakota	941	672	679	517	48	48	47	49	0.1	0.1	0.1	0.1
D. of Columbia	825	809	1,003	485	49	47	46	50	0.1	0.1	0.1	0.1
Montana	711	361	541	530	50	51	49	48	0.1	0.1	0.1	0.1
Wyoming	669	582	502	560	51	49	50	47	0.1	0.1	0.1	0.1
unknown	*36,812*	*35,168*	*58,454*	65,977	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*

Note: States ranked by their 2005 exports; shaded states increased their share of total exports from 1997 to 2005.

Sources: WISERTrade and U.S. Census Bureau, Foreign Trade Division

3.4. Total value of Texas exports in current dollars, 1996-2005

NAICS code and description		exports (million US$)				share of total				change
		2005	2003	2000	1997	2005	2003	2000	1997	1997-2005
-	Texas - all industries	128,761	98,846	103,866	76,184	100%	100%	100%	100%	-
111	agricultural products	2,712	2,618	2,125	2,748	2.1	2.6	2.0	3.6	(1.5)
112	livestock & livestock products	78	66	101	152	0.1	0.1	0.1	0.2	(0.1)
113	forestry products	27	24	17	16	0.0	0.0	0.0	0.0	(0.0)
114	fish & other marine products	27	25	39	27	0.0	0.0	0.0	0.0	(0.0)
211	oil & gas	1,314	673	738	629	1.0	0.7	0.7	0.8	0.2
212	minerals & ores	182	159	144	106	0.1	0.2	0.1	0.1	0.0
311	food & kindred products	3,067	2,755	2,575	1,912	2.4	2.8	2.5	2.5	(0.1)
312	beverages & tobacco products	58	79	90	70	0.0	0.1	0.1	0.1	(0.0)
313	textiles & fabrics	1,324	1,413	1,469	525	1.0	1.4	1.4	0.7	0.3
314	textile mill products	290	171	283	124	0.2	0.2	0.3	0.2	0.1
315	apparel & accessories	483	505	973	1,013	0.4	0.5	0.9	1.3	(1.0)
316	leather & allied products	607	651	668	456	0.5	0.7	0.6	0.6	(0.1)
321	wood products	175	133	153	134	0.1	0.1	0.1	0.2	(0.0)
322	paper	1,409	1,234	1,273	984	1.1	1.2	1.2	1.3	(0.2)
323	printing, publishing & similar products	324	270	278	198	0.3	0.3	0.3	0.3	(0.0)
324	petroleum & coal products	8,896	4,701	4,352	2,936	6.9	4.8	4.2	3.9	3.1
325	chemicals	24,689	17,125	15,363	12,376	19.2	17.3	14.8	16.2	2.9
326	plastics & rubber products	2,917	2,519	3,225	1,723	2.3	2.5	3.1	2.3	0.0
327	nonmetallic mineral products	669	541	699	450	0.5	0.5	0.7	0.6	(0.1)
331	primary metal manufacturing	4,006	2,097	1,916	2,067	3.1	2.1	1.8	2.7	0.4
332	fabricated metal products	4,086	3,073	3,855	2,539	3.2	3.1	3.7	3.3	(0.2)
333	machinery, except electrical	16,518	11,408	13,227	11,277	12.8	11.5	12.7	14.8	(2.0)
334	computer & electronic products	31,145	28,378	30,354	19,076	24.2	28.7	29.2	25.0	(0.9)
335	electrical equipt., appliances & compts.	5,944	4,643	4,969	3,741	4.6	4.7	4.8	4.9	(0.3)
336	transportation equipment	13,927	9,903	11,734	8,659	10.8	10.0	11.3	11.4	(0.5)
337	furniture & fixtures	153	130	182	97	0.1	0.1	0.2	0.1	(0.0)
339	miscellaneous manuftd. commodities	1,905	1,948	1,536	1,070	1.5	2.0	1.5	1.4	0.1
511	prepackaged software	37	30	-	-	0.0	0.0	-	-	0.0
910	waste & scrap	908	486	284	298	0.7	0.5	0.3	0.4	0.3
920	used or second-hand merchandise	200	207	173	116	0.2	0.2	0.2	0.2	0.0
980	exports returned to Canada; US Goods	8	67	98	136	0.0	0.1	0.1	0.2	(0.2)
990	special classification provisions	676	814	973	528	0.5	0.8	0.9	0.7	(0.2)

Note: Only sectors with exports were considered; shaded sectors increased their share of state exports from 1997 to 2005.

Sources: WISERTrade and U.S. Census Bureau, Foreign Trade Division.

3.5a. Largest corporations in Texas, 1985

	company	*rank*	*headquarters*	*sector*
1	Shell Oil	16	Houston	petroleum, other oil & gas
2	Tenneco	27	Houston	natural gas utilities
3	Southland	38	Dallas	supermarkets & conv. stores
4	LTV	84	Dallas	metals
5	Coastal Corp	96	Houston	petroleum, other oil & gas
6	Texas Eastern	99	Houston	natural gas utilities
7	Texas Instruments	110	Dallas	electronics & semiconductors
8	Halliburton	119	Dallas	oilfield Drillers & services
9	American General	123	Houston	insurance
10	AMR	124	Dallas [Fort Worth]	air transport
11	Diamond Shamrock	155	Dallas	petroleum, other oil & gas
12	Houston Industries	175	Houston	electric utilities
13	United Energy Resources	180	Houston	natural gas utilities
14	Texas Utilities	184	Dallas	electric utilities
15	Dresser Industries	189	Dallas	oilfield drillers & services
16	Transco Energy	198	Houston	natural gas utilities
17	Enserch	203	Dallas	builders
18	Panhandle Eastern	230	Houston	natural gas utilities
19	Tesoro Petroleum	250	San Antonio	petroleum, other oil & gas
20	Central & South West	261	Dallas	electric utilities
21	Tandy	262	Dallas [Fort Worth]	leisure & recreation
22	Sysco	286	Houston	services (food distributors)
23	InterFirst	296	Dallas	banks
24	First City Bancorporation	298	Houston	banks
25	Penzoil	299	Houston	petroleum, other oil & gas
26	Valero Energy	306	San Antonio	natural Gas utilities
27	Republic Bank	315	Dallas	banks
28	American Petrofina	322	Dallas	petroleum,other oil & gas
29	Texas Commerce Bancshares	330	Houston	banks
30	Texas Oil & Gas	336	Dallas	petroleum, other oil & gas
31	Cooper Industries	339	Houston	industrial machinery
32	Houston Natural Gas	344	Houston	natural gas utilities
33	National Gypsum	398	Dallas	building materials
34	Anderson, Clayton	401	Houston	food processors
35	Mcorp	421	Dallas	banks
36	Gulf States Utilities	431	Beaumont	electric utilities
37	Texas Air	464	Houston	air transport
38	Cullum Companies	497	Dallas	supermarkets
39	Temple-Inland	499	Diboll	packaging

Notes: Column 'rank' expresses the corporation national ranking by total sales/revenue according to "The Forbes 500" (April 29, 1985). Column 'sector' reflects the designation used at the source.

Sources: Forbes and Fortune magazines.

3.5b. Largest corporations in Texas, 1995

	company	*rank*	*headquarters*	*sector*
1	Exxon	3	Dallas [Irving]	petroleum refining
2	J.C. Penney	32	Dallas [Plano]	general merchandisers
3	AMR	49	Dallas [Fort Worth]	airlines
4	Tenneco	68	Houston	industrial & farm equipment
5	SBC Communications	89	San Antonio	telecommunications
6	Sysco	99	Houston	wholesalers
7	Compaq Computer	100	Houston	computers & office equipment
8	Texas Instruments	106	Dallas	electronics & electrical equipment
9	Coastal	110	Houston	petroleum refining
10	Enron	129	Houston	pipelines
11	Kimberly-Clark	160	Dallas [Irving]	forest & paper products
12	Cooper Industries	186	Houston	electronics & electrical equipment
13	USAA	189	San Antonio	insurance (stock)
14	Halliburton	205	Dallas	engineering & construction
15	Continental Airlines	208	Houston	airlines
16	Texas Utilities	210	Dallas	electric & gas utilities
17	Foxmeyer Health	214	Dallas [Carrollton]	wholesalers
18	Dresser Industries	219	Dallas	industrial & farm equipment
19	Burlington Northern	229	Dallas [Fort Worth]	railroads
20	Tandy	232	Dallas [Fort Worth]	specialist retailers
21	American General	238	Houston	diversified financials
22	Panhandle Eastern	252	Houston	pipelines
23	Browning-Ferris Industries	271	Houston	waste management
24	Houston Industries	287	Houston	electric & gas utilities
25	Lyondell Petrochemical	293	Houston	chemicals
26	Central & South West	315	Dallas	electric & gas utilities
27	Dell Computer	330	Austin	computers & office equipment
28	Centex	353	Dallas	engineering & construction
29	Temple-Inland	387	Diboll	forest & paper products
30	Transco Energy	401	Houston	pipelines
31	Noram Energy	404	Houston	pipelines
32	Diamond Shamrock	430	San Antonio	petroleum refining
33	Southwest Airlines	434	Dallas	airlines
34	Pennzoil	439	Houston	petroleum refining
35	Baker Hughes	448	Houston	industrial & farm equipment
36	American Medical Holdings	469	Dallas	health care

Note: Column 'rank' expresses the corporation national ranking by total sales/revenue according to "The Fortune 500 Largest U.S. Corporations" (vol. 131.9, May 15, 1995). Column 'sector' reflects the designation used at the source.

Sources: Forbes and Fortune magazines.

3.5c. Largest corporations in Texas, 2005

	company	*rank*	*headquarters*	*sector*
1	Exxon Mobil	2	Dallas [Irving]	petroleum refining
2	Conoco Phillips	7	Houston	petroleum refining
3	Valero Energy	22	San Antonio	petroleum refining
4	Dell Computer	28	Austin [Round Rock]	computers & office equipment
5	Marathon Oil	31	Houston	petroleum refining
6	SBC Communications	33	San Antonio	telecommunications
7	Sysco	60	Houston	wholesalers: food & grocery
8	J.C. Penney	74	Dallas [Plano]	general merchandisers
9	Electronic Data Systems	95	Dallas [Plano]	computer & data services
10	Plains All American Pipeline	96	Houston	pipelines
11	Halliburton	101	Houston	oil and gas equipment & services
12	AMR	119	Dallas [Fort Worth]	airlines
13	Kimberley-Clark	135	Dallas [Irving]	household & personal products
14	Texas Instruments	166	Dallas	semiconductors & oth. elect. comp.
15	Waste Management	168	Houston	waste management
16	Tenet Healthcare	169	Dallas	health care: medical facilities
17	Tesoro	177	San Antonio	petroleum refining
18	USAA	191	San Antonio	insurance: property & casualty
19	TXU	195	Dallas	energy
20	Burlington Northern Santa Fe	200	Dallas [Fort Worth]	railroads
21	D.R. Horton	203	Dallas [Fort Worth]	homebuilders
22	Centex	204	Dallas	homebuilders
23	Dean Foods	205	Dallas	food consumer products
24	Centerpoint Energy	209	Houston	utilities: gas & electric
25	Continental Airlines	232	Houston	airlines
26	Clear Channel Communications	239	San Antonio	entertainment
27	Reliant Energy	250	Houston	energy
28	Enterprise Products	260	Houston	pipelines
29	Kinder Morgan Energy	271	Houston	pipelines
30	El Paso	314	Houston	pipelines
31	Southwest Airlines	318	Dallas	airlines
32	Dynegy	327	Houston	energy
33	Baker Hughes	330	Houston	oil and gas equipment & services
34	Anadarko Petroleum	333	Houston [Woodlands]	mining & crude-oil production
35	Lyondell Chemical	338	Houston	chemicals
36	Burlington Resources	353	Houston	mining & crude-oil production
37	Group 1 Automotive	361	Houston	automotive retailing & services
38	Pilgrim's Pride	364	Dallas [Pittsburg]	food production
39	Apache	367	Houston	mining & crude-oil production
40	Radioshack	399	Dallas [Fort Worth]	specialty retailers
41	Commercial Metals	404	Dallas [Irving]	metals
42	Temple-Inland	405	Austin	packaging & containers
43	Triad Hospitals	426	Dallas [Plano]	health care: medical facilities
44	Smith International	438	Houston	oil and gas equipment & services
45	Enbridge Energy Partners	448	Houston	pipelines
46	Affiliated Computer Services	460	Dallas	computer & data services
47	Whole Food Market	479	Austin	food & drug stores
48	Brinker International	492	Dallas	food services

Note: Column 'rank' expresses the corporation national ranking by total sales/revenue according to "The Fortune 500 Largest U.S. Corporations" (vol. 155.8, April 18, 2005). Column 'sector' reflects the designation used at the source.

Sources: Fortune magazine.

3.6. Codes for the abbreviations of city names used in figures 3.9 and 3.10

Code - City Name:

AB - Abu Dhabi
AD - Adelaide
AK - Auckland
AM - Amsterdam
AS - Athens
AT - Atlanta
AN - Antwerp
BA - Buenos Aires
BB - Brisbane
BC - Barcelona
BD - Budapest
BG - Bogota
BJ - Beijing
BK - Bangkok
BL - Berlin
BM - Birmingham
BN - Bangalore
BR - Brussels
BS - Boston
BT - Beirut
BU - Bucharest
BV - Bratislava
CA - Cairo
CC - Calcutta
CG - Calgary
CH - Chicago
CL - Charlotte
CN - Chennai
CO - Cologne
CP - Copenhagen
CR - Caracas
CS - Casablanca
CT - Cape Town
CV - Cleveland
DA - Dallas
DB - Dublin
DS - Dusseldorf
DT - Detroit
DU - Dubaï
DV - Denver
FR - Frankfurt
GN - Geneva
GZ - Guangzhou
HB - Hamburg
HC - Ho Chi Minh City
HK - Hong Kong
HL - Helsinki
HM - Hamilton (Brmda)
HS - Houston
IN - Indianapolis
IS - Istanbul
JB - Johannesburg
JD - Jeddah
JK - Jakarta
KC - Kansas City
KL - Kuala Lumpur
KR - Karachi
KU - Kuwait
KV - Kiev
LA - Los Angeles
LB - Lisbon
LG - Lagos
LM - Lima
LN - London
LX - Luxembourg
LY - Lyons
MB - Mumbai
MC - Manchester
MD - Madrid
ME - Melbourne
MI - Miami
ML - Milan
MM - Manama
MN - Manila
MP - Minneapolis
MS - Moscow
MT - Montreal
MU - Munich
MV - Montevideo
MX - Mexico City
NC - Nicosia
ND - New Delhi
NR - Nairobi
NS - Nassau
NY - New York
OS - Oslo
PA - Paris
PB - Pittsburgh
PD - Portland
PE - Perth
PH - Philadelphia
PL - Port Louis
PN - Panama City
PR - Prague
QU - Quito
RJ - Rio de Janeiro
RM - Rome
RT - Rotterdam
RY - Riyadh
SA - Santiago
SD - San Diego
SE - Seattle
SF - San Francisco
SG - Singapore
SH - Shanghai
SK - Stockholm
SL – St. Louis
SO - Sofia
SP - Sao Paulo
ST - Stuttgart
SU - Seoul
SY - Sydney
TA - Tel Aviv
TP - Taipei
TR - Toronto
TY - Tokyo
VI - Vienna
VN - Vancouver
WC – Washington, DC
WL - Wellington
WS - Warsaw
ZG - Zagreb
ZU - Zurich

Source: Atlas of Hinterworlds, University of Loughborough, UK.

3.7. Global connectivity of the major nodes in the world city network

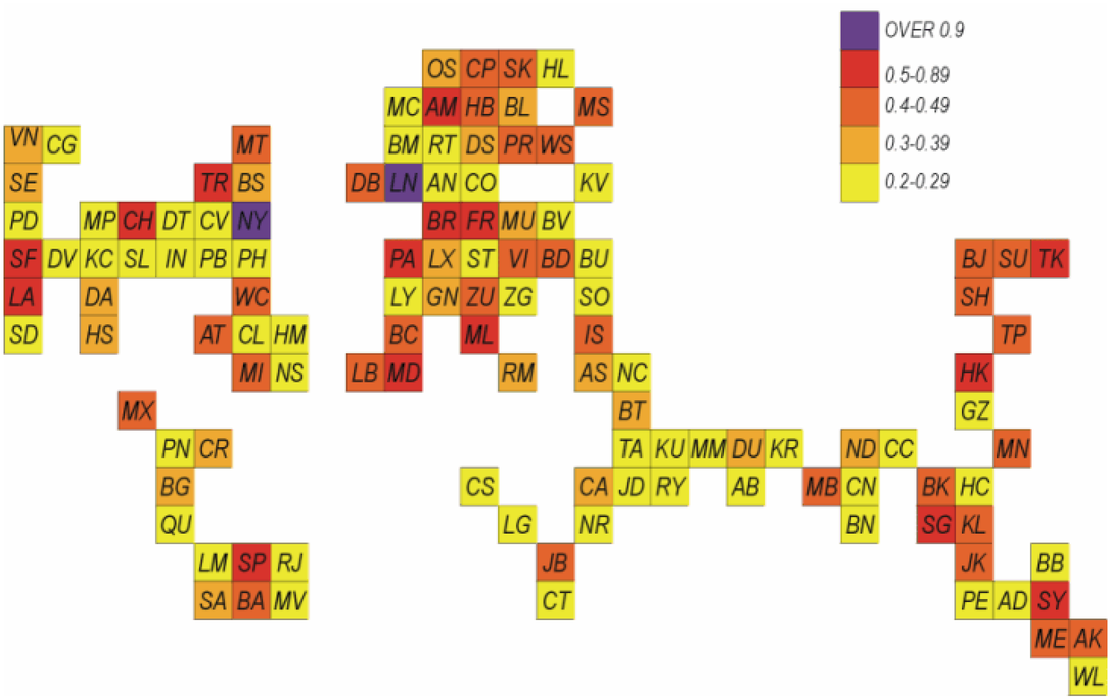


Figure taken from Taylor et al (2002b).

Also available online at http://www.lboro.ac.uk/gawc/rb/rb43.html.

The cartogram places cities in their approximate relative geographical positions. The codes for cities are:

AB - Abu Dubai; AD - Adelaide; AK - Auckland; AM - Amsterdam; AS - Athens; AT - Atlanta; AN - Antwerp; BA - Buenos Aires; BB - Brisbane; BC - Barcelona; BD - Budapest; BG - Bogota; BJ - Beijing; BK - Bangkok; BL - Berlin; BM - Birmingham; BN - Bangalore; BR - Brussels; BS - Boston; BT - Beirut; BU - Bucharest; BV - Bratislava; CA - Cairo; CC - Calcutta; CG - Calgary; CH - Chicago; CL - Charlotte; CN - Chennai; CO - Cologne; CP - Copenhagen; CR - Caracas; CS - Casablanca; CT - Cape Town; CV - Cleveland; DA - Dallas; DB - Dublin; DS - Dusseldorf; DT - Detroit; DU - Dubai; DV - Denver; FR - Frankfurt; GN - Geneva; GZ - Guangzhou; HB - Hamburg; HC - Ho Chi Minh City; HK - Hong Kong; HL - Helsinki; HM - Hamilton(Bermuda); HS - Houston; IN - Indianapolis; IS - Istanbul; JB - Johannesburg; JD - Jeddah; JK - Jakarta; KC - Kansas City; KL - Kuala Lumpur; KR - Karachi; KU - Kuwait; KV - Kiev; LA - Los Angeles; LB - Lisbon; LG - Lagos; LM - Lima; LN - London; LX - Luxembourg; LY - Lyons; MB - Mumbai; MC - Manchester; MD - Madrid; ME - Melbourne; MI - Miami; ML - Milan; MM - Manama; MN - Manila; MP - Minneapolis; MS - Moscow; MT - Montreal; MU - Munich; MV - Montevideo; MX - Mexico City; NC - Nicosia; ND - New Delhi; NR - Nairobi; NS - Nassau; NY - New York; OS - Oslo; PA - Paris; PB - Pittsburg; PD - Portland; PE - Perth; PH - Philadelphia; PN - Panama City; PR - Prague; QU - Quito; RJ - Rio de Janeiro; RM - Rome; RT - Rotterdam; RY - Riyadh; SA - Santiago; SD - San Diego; SE - Seattle; SF - San Francisco; SG - Singapore; SH - Shanghai; SK - Stockholm; SL - St Louis; SO - Sofia; SP - Sao Paulo; ST - Stuttgart; SU - Seoul; SY - Sydney; TA - Tel Aviv; TP - Taipei; TR - Toronto; VI - Vienna; VN - Vancouver; WC - Washington DC; WL - Wellington; WS - Warsaw; ZG - Zagreb; ZU - Zurich.

4.1. GDP (purchase power parity in U.S. dollars) by country, 2004

Rank	Country	GDP	
1	United States	11,651,110	
2	People's Rep. of China	7,642,283	a
3	Japan	3,737,289	
4	India	3,389,670	b
5	Germany	2,335,494	
6	United Kingdom	1,845,169	
7	France	1,769,171	
8	Italy	1,622,425	
9	Brazil	1,507,106	
10	Russia	1,424,418	
11	Spain	1,069,253	
12	Mexico	1,017,529	
13	Canada	999,608	
14	South Korea	985,649	
15	Indonesia	785,169	
16	Australia	609,988	
17	Turkey	556,074	
18	Netherlands	517,587	
19	Thailand	515,268	
20	Argentina	510,266	
21	South Africa	509,349	b
22	Iran	504,209	
23	Poland	495,386	
24	Philippines	376,586	
25	Pakistan	338,399	
26	Saudi Arabia	331,114	b
27	Colombia	325,915	b
28	Belgium	324,053	
29	Egypt	305,884	
30	Ukraine	303,409	
31	Sweden	265,630	
32	Austria	263,803	
33	Bangladesh	260,370	
34	Malaysia	255,818	
35	Greece	245,514	
36	Switzerland	244,149	
37	Vietnam	225,517	
38	Algeria	213,661	b
39	Hong Kong SAR (PRC)	212,136	
40	Portugal	206,142	
41	Czech Republic	198,276	
42	Romania	183,878	
43	Norway	176,543	
44	Chile	175,324	
45	Denmark	172,478	
46	Hungary	169,944	
47	Israel	165,738	
48	Ireland	157,958	
49	Venezuela	157,877	
50	Finland	156,590	
51	Peru	156,511	
52	Nigeria	148,553	
53	Morocco	128,523	
54	Singapore	119,053	
55	Kazakhstan	111,559	
56	United Arab Emirates	103,921	
57	New Zealand	95,080	
58	Sri Lanka	85,242	
59	Slovak Republic	78,705	
60	Tunisia	77,151	
61	Sudan	69,224	
62	Belarus	68,475	
63	Syrian Arab Republic	67,078	
64	Dominican Republic	65,315	b
65	Bulgaria	62,693	
66	Croatia	54,157	
67	Guatemala	53,027	b
68	Ethiopia	52,877	b
69	Ecuador	51,681	
70	Uzbekistan	48,993	
71	Ghana	48,522	b
72	Kuwait	47,675	b
73	Lithuania	45,030	
74	Slovenia	41,816	
75	Uganda	41,131	b
76	Costa Rica	40,325	b
77	Nepal	39,615	
78	Democratic Rep. of Congo	39,351	b
79	Oman	38,664	b
80	Kenya	38,141	
81	Cameroon	34,860	
82	Azerbaijan	34,496	
83	El Salvador	34,088	b
84	Angola	33,774	b
85	Cambodia	33,431	b
86	Uruguay	32,402	
87	Luxembourg	31,713	
88	Paraguay	28,960	b
89	Côte d'Ivoire	27,719	
90	Bosnia and Herzegovina	27,492	b
91	Latvia	26,952	
92	Zimbabwe	26,716	
93	Jordan	25,502	
94	Tanzania	25,375	
95	Bolivia	24,501	
96	Mozambique	24,020	b
97	Panama	23,110	
98	Lebanon	20,664	
99	Honduras	20,273	b
100	Guinea	20,061	
101	Chad	19,747	b
102	Estonia	19,635	
103	Nicaragua	19,538	b
104	Senegal	19,502	

105	Cyprus	18,835	
106	Yemen	17,860	
107	Botswana	17,593	
108	Trinidad and Tobago	15,852	
109	Madagascar	15,523	
110	Albania	15,489	
111	Haiti	15,280	b
112	Burkina Faso	14,986	b
113	Namibia	14,905	b
114	Bahrain	14,859	
115	Mauritius	14,844	
116	Papua New Guinea	14,681	b
117	Macedonia	13,422	
118	Mali	13,095	
119	Georgia	12,848	
120	Armenia	12,410	
121	Lao PDR	11,317	
122	Rwanda	11,216	
123	Jamaica	11,010	
124	Zambia	10,827	
125	Niger	10,517	b
126	Kyrgyz Republic	9,856	
127	Iceland	9,654	
128	Togo	9,197	
129	Gabon	9,023	
130	Benin	8,921	
131	Malawi	8,148	
132	Tajikistan	7,726	
133	Malta	7,576	
134	Moldova	7,292	
135	Swaziland	6,314	
136	Mauritania	5,783	b
137	Bahamas, The	5,294	
138	Mongolia	5,169	
139	Fiji	5,100	
140	Burundi	4,932	b
141	Lesotho	4,709	b
142	Central African Republic	4,362	b
143	Eritrea	4,135	b
144	Republic of the Congo	3,798	
145	Guyana	3,330	b
146	Sierra Leone	2,994	
147	Gambia, The	2,942	b
148	Cape Verde	2,836	b
149	Belize	1,907	
150	Djibouti	1,553	b
151	Seychelles	1,393	
152	Comoros	1,143	b
153	Guinea-Bissau	1,112	b
154	St. Lucia	1,035	
155	Samoa	1,031	
156	Antigua and Barbuda	1,008	
157	Grenada	848	
158	Solomon Islands	845	b
159	Tonga	803	b
160	St. Vincent and the Grenadines	758	
161	Vanuatu	633	b
162	St. Kitts and Nevis	578	
163	Dominica	403	

Notes:

a: estimate is based on a bilateral comparison between the People's Republic of China and the United States.

b: estimate is based on regression; other PPP figures are extrapolated from the latest International Comparison Programme benchmark estimates.

c: small discrepancies with figures presented in other tables are due to the use of different sources.

Source:

World Development Indicators database, World Bank, 18 April 2006.

4.2. Corporation categories (used by Fortune and Forbes in 1984, 1989, 1994, 1999 and 2004) grouped by types of activities

type of activities (after grouping categories)	*categories used by Fortune and Forbes*
aerospace & defense	Aerospace Aerospace & Defense
airlines	Air Transport Airlines
banking	Banking Banks Commercial Banks Savings Institutions Thrift Institutions
chemicals	Chemicals Diversified Chemicals Specialized Chemicals
computers	Computers Computers, Office Equipment Computer & Data Services Computer Services and Software Software & Services
electronics & specialized equipment	Electrical Equipment Electronics Electronics, Appliances Electronics, Electrical Equipment Measuring, Scientific, Photographic Equipment Scientific, Photo & Control Equipment Semiconductors Semiconductors & Other Electronic Components Technology Hardware & Equipment
energy & utilities	Energy Electric & Gas Utilities Electric Utilities Natural Gas Utilities Utilities
engineering, construction & real estate	Builders Building Materials Building Materials, Glass Construction Engineering, Construction Glass, Concrete, Abrasives, Gypsum Homebuilders Real Estate Waste Management
financial services	Brokerage Diversified Financials Financial Services Securities
food, beverages & tobacco	Beverages Consumer Food Products Food Food Consumer Products Food, Drink & Tobacco Food Markets

	Food Processors Food Production Food Services Tobacco
forest & paper products	Forest & Paper Products Paper Paper, Fiber & Wood Products
general merchandisers	Food & Drug Stores Furniture General Merchandisers General Retailers Retailing Supermarkets
industrial & farm equipment	Heavy Equipment Industrial & Farm Equipment Industrial Machinery
insurance	Insurance Insurance (diversified) Insurance (mutual) Insurance (stock) Insurance: Life, Health (mutual) Insurance: Life, Health (stock) Insurance: Property & Casualty (mutual) Insurance: Property & Casualty (stock)
land transportation	Shipbuilding, Railroad & Transportation Equipment Marine Services Railroads Surface Transportation Transportation (Bus and Rail) Transportation Equipment Truck Leasing
mail, package & shipping	Mail, Package & Freight Delivery Package & Freight Delivery Packaging Packaging, Containers Shipping Trucking
metals & metal products	Materials Metal Manufacturing Metal Products Metals
mining and oil production & refining	Coal Mining, Crude-Oil Production Oil and Gas Equipment & Services Oil & Gas Operations Oilfield Drillers & Services Petroleum Petroleum Refining Pipelines
motor Vehicles & parts	Automobiles & Trucks Automotive Retailing, Services Automotive Suppliers Motor Vehicles & Equipment Motor Vehicles & Parts
network & telecommunications	Broadcasting Network and Other Communications Equipment Telecommunications

pharmaceuticals, personal & health care	Drugs & Biotechnology Health Care Health Care: Insurance & Managed Care Health Care: Medical Facilities Health Care: Pharmacy, Other Services Health Care Equipment & Services Household and Personal Products Medical Products & Equipment Pharmaceuticals Soaps Soaps, Cosmetics
specialized services	Advertising, Marketing Business Services & Supplies Diversified Outsourcing Human Resources Media (printed) Publishing Publishing, Printing Security Services Temporary Help
specialty products	Apparel Jewelry, Silverware Musical Instruments, Toys, Sporting Goods Specialist Retailers Specialty Retailers Toys, Sporting Goods
tourism & entertainment	Entertainment Hotels, Casinos & Resorts Hotels, Restaurants & Leisure Leisure & Recreation
wholesalers	Trading Trading Companies Wholesalers Wholesalers: Diversified Wholesalers: Electronics & Office Equipment Wholesalers: Food & Grocery Wholesalers: Health Care
other (reassessed and reclassified case by case)	Capital Goods Conglomerates Consumer Durables Consumer Products Diversified Companies Miscellaneous Multicompanies Rubber & Plastic Products Services Textiles Textiles, Vinyl Flooring

Notes: correspondence between classes is provided only for general reference; frequent cases of conflicting or insufficient information were solved based on case by case research.

Sources: Forbes and Fortune magazines.

4.3. Industry share of total employment in classes of metropolitan areas

NAICS code	industry code description	metropolitan area rankings by total number of employees					
		1 to 5	6 to 20	21 to 50	51 to 100	101 to 305	all
11	forestry, fishing, hunting, and agriculture support	0.0%	0.1%	0.1%	0.2%	0.3%	0.1%
21	mining	0.0%	0.2%	0.1%	0.3%	0.6%	0.2%
22	utilities	0.4%	0.5%	0.5%	0.5%	0.6%	0.5%
23	construction	5.4%	5.9%	6.2%	6.2%	6.2%	5.9%
31	manufacturing	9.3%	9.9%	11.1%	12.7%	13.8%	10.9%
42	wholesale trade	6.1%	5.8%	5.3%	4.8%	4.1%	5.4%
44	retail trade	11.7%	12.6%	13.0%	14.2%	15.8%	13.1%
48	transportation and warehousing	3.5%	3.6%	3.9%	3.8%	3.2%	3.6%
51	information	4.0%	3.6%	3.0%	2.6%	2.3%	3.3%
52	financial and insurance	6.5%	6.3%	6.6%	5.5%	4.4%	6.0%
53	real estate and rental & leasing	2.2%	2.0%	1.9%	1.6%	1.6%	1.9%
54	professional, scientific, & technical services	9.8%	7.7%	6.1%	5.4%	4.4%	7.1%
55	management of companies and enterprises	2.9%	3.5%	2.7%	2.2%	1.3%	2.7%
56	administrative & support and waste management & remediation services	7.4%	7.6%	7.3%	6.7%	5.5%	7.1%
61	educational services	3.2%	2.7%	2.3%	2.3%	2.0%	2.6%
62	health care and social assistance	12.9%	12.8%	12.9%	14.8%	16.4%	13.6%
71	arts, entertainment, and recreation	1.8%	1.7%	1.9%	1.5%	1.5%	1.7%
72	accommodation & food services	7.9%	8.8%	10.3%	9.8%	11.1%	9.3%
81	other services (except public administration)	4.8%	4.6%	4.9%	5.0%	4.9%	4.8%
99	unclassified	0.0%	0.1%	0.0%	0.0%	0.1%	0.1%

Sources: U.S. Census Bureau, CenStats Databases.

4.4 Sample of CenStats tables for metropolitan statistical areas

U.S. Census Bureau

2004 MSA Business Patterns (NAICS)

Chicago-Naperville-Joliet, IL-IN-WI Metropolitan Statistical Area Major Industry

CenStats

Amarillo, TX Metropolitan Statistical Area 2004

Go!

Industry Code	Industry Code Description	Number of Employees for week including March 12	Payroll ($1,000)		Total Establishments
			1st Quarter	Annual	
------	Total	4,039,508	42,642,234	173,120,750	235,791
11----	Forestry, Fishing, Hunting, and Agriculture Support	1,781	16,350	77,987	154
21----	Mining	1,651	19,907	116,926	101
22----	Utilities	20,330	470,171	1,661,593	218
23----	Construction	207,690	2,341,957	11,160,974	23,529
31----	Manufacturing	495,326	5,379,805	22,566,365	12,629
42----	Wholesale Trade	265,055	3,681,957	15,025,942	15,978
44----	Retail Trade	458,600	2,501,910	10,509,466	29,984
48----	Transportation and Warehousing	167,811	1,660,528	7,006,394	7,364
51----	Information	100,000 or more	0	0	4,232
52----	Finance and Insurance	279,211	6,426,385	20,584,418	17,403
53----	Real Estate and Rental and Leasing	50,000-99,999	0	0	10,465
54----	Professional, Scientific, and Technical Services	100,000 or more	0	0	32,029
55----	Management of Companies and Enterprises	100,000 or more	0	0	1,705
56----	Administrative and Support and Waste Management and Remediation Services	100,000 or more	0	0	12,220
61----	Educational Services	112,170	902,753	3,824,992	2,628
62----	Health Care and Social Assistance	489,958	4,240,837	18,434,103	21,687
71----	Arts, Entertainment, and Recreation	50,000-99,999	0	0	3,116
72----	Accommodation and Food Services	327,941	1,117,326	4,841,521	17,843
81----	Other Services (except Public Administration)	201,849	1,274,419	5,295,696	21,836
99----	Unclassified	819	3,604	24,811	670

Industry	Industry Code	Total	Number of Establishments by Employment-size class

Code	Description	Estabs	1-4	5-9	10-19	20-49	50-99	100-249	250-499	500-999	1000 or more
------	Total	235,791	129,139	41,323	29,719	21,244	7,869	4,603	1,194	430	270
11----	Forestry, Fishing, Hunting, and Agriculture Support	154	110	26	9	5	1	1	1	1	0
21----	Mining	101	51	14	13	13	8	2	0	0	0
22----	Utilities	218	78	30	26	23	15	22	12	9	3
23----	Construction	23,529	15,414	3,613	2,369	1,439	434	189	59	10	2
31----	Manufacturing	12,629	4,090	2,052	2,127	2,101	1,137	814	214	71	23
42----	Wholesale Trade	15,978	8,414	2,865	2,165	1,558	563	294	78	26	15
44----	Retail Trade	29,984	13,733	6,876	4,466	2,940	1,147	682	117	20	3
48----	Transportation and Warehousing	7,364	4,424	1,002	713	649	280	211	54	18	13
51----	Information	4,232	2,258	611	469	443	233	133	52	28	5
52----	Finance and Insurance	17,403	9,933	3,137	2,158	1,327	430	276	82	34	26
53----	Real Estate and Rental and Leasing	10,465	7,100	1,742	1,019	404	127	56	12	3	2
54----	Professional, Scientific, and Technical Services	32,029	23,051	3,998	2,600	1,531	465	259	71	32	22
55----	Management of Companies and Enterprises	1,705	504	249	217	306	152	152	75	34	16
56----	Administrative and Support and Waste Management and Remediation Services	12,220	7,039	1,704	1,203	1,067	531	421	167	55	33
61----	Educational Services	2,628	1,187	342	378	392	190	77	27	16	19
62----	Health Care and Social Assistance	21,687	10,519	4,801	3,257	1,869	557	471	97	39	77
71----	Arts, Entertainment, and Recreation	3,116	1,767	415	339	340	143	90	9	8	5
72----	Accommodation and Food Services	17,843	6,661	3,090	3,257	3,384	1,110	283	36	16	6
81----	Other Services (except Public Administration)	21,836	12,175	4,726	2,926	1,452	346	170	31	10	0
99----	Unclassified	670	631	30	8	1	0	0	0	0	0

For information on businesses with no paid employees, see Nonemployer Statistics

USCENSUSBUREAU
Helping You Make Informed Decisions

Source: USBC [United States Bureau of Census] online, http://censtats.census.gov/cgi-bin/msanaic/msasect.pl

4.5. VBA routine used to estimate driving times to selected cities

```
Option Explicit

Dim pMXdoc
As IMxDocument
Dim pMap As IMap
Dim pActiveView As IActiveView
Dim pFeatureLayer As IFeatureLayer
Dim pFeatureSelection As IFeatureSelection
Dim pQueryFilter As IQueryFilter

Dim pEnumFeat As IEnumFeature
Dim pFeature As IFeature
Dim pSelection As ISelection
Dim pDisplay As IScreenDisplay
Dim pPolyline As IPolyline
Dim pPoint As IPoint


Private m_ipPoints As esriGeometry.IPointCollection
Private m_ipPathFinder As NetObjVB6.PathFinder

Private Sub UIButtonControl1_Click()

Dim ipMxDoc As IMxDocument
Dim ipMap As IMap
Dim ipLayer As ILayer
Dim ipFeatureLayer As IFeatureLayer
Dim ipFDB As IFeatureDataset

If m_ipPathFinder Is Nothing Then
Set m_ipPathFinder = New NetObjVB6.PathFinder


Set ipMxDoc = ThisDocument
Set ipMap = ipMxDoc.FocusMap

Debug.Assert ipMap.LayerCount > 0
Set ipLayer = ipMap.Layer(1)
Set ipFeatureLayer = ipLayer

Set ipFDB = ipFeatureLayer.FeatureClass.FeatureDataset

Set m_ipPathFinder.Map = ipMap

m_ipPathFinder.OpenFeatureDatasetNetwork ipFDB
```

```
End If

Set pMXdoc = Application.Document
Set pMap = pMXdoc.FocusMap
Set pActiveView = pMap
Set pFeatureLayer = pMap.Layer(0)
Dim pFCursor As IFeatureCursor
Set pFCursor = pFeatureLayer.Search(Nothing, False)
Dim pFeat As IFeature
Set pFeat = pFCursor.NextFeature

Dim pMxApp As IMxApplication
Dim ipNew
As IPoint

Dim ipPolyResult As IPolyline

Dim ipGraphicsContainer As IGraphicsContainer
Dim ipElemet As IElement
Dim pScreenDisplay As IScreenDisplay
Dim ipLineSymbol As ILineSymbol
Dim m_ipClipEnv As esriGeometry.Envelope

Do Until pFeat Is Nothing

Dim pPoint As IPoint 'change to point

Set pPoint = pFeat.Shape

'pPolyline.FromPoint , pPolyline.ToPoint


If m_ipPoints Is Nothing Then
Set m_ipPoints = New
esriGeometry.Multipoint
Set m_ipPathFinder.StopPoints = m_ipPoints
End If

Set pMxApp = Application
'Set ipNew = pMxApp.Display.DisplayTransformation.ToMapPoint(-96.793, 32.804)
'Set ipNew.x = -96.793
'Set ipNew.y = 32.804
Set ipNew = New Point
ipNew.PutCoords -96.793, 32.804

m_ipPoints.AddPoint ipNew
m_ipPoints.AddPoint pPoint
```

```
'Set ipNew = pMxApp.Display.DisplayTransformation.ToMapPoint(x, y)
'm_ipPoints.AddPoint ipNew

m_ipPathFinder.SolvePath "LENGHT"

Set ipPolyResult = m_ipPathFinder.PathPolyLine
Set ipMxDoc = ThisDocument
Set pScreenDisplay = ipMxDoc.ActiveView.ScreenDisplay

Set ipLineSymbol = New CartographicLineSymbol
ipLineSymbol.Width = 5

pScreenDisplay.StartDrawing 0, esriNoScreenCache

pScreenDisplay.SetSymbol ipLineSymbol
pScreenDisplay.DrawPolyline ipPolyResult
Set m_ipClipEnv = pScreenDisplay.ClipEnvelope
pScreenDisplay.FinishDrawing

'MsgBox "Drive Time: " + CStr(m_ipPathFinder.PathCost)


'Dim pArea As IArea
 'Set pArea = pFeat.Shape

pFeat.value(pFeatureLayer.FeatureClass.FindField("TIME")) = m_ipPathFinder.PathCost
 pFeat.Store
Set pFeat = pFCursor.NextFeature
Set m_ipPoints = Nothing
'pStatusBar.StepProgressBar
Loop

End Sub
```

4.6. VBA routine used to identify minimum travel time (road or road and air) and corresponding path between pairs of cities

```
Option Explicit

  Dim pMXdoc As IMxDocument
  Dim pMap As IMap
  Dim pActiveView As IActiveView
  Dim pFeatureLayer As IFeatureLayer
  Dim pFeatureLayer2 As IFeatureLayer
  Dim pFeatureSelection As IFeatureSelection
  Dim pQueryFilter As IQueryFilter

  Dim pEnumFeat As IEnumFeature
  Dim pFeature As IFeature
  Dim pSelection As ISelection
  Dim pDisplay As IScreenDisplay
  Dim pPolyline As IPolyline
  Dim pPoint As IPoint


  Private m_ipPoints As esriGeometry.IPointCollection
  Private m_ipPathFinder As NetObjVB6.PathFinder

Private Sub UIButtonControl1_Click()

  Dim ipMxDoc As IMxDocument
  Dim ipMap As IMap
  Dim ipLayer As ILayer
  Dim ipFeatureLayer As IFeatureLayer
  Dim ipFeatureLayer2 As IFeatureLayer
  Dim ipFDB As IFeatureDataset

  If m_ipPathFinder Is Nothing Then
    Set m_ipPathFinder = New NetObjVB6.PathFinder

    Set ipMxDoc = ThisDocument
    Set ipMap = ipMxDoc.FocusMap

    Debug.Assert ipMap.LayerCount > 0
    Set ipLayer = ipMap.Layer(2)
    Set ipFeatureLayer = ipLayer

    Set ipFDB = ipFeatureLayer.FeatureClass.FeatureDataset

    Set m_ipPathFinder.Map = ipMap
```

```
  m_ipPathFinder.OpenFeatureDatasetNetwork ipFDB

 End If

 Set pMXdoc = Application.Document
 Set pMap = pMXdoc.FocusMap
 Set pActiveView = pMap
 Set pFeatureLayer = pMap.Layer(1)



 Dim pFCursor As IFeatureCursor
 Set pFCursor = pFeatureLayer.Search(Nothing, False)



 Dim pFeat As IFeature
 Set pFeat = pFCursor.NextFeature



 Dim pMxApp As IMxApplication
 Dim ipNew As IPoint

 Dim ipPolyResult As IPolyline

 Dim ipGraphicsContainer As IGraphicsContainer
 Dim ipElemet As IElement
 Dim pScreenDisplay As IScreenDisplay
 Dim ipLineSymbol As ILineSymbol
 Dim m_ipClipEnv As esriGeometry.Envelope

'  Dim pairportLayer As IGeoFeatureLayer
'  Set pairportLayer = pMap.Layer(0)
 Dim dblTime2 As Double

 Dim dblCar As Double

 Dim dblPlane As Double

 Dim Check As Double

 Dim dblMinFlightTime As Double

 Do Until pFeat Is Nothing

 Set pFeatureLayer2 = pMap.Layer(0)
```

```
Dim pFCursor2 As IFeatureCursor
Set pFCursor2 = pFeatureLayer2.Search(Nothing, False)
Dim pFeat2 As IFeature
Set pFeat2 = pFCursor2.NextFeature

    Dim pPoint As IPoint   'cambiar a punto

    Set pPoint = pFeat.Shape

    If m_ipPoints Is Nothing Then
       Set m_ipPoints = New esriGeometry.Multipoint
       Set m_ipPathFinder.StopPoints = m_ipPoints
    End If

    Set ipNew = New Point
    ipNew.PutCoords 1216742.087965, 902669.516513

    m_ipPoints.AddPoint ipNew
    m_ipPoints.AddPoint pPoint
    'Set ipNew = pMxApp.Display.DisplayTransformation.ToMapPoint(x, y)
    'm_ipPoints.AddPoint ipNew

m_ipPathFinder.SolvePath "Tiempo"

dblCar = m_ipPathFinder.PathCost

Set m_ipPoints = Nothing

dblMinFlightTime = 0

Do Until pFeat2 Is Nothing

    dblTime2 = pFeat2.Value(pFeatureLayer2.FeatureClass.FindField("AUS_FLY2"))

    Dim pPoint2 As IPoint

    Set pPoint2 = pFeat2.Shape

    If m_ipPoints Is Nothing Then
       Set m_ipPoints = New esriGeometry.Multipoint
       Set m_ipPathFinder.StopPoints = m_ipPoints
    End If

    m_ipPoints.AddPoint pPoint
    m_ipPoints.AddPoint pPoint2

m_ipPathFinder.SolvePath "Tiempo"
```

```
  dblPlane = m_ipPathFinder.PathCost + dblTime2

  If dblMinFlightTime = 0 Then dblMinFlightTime = dblPlane

  If dblPlane < dblMinFlightTime Then
      dblMinFlightTime = dblPlane
      Check = dblTime2
  End If

    Set pFeat2 = pFCursor2.NextFeature
    Set m_ipPoints = Nothing
    'pStatusBar.StepProgressBar


  Loop

  If dblCar < dblMinFlightTime Then
      pFeat.Value(pFeatureLayer.FeatureClass.FindField("Austin3")) = dblCar
  Else
      pFeat.Value(pFeatureLayer.FeatureClass.FindField("Austin3")) = dblMinFlightTime
  End If

  'pFeat.Value(pFeatureLayer.FeatureClass.FindField("Austin1")) = dblCar

  pFeat.Store

'    Set pFeatureLayer2 = pMap.Layer(0)
'    Set pFCursor2 = pFeatureLayer.Search(Nothing, False)
'    Set pFeat2 = pFCursor2.NextFeature

    Set pFeat = pFCursor.NextFeature
    Set m_ipPoints = Nothing
    'MsgBox dblMinFlightTime & "Check " & Check & "Car" & dblCar

  Loop

End Sub
```

5.1. Measures of the world and USA GDP and corporation sales of the 500 largest corporations, current and chained 2000 dollars (1984-2004)

year	*Top 500 sales*		*world GDP*		*USA GDP*	
	current $	*chained 2000 $*	*current $*	*chained 2000 $*	*current $*	*chained 2000 $*
1984	4,620.8	6,830.0	18,322.6	27,082.4	3,933.2	5,813.6
1989	7,201.5	9,167.2	25,578.0	32,559.7	5,484.4	6,981.4
1994	10,297.5	11,408.9	32,765.8	36,302.2	7,072.2	7,835.5
1999	12,849.4	13,129.3	42,160.1	43,078.5	9,268.4	9,470.3
2004	16,798.1	15,397.2	55,938.2	51,273.1	11,734.3	10,755.7

Note: Sales and GDP expressed in billions of 2000 chained US $.

Sources: United States Bureau of Economic Analysis, World Bank and Maddison (2003).

5.2a. The world's 500 largest corporations by sales, 1984-2004

corporation	*1984*	*1989*	*1994*	*1999*	*2004*
3M					20,011.0
A.P. Møller-Mærsk Group					27,920.7
Aachener & Münchener			10,364.2		
ABB / Asea Brown Boveri		20,442.0	29,718.0	24,681.0	21,886.0
Abbey National			8,772.8	17,113.0	
Abbott Laboratories		5,380.0	9,156.0	13,178.0	20,473.1
ABN-Amro Holding			21,545.6	38,821.0	42,319.0
Accenture					13,673.6
ACS					14,152.9
Adecco				12,294.0	21,441.2
AEG Telefunken	3,870.0				
Aegon Insurance Group		5,542.0	11,325.8	23,866.0	35,463.4
AEON					38,943.6
Aerospatiale Matra		5,736.0	8,946.2	13,992.0	
Aetna	15,411.0	19,671.0	17,524.7	26,453.0	19,904.1
AFLAC					13,281.0
AGF - Assurances Générales de France		6,730.0	16,416.8		
Agricultural Bank of China				14,128.0	15,284.6
Agway	4,101.0				
Ahold (Koninklijke Ahold)		8,051.0	15,928.1	35,798.0	
Air France-KLM Group			11,087.0	10,662.0	24,011.3
Aisin Seiki					17,018.9
Akzo / Akzo Nobel	5,148.0	8,835.0	12,206.9	15,394.0	15,780.8
Albertson's	4,736.0	7,423.0	11,894.6	37,478.0	40,052.0
Alcan	5,467.0	8,839.0	8,325.0		24,885.0
Alcatel (f. Alcatel Alsthom)			30,223.9	24,558.0	15,254.7
Alco Standard	3,497.0				
Alcoa / Aluminium Co. of America	5,751.0	10,910.0	10,391.5	16,446.0	23,960.0
Alfred Toepfer Internationale	4,154.0				
All Nippon Airways			9,203.6	10,864.0	
Alliance Unichem					16,304.7
Allianz	5,800.0	16,932.0	40,415.2	74,178.0	118,937.2
Allied Chemical	10,734.0				
Allied Domecq (Allied Lyons)		6,872.0	8,137.7		
Allied Stores	3,971.0				
Alliedsignal		11,942.0	12,817.0		
Allstate				26,959.0	33,936.0
Almanij				16,243.0	24,401.1
Alstom				16,760.0	17,194.8
Altria Group / Philip Morris	10,138.0	39,011.0	53,776.0	61,751.0	64,440.0
Alusuisse	3,551.0				
Amer Information Technologies	8,347.0				
Amerada Hess	8,277.0	5,589.0			17,126.0
American Brands	5,333.0	7,265.0	8,441.5		
American Broadcasting	3,703.0				
American Can	4,213.0				

American Cyanamid	3,857.0				
American Electric Power	4,952.0				14,357.0
American Express	12,895.0	25,047.0	15,593.0	21,278.0	29,115.0
American Financial		7,286.0			
American General	5,362.0			10,679.0	
American Home Products	4,486.0	6,747.0	8,966.2	13,550.0	
American Hospital Supply	3,449.0				
American International Group	4,281.0	14,150.0	22,385.7	40,656.0	97,987.0
American Motors	4,215.0				
American Natural Resources	3,493.0				
American Stores	12,119.0	22,004.0	18,355.1		
AmerisourceBergen					53,179.0
Ameritech		10,211.0	12,569.5		
Ames Department Stores		5,295.0			
Amoco		23,966.0	26,953.0		
AMP				17,760.0	14,600.8
AMR - American Airlines	5,354.0	10,480.0	16,137.0	20,262.0	18,645.0
Anglo American				11,578.0	24,930.0
Anheuser-Busch	6,501.0	9,481.0	12,053.8	11,704.0	14,934.2
Apple Computer		5,372.0	9,188.7		
Arbed		5,634.0		11,363.0	
Arbed (became part of Arcelor)				10,769.0	
Arcelor					37,531.7
Archer Daniels Midland	4,610.0	7,745.0	11,374.4	14,283.0	36,151.4
AREVA					13,816.9
Argyll Group		6,700.0	9,045.7		
Armco	4,543.0				
Asahi Bank			13,038.8	10,420.0	
Asahi Glass		7,922.0	12,142.5	11,290.0	13,647.8
Asahi Kasei (f. Asahi Chemical)	3,951.0	8,262.0	11,626.3	10,727.0	12,819.0
Asahi Mutual Life	4,250.0		26,505.5	26,246.0	
ASEA Group (became part of Asea Brown	4,364.0				
Ashland Oil	8,267.0	8,017.0	9,505.3		
ASKO Deutsches Kaufhaus			11,417.3		
Assicurazioni Generali	4,200.0	11,629.0	20,764.9	53,723.0	83,267.6
Associated British Foods	3,682.0				
Associated Dry Goods	4,107.0				
Associates First Capital				12,131.0	
AstraZeneca				18,445.0	21,426.0
AT&T	33,188.0	36,112.0	75,094.0	62,391.0	30,537.0
Atlantic Richfield	23,768.0	15,351.0	15,682.0	13,176.0	
Auchan, Groupe				23,494.0	37,370.1
Australia & New Zealand Banking		8,019.0			12,618.4
AutoNation				24,207.0	19,734.1
Aventis				13,438.0	
Aviva					73,025.2
AXA			22,426.1	87,646.0	121,606.3
Axel Johnson	5,032.0				
BAE Systems				11,397.0	16,664.9
Banca Commerciale Italiana			10,386.9		
Banca di Roma			8,968.0		

Banca Intesa				12,391.0	18,155.2
Banca Nazionale del Lavoro	3,982.0		10,311.3		
Banco Bradesco	6,374.0	14,491.0		15,164.0	15,899.0
Banco Central Hispano Americano		9,282.0	8,405.0		
Banco de la Nacion Argentina	4,852.0				
Banco de la Provincia de Buenos Aires	3,607.0				
Banco do Brasil	8,413.0	23,120.0	11,384.6	17,982.0	14,768.5
Banco Itaú	5,151.0	9,812.0			
Banco Nacional de Mexico	4,214.0				
Banespa	4,009.0	9,765.0			
Bank Hapoalim BM	19,562.0				
Bank Leumi le-Israel	12,915.0				
Bank of America [Charlotte]				51,392.0	63,324.0
Bank of Boston		6,844.0			
Bank of China	4,789.0		15,288.5	17,624.0	17,960.4
Bank of Montreal [Montreal]	6,306.0	8,962.0			
Bank of Montreal [Toronto]				11,139.0	
Bank of New York		5,497.0			
Bank of Nova Scotia	4,852.0	7,306.0		11,119.0	12,504.2
Bank of Seoul		6,372.0			
Bank of Tokyo-Mitsubishi	6,289.0	14,246.0	16,988.6	32,624.0	
Bank One				25,986.0	
BankAmerica [San Francisco]	14,397.0	11,389.0	16,531.0		
Bankers Trust NY	4,834.0	7,258.0			
Bankgesellschaft Berlin				12,251.0	
Barclays	12,294.0	25,571.0	20,205.3	21,573.0	39,347.2
Barlow Rand	7,390.0	9,800.0			
BASF	15,293.0	25,328.0	26,927.7	31,438.0	46,686.6
Bass		5,619.0			
BAT Industries	14,908.0	18,199.0	22,094.4		
BATUS	5,669.0				
Baxter International		7,399.0	9,324.0		
Bayer	15,120.0	23,031.0	26,771.1	29,142.0	37,011.9
Bayerische Hypotheken Bank		5,913.0	12,464.7		
Bayerische Landesbank			10,258.9	15,203.0	16,435.1
Bayerische Vereinsbank	3,580.0	6,535.0	14,623.6		
BBC / Brown Boveri	4,772.0				
BBVA - Banco Bilbao Vizcaya Argentaria		7,988.0	9,006.7	14,486.0	21,335.5
BCE / Bell Canada	8,168.0	14,089.0	15,865.0		14,841.5
Beatrice	11,427.0				
Bell Atlantic	8,090.0	11,449.0	13,791.4	33,174.0	
BellSouth	9,519.0	13,996.0	16,844.5	25,224.0	22,729.0
Bergen Brunswig				17,245.0	
Berkshire Hathaway				24,028.0	74,382.0
Bertelsmann		6,717.0	10,915.1	14,811.0	21,163.8
Best Buy				12,494.0	27,433.0
Bethlehem Steel	5,392.0	5,251.0			
Bharat Petroleum					14,436.9
BHP Billiton / Broken Hill Prop.	4,885.0	8,602.0	11,736.9	13,778.0	22,887.0
BICC		6,218.0			
BL	4,545.0				

BMW	5,792.0	14,104.0	25,972.6	36,696.0	55,142.2
BNP / BNP Paribas	11,377.0	21,235.0	10,830.0	40,099.0	68,654.4
Boeing [Chicago]					52,553.0
Boeing [Seattle]	10,354.0	20,276.0	21,924.0	57,993.0	
Boise Cascade	3,817.0				
Bombardier					15,839.0
Bond Corp. Holdings		6,921.0			
Borden	4,568.0	7,593.0			
Borg-Warner	3,916.0				
Bouygues		7,367.0	14,068.4	17,895.0	29,106.5
BP / BP Amoco	50,690.0	48,602.0	50,736.9	83,566.0	285,059.0
Bridgestone		12,242.0	15,608.4	18,343.0	22,350.0
Bristol-Myers / BM Squibb	4,189.0	9,189.0	11,983.6	20,222.0	21,886.0
British Aerospace		14,897.0	10,959.1		
British Airways	3,680.0	7,823.0	11,165.2	14,405.0	14,414.1
British American Tobacco				19,329.0	24,201.3
British Coal		7,596.0			
British Gas	9,585.0	12,908.0	14,858.3		
British National Oil	12,777.0				
British Post Office	4,244.0		9,144.4	12,120.0	
British Railways Board	3,800.0				
British Steel	5,012.0	8,268.0			
BSN	4,772.0	7,628.0			
BT - British Telecom	10,262.0	19,913.0	21,613.3	30,546.0	34,672.7
BTR	4,659.0	11,519.0	14,469.1		
Bunge					25,168.0
Burlington Northern	9,156.0				
Burroughs	4,808.0				
C Itoh	56,967.0	147,016.0			
Cable & Wireless				14,826.0	
Caisse d' Épargne, Groupe				16,219.0	29,174.9
Campbell Soup	3,834.0	6,003.0			
Campeau		10,439.0			
Canadian Imperial Bank of Commerce	5,942.0	9,476.0	8,263.2	13,441.0	12,661.8
Canadian National Railway	3,862.0				
Canadian Pacific	11,300.0	9,308.0			
Canadian Wheat Board	4,111.0				
Canon	3,496.0	9,792.0	18,918.0	23,062.0	32,071.5
Cardinal Health				25,034.0	65,130.6
Caremark Rx					25,801.1
Cariplo	4,089.0		9,554.9		
Carrefour	4,497.0	11,577.0	24,573.0	39,856.0	90,381.7
Carter Hawley Hale	3,833.0				
Casino, Groupe		5,494.0	11,268.1		
Caterpillar	6,576.0	11,126.0	14,328.0	19,702.0	30,251.0
CBS	4,832.0				
CEA-Industrie		5,256.0	9,173.9		
Cendant					19,979.0
Centex					12,859.7
Central Japan Railway			10,911.9	10,971.0	13,114.9
Centrica				11,678.0	33,536.9

CEPSA					15,650.0
CFE					14,465.0
CGNU (Aviva)				41,974.0	
Champion International	5,121.0				
Chase Manhattan	9,881.0	13,904.0	11,187.0	33,710.0	
Chemical Banking	5,857.0	8,227.0	12,685.0		
Chevron	27,830.0	29,443.0	31,064.0	32,676.0	147,967.0
China Construction Bank				13,392.0	19,047.9
China First Automotive Works					13,825.4
China Life Insurance					24,980.6
China Mobile Communications					23,957.6
China National Petroleum	5,722.0			21,254.0	67,723.8
China Southern Power Grid					18,928.8
China Telecommunications				18,485.0	21,561.8
Chinese Petroleum		8,008.0	8,511.5		15,189.5
Chiyoda Mutual Life			14,826.5	13,199.0	
Chori		5,355.0			
Chrysler	19,573.0	34,922.0	52,224.0		
Chubb					13,177.2
Chubu Electric Power	7,174.0	11,973.0	20,523.2	19,467.0	19,849.0
Chugoku Electric Power	3,639.0	6,245.0	10,453.3		
Ciba-Geigy	7,436.0	12,597.0	16,131.8		
Cie. de Suez			19,586.2		
Cie. Générale d'Électricité	8,483.0				
Cie. Générale des Eaux	4,658.0	15,470.0	28,153.1		
CIGNA	14,775.0	15,654.0	18,392.0	20,644.0	18,176.0
Circuit City Group				12,614.0	
Cisco Systems				12,154.0	22,045.0
Citgo Petroleum		15,654.0			
Citigroup / Citicorp	20,494.0	37,970.0	31,650.0	82,005.0	108,276.0
CNP Assurances			13,710.1	26,803.0	36,942.9
Co op AG	3,635.0	6,577.0			
Coastal	6,260.0	8,271.0	10,012.7		
Coca-Cola Enterprises				14,406.0	18,158.0
Coca-Cola	7,364.0	8,966.0	16,172.0	19,805.0	21,962.0
COFCO			10,985.9	12,099.0	14,189.4
Coles Myer	4,915.0	11,382.0	11,089.6	14,538.0	23,184.4
Colgate-Palmolive	4,910.0				
Columbia / HCA Healthcare			11,132.0	16,657.0	
Columbia Gas System	4,593.0				
Comcast					20,307.0
Commercial Union	3,979.0	6,156.0	11,247.1		
Commerzbank	3,854.0	8,264.0	14,074.2	26,221.0	18,463.6
Commonwealth Bank of Australia					15,083.9
Commonwealth Edison	4,930.0	5,751.0			
Compaq Computer			10,866.0	38,525.0	
Compass					21,103.8
Computer Sciences					15,849.1
ConAgra Foods	4,777.0	14,467.0	23,512.2	24,594.0	18,178.7
ConocoPhillips				20,817.0	121,663.0
Consolidated Edison	5,729.0	5,551.0			

Consolidated Foods	7,000.0				
Consolidated Natural Gas	3,519.0				
Constellation Energy					12,549.7
Continental Corp	4,641.0	6,079.0			
Continental Illinois	4,091.0				
Continental					15,668.2
Control Data	5,027.0				
Coop (France)	3,558.0				
Coop Suisse	3,490.0				
Corus				11,795.0	17,099.2
Cosmo Oil		10,712.0	12,241.4	10,266.0	15,296.5
Costco Wholesale				27,456.0	48,107.0
Countrywide Financial					14,050.7
CPC International	4,373.0				
Crédit Agricole	7,680.0		27,753.1	32,924.0	59,053.8
Crédit Commercial		6,229.0	9,274.0		
Crédit Lyonnais	10,884.0	24,003.0	26,388.1	16,838.0	
CRH					15,273.5
CS - Credit Suisse		7,115.0	20,031.5	49,362.0	58,825.0
CSX	7,934.0	7,745.0	9,608.0	10,811.0	
CVS				18,098.0	30,594.3
Daewoo Corp.	7,938.0	19,981.0	35,706.6	18,619.0	
Dai Nippon Printing		7,492.0	12,008.1	11,556.0	13,258.6
Daido Life			13,589.2	12,874.0	
Daiei	5,981.0	15,561.0	32,062.3	25,320.0	17,020.5
Daihatsu Motor		5,364.0	8,174.3		
Daihyaku Mutual Life Ins.			8,480.3		
Dai-ichi Kangyo Bank	7,729.0	29,628.0	26,500.2	18,065.0	
Dai-ichi Mutual Life Insurance			54,900.4	55,105.0	44,468.8
Daikyo Oil	4,900.0				
Daimaru		5,759.0			
DaimlerChrysler / Daimler Benz	15,286.0	40,633.0	64,168.6	159,986.0	176,687.5
Dainippon Ink & Chemicals		5,622.0	8,553.5		
Daiwa Bank		6,530.0	11,505.6		
Daiwa House Industry			9,871.8		12,709.4
Daiwa Securities		6,371.0			
Dalgety	5,377.0	8,161.0			
Dana	3,575.0			13,353.0	
Danone, Groupe			13,849.7	14,179.0	17,039.5
Danske Bank Group					12,890.3
Dart & Kraft	9,759.0				
Dayton Hudson	8,009.0	13,644.0	21,311.0		
DDI				13,705.0	
Deere	4,275.0	7,488.0	9,029.8	11,751.0	19,986.1
Degussa	4,041.0	7,675.0	8,591.0		
Delhaize Group (Delhaize le Lion)		6,598.0	11,564.7	15,562.0	22,793.0
Dell / Dell Computer				25,265.0	49,205.0
Delphi Automotive Systems				29,192.0	28,700.0
Delta Air Lines	4,459.0	8,572.0	12,359.0	14,711.0	15,002.0
Denso				16,915.0	26,052.7
Dentsu			12,306.7	14,368.0	

Deutsche Bahn	9,585.0		20,008.6	16,672.0	29,803.0
Deutsche Bank	6,988.0	15,745.0	33,069.2	58,585.0	55,669.5
Deutsche Post	17,500.0		17,633.6	25,101.0	55,388.4
Deutsche Telekom			41,071.2	37,835.0	71,988.9
Dexia Group				14,937.0	20,292.0
DG Bank			10,227.5	12,346.0	
Diageo				16,309.0	
Diamond Shamrock	4,483.0				
Digital Equipment	6,230.0	12,937.0	13,450.8		
Dior (Christian Dior)					16,418.9
Docks de France			8,344.7		
Dominion Resources					13,980.0
Dow Chemical	11,418.0	17,600.0	20,015.0	18,929.0	40,161.0
Dresdner Bank	5,192.0	10,299.0	17,321.0	23,209.0	
Dresser Industries	3,841.0				
Duke Energy				21,742.0	22,779.0
DuPont / E.I. DuPont de Nemours	35,999.0	35,099.0	34,968.0	27,892.0	27,995.0
Dynegy				15,430.0	
DZ Bank					32,261.9
E.On (formerly VEBA Group)			40,071.9	52,228.0	55,652.1
EADS					39,503.1
East Japan Railway			24,643.4	22,479.0	23,610.5
Eastern Airlines	4,364.0				
Eastman Kodak	10,600.0	18,398.0	16,862.0	14,089.0	13,829.0
Eaton	3,510.0				
Edeka Zentrale	3,819.0		9,481.2		14,418.5
El Paso Energy				10,581.0	
Elders IXL	4,804.0	10,338.0			
Électricité de France	13,395.0	22,570.0	33,466.6	34,147.0	58,367.2
Electricity Council	14,272.0				
Electrolux	4,228.0	13,169.0	13,999.9	14,914.0	16,424.9
Electronic Data Systems		5,467.0		18,534.0	21,033.0
Elf Aquitaine	20,294.0	23,510.0	39,459.1	37,918.0	
Eli Lilly				10,003.0	13,857.9
Emerson Electric	4,321.0	6,998.0	8,607.2	14,270.0	15,615.0
EnCana					12,433.0
Endesa				14,376.0	21,969.8
ENEL	11,468.0		21,840.3	22,320.0	45,530.4
ENI - Ente Nazionali Idrocarburi	25,810.0	27,119.0	32,565.9	34,091.0	74,227.7
EniMont (Enichen Montedison)		11,185.0			
Enron		9,836.0	8,983.7	40,112.0	
Enserch	3,545.0				
Eurohypo					13,952.5
Exelon					14,515.0
Express Scripts					15,114.7
Exxon	90,854.0	86,656.0			
Exxon Mobil			101,459.0	163,881.0	270,772.0
Fannie Mae				36,969.0	
Farmland Industries	5,238.0			10,709.0	
Federal Express		6,769.0	8,479.5		
Federal Natl. Mortgage Association	9,084.0	11,557.0	18,572.4		

Federated Department Stores	9,672.0		8,315.9	17,716.0	15,630.0
FedEx				16,773.0	24,710.0
Ferruzzi Financiaria (to Montedison)	5,000.0	12,076.0	14,889.8		
Fiat	13,553.0	38,044.0	40,851.4	51,332.0	59,972.9
Firestone	3,966.0				
First Chicago	4,526.0	5,551.0			
First Interstate Bancorp	4,965.0	6,535.0			
First Union				22,084.0	
FirstEnergy					12,949.0
FleetBoston				20,026.0	
Fleming	5,512.0	12,045.0	15,753.5	14,646.0	
Fletcher Challenge		6,528.0			
Flextronics International					15,908.2
Fluor	4,211.0	6,733.0	8,556.3	12,417.0	
Foncière Euris				17,475.0	29,666.2
Ford Motor	52,366.0	96,146.0	128,439.0	162,558.0	172,233.0
Fortis			19,306.3	43,660.0	75,518.1
Fortum					14,508.5
FPL Group	3,941.0	6,180.0			
France Télécom			25,706.3	29,049.0	58,652.1
Franz Haniel	4,645.0		12,158.4	17,330.0	30,244.5
Freddie Mac				24,268.0	32,564.0
Friedrich Flick	3,695.0				
Friedrich Krupp	6,408.0	9,402.0	12,569.2		
Fuji Bank	7,352.0	22,353.0	30,103.3	27,816.0	
Fuji Electric		5,384.0	8,620.4		
Fuji Heavy Industries			11,106.7	11,946.0	13,459.2
Fuji Photo Film		6,902.0	10,274.5	12,589.0	23,516.4
Fujitsu	5,119.0	17,852.0	32,795.1	47,196.0	44,316.0
Fukoku Mutual Life Ins.			9,569.4		
Furukawa Electric		5,567.0			
GAN		13,589.0	23,667.8		
Gap				11,635.0	16,267.0
Gasunie					15,117.2
Gaz de France	5,469.0		8,498.2		22,548.2
GEC / General Electric (UK)	7,867.0	10,396.0	9,089.9		
GEDELFI	6,324.0				
Gehe			9,367.0	14,076.0	
Gencor - General Mining Union	3,614.0				
General Accident		6,297.0	9,545.4		
General Dynamics [St. Louis]	7,839.0	10,043.0			
General Dynamics [Washington]					19,552.0
General Electric	27,947.0	54,574.0	64,687.0	111,630.0	152,866.0
General Foods	8,915.0				
General Mills	5,649.0	6,180.0	8,516.9		
General Motors	83,890.0	126,932.0	154,951.2	176,558.0	193,517.0
Generale Bank		7,373.0	8,426.8		
George Weston	6,373.0	8,834.0	9,519.0	14,034.0	23,015.4
Georgia-Pacific	6,682.0	10,171.0	12,738.0	17,796.0	19,876.0
GIB		5,634.0			
Glaxo Wellcome			8,465.8		

GlaxoSmithKline				13,738.0	37,304.2
Goldman Sachs Group				25,363.0	29,839.0
Goodyear Tire & Rubber	10,241.0	10,869.0	12,288.2	12,881.0	18,370.4
Grand Metropolitan	6,190.0	11,552.0	11,217.6		
Great Atlantic & Pacific Tea	5,878.0	11,148.0	10,332.0	10,151.0	
Groupama				17,655.0	20,237.2
Grupo Financiero Bancomer			8,046.0		
GTE	14,547.0	17,424.0	19,944.3	25,336.0	
Guardian Royal Exchange		5,437.0			
Gulf & Western Industries	5,596.0				
GUS					14,366.1
Gutehoffnungshütte	6,203.0				
Halifax (H. Buildings Society)			8,259.5	14,456.0	
Halliburton [Dallas]	5,446.0	5,661.0		14,898.0	
Halliburton [Houston]					20,466.0
Hanson		8,678.0	13,224.2		
Hanwa		5,405.0			
Hanwha					15,406.3
Hartford Financial Services				13,528.0	22,693.0
Harvest States	3,569.0				
HBOS					47,755.7
HCA				16,657.0	23,502.0
Heineken					12,443.8
Henkel		6,191.0	8,674.4	12,119.0	13,173.9
Hewlett-Packard	6,297.0	12,345.0	24,991.0	48,253.0	79,905.0
Hillsdown Holdings		6,047.0			
Hilton Group					21,792.5
Hindustan Petroleum					14,114.9
Hitachi	20,530.0	49,557.0	76,430.9	71,859.0	83,993.9
HJ Heinz	4,088.0	6,022.0			
Hochteif					15,066.3
Hoechst	14,567.0	24,413.0	30,604.2		
Hoesch		5,680.0			
Home Depot			12,476.7	38,434.0	73,094.0
Hon Hai Precision Industry					16,239.5
Honda Motor	10,985.0	26,976.0	39,927.2	54,773.0	80,486.6
Honeywell		7,241.0			
Honeywell Intl.	6,074.0	6,059.0		23,735.0	25,601.0
Hospital Corporation	3,499.0				
Household International	8,322.0				
Houston Industries	4,182.0				
HSBC Holdings			21,146.0	39,348.0	72,550.0
Hudson's Bay	3,710.0				
Humana				10,113.0	13,104.3
Hutchison Whampoa					17,280.8
HVB Group (Hypovereinsbank)				31,868.0	27,140.1
Hyundai	10,303.0	8,493.0	15,939.8	31,669.0	
Hyundai Motor		5,870.0	11,571.8	20,566.0	46,358.2
Iberdrola					12,828.8
IBM - Intl. Business Machines	45,937.0	62,710.0	64,052.0	87,548.0	96,293.0
IBP			12,075.4	14,075.0	

IC Industries	4,224.0				
IDB Bankholding	6,721.0				
Idemitsu Kosan	10,663.0	11,249.0	14,371.8	15,636.0	21,434.9
IEL – Industrial Equity Ltd		6,091.0			
Imperial Chemical Inds.	13,241.0	21,595.0	14,078.4	13,672.0	
Inchcape			9,348.2		
Indian Oil	10,045.0	10,610.0	8,235.7	18,729.0	29,643.2
Industrial & Commercial Bank of China				20,130.0	23,444.6
Industrial Bank of Japan	5,960.0	18,093.0	31,072.3	26,940.0	
ING Group (Int'l Nederlanden Group)			26,926.3	62,492.0	105,886.4
Ingram Micro				28,069.0	25,462.1
INH - Inst. Nacional de Hidrocarburos	8,224.0				
INI	11,197.0	15,277.0	20,339.9		
Intel			11,521.0	29,389.0	34,209.0
International Harvester	3,548.0				
International Paper	4,716.0	11,378.0	14,966.0	24,573.0	26,722.0
InterNorth	7,510.0				
Invensys				14,557.0	
IRI	23,365.0	49,077.0	45,388.5	23,945.0	
Ishikawajima-Harima	4,450.0	6,128.0	10,300.5		
Istituto Banc. San Paolo			13,451.0		
Isuzu Motors		9,911.0	15,385.4	13,531.0	13,897.2
Itochu			167,824.7	109,069.0	18,527.9
Itoman		5,775.0			
Ito-Yokado	4,379.0	11,810.0	28,631.5	28,671.0	33,631.9
ITT - International Telephone & Telegraph	19,285.0	20,054.0	23,767.0		
J Sainsbury	3,767.0	11,206.0	17,668.0	26,218.0	28,427.8
James River of Virginia		6,071.0			
Japan Airlines	3,513.0	8,514.0	13,574.4	14,356.0	19,817.8
Japan Energy			15,434.3	13,433.0	
Japan Post			18,174.6	17,497.0	18,006.4
Japan Tobacco		7,769.0	16,961.1	19,486.0	18,739.0
Japan Travel Bureau			14,749.1	11,634.0	
Jardine Matheson			9,558.8	10,675.0	
JC Penney [Dallas]		16,103.0	21,082.0	32,510.0	25,678.0
JC Penney [New York]	13,451.0				
JFE Holdings					26,087.6
Johnson & Johnson	6,125.0	9,757.0	15,734.0	27,471.0	47,348.0
Johnson Controls				16,139.0	26,553.4
JP Morgan Chase & Co.	6,562.0	10,394.0	11,915.0	18,110.0	56,931.0
Jusco	3,456.0	9,586.0	19,903.9	22,451.0	
K mart	21,096.0	29,792.0	34,313.0	35,925.0	19,701.0
Kaiser Aluminum & Chemical	3,478.0				
Kajima	4,380.0	11,062.0	21,045.3	15,518.0	15,700.6
Kanematsu / Kanematsu-Gosho	15,838.0	39,219.0	55,856.1	12,644.0	
Kansai Electric Power	8,593.0	14,563.0	25,585.3	23,246.0	24,317.7
Karstadt Quelle	3,789.0	6,893.0	14,909.5	15,833.0	17,782.2
Kaufhof		6,924.0	13,618.3		
Kawasaki Heavy Industries	3,471.0	6,830.0	10,776.1	10,325.0	
Kawasaki Steel	4,621.0	8,896.0	11,564.6	11,293.0	
Kawasho	6,627.0	11,079.0	14,053.2	11,488.0	

KBC Bankassurance				13,062.0	
KDDI					27,170.1
Kerr-McGee	3,537.0				
Kesko		6,882.0			
KF / Konsum Coop	4,164.0				
KFW Bankengruppe					15,218.9
Kimberly-Clark [Appleton]	3,616.0				
Kimberly-Clark [Dallas]		5,734.0		13,007.0	15,400.9
Kingfisher				17,602.0	14,060.9
Kinki Nippon Railway		5,699.0	9,285.8	10,256.0	
Kirin Brewery			9,019.9		
Kloeckner & Co	6,061.0				
Kobe Steel	5,470.0	9,745.0	13,445.2	11,249.0	13,433.8
Koç Holding		6,415.0	8,212.3		15,578.8
Komatsu		6,210.0	9,250.6		13,350.3
Koor Industries	5,881.0				
Korea Electric Power	3,950.0		10,985.8	12,899.0	20,914.2
Kroger	15,923.0	18,832.0	22,959.1	45,352.0	56,434.4
KT					14,901.1
Kubota		5,748.0	10,207.6		
Kumagai Gumi		7,912.0	9,330.8		
Kuwait Petroleum	14,997.0	11,796.0			
Kyobo Life Insurance				10,899.0	
Kyoei Life			12,174.4	11,129.0	
Kyowa Bank		6,407.0			
Kyushu Electric Power	4,418.0	8,100.0	13,707.6	12,830.0	13,107.8
Ladbroke		6,000.0			
Lafarge				11,230.0	17,954.9
Lagardère Groupe			10,021.4	13,104.0	17,384.3
Landesbank Baden-Württemberg				16,458.0	20,807.5
Lear				12,428.0	16,960.0
Leclerc	5,205.0				
Legal & General Group		5,980.0	8,457.0	16,443.0	21,769.8
Lehman Brothers Hldgs.			9,190.0	18,989.0	21,250.0
LG Electronics / Lucky-Gold Star	8,966.0		9,351.0	15,021.0	37,757.5
LG International				15,178.0	
Liberty Mutual Ins. Group			8,985.5	15,499.0	19,754.0
Lincoln National	4,345.0	8,081.0			
Litton Industries	4,652.0				
Lloyds TSB Group	7,591.0	15,459.0	10,514.8	22,837.0	28,925.0
LM Ericsson	3,551.0	6,127.0	10,930.7	26,052.0	17,966.1
Lockheed	8,113.0	9,891.0	13,130.0		
Lockheed Martin				25,530.0	35,526.0
Loews	5,221.0	11,113.0	13,515.2	20,953.0	14,584.2
Long-Term Credit Bank	4,693.0	12,762.0	24,605.1		
Lonrho Group		6,103.0			
L'Oréal			8,586.0	11,451.0	18,076.7
Lowe's				15,906.0	36,464.0
LTV	7,046.0	6,362.0			
Lucent Technologies				38,303.0	
Lucky Stores	9,237.0				

Lufthansa Group	3,619.0	6,944.0	11,613.3	13,630.0	21,100.4
Lukoil				10,781.0	28,810.0
Lyondell Petrochemicals		5,358.0			
Lyonnaise des Eaux		8,661.0	19,126.3		
Magna International					20,653.0
MAN Group		9,188.0	10,760.5	15,007.0	18,590.5
Mannesmann	5,539.0	11,877.0	18,741.9	24,816.0	
Manpower					14,930.0
Manufacturers Hanover	8,315.0	8,300.0			
Manulife Financial					20,855.4
Marathon Oil					45,444.0
Marks & Spencer	4,037.0	9,068.0	10,588.8	13,206.0	14,652.6
Marriott International	3,525.0	7,536.0	8,415.0		
Martin Marietta	3,920.0	5,796.0	9,873.7		
Marubeni	50,859.0	131,419.0	150,187.4	91,807.0	28,273.7
Maruha			9,615.0		
Maruzen Oil	7,151.0				
Masco					12,431.0
Massachusetts Mutual Life Ins.					23,159.2
Matsushita Electric Industrial	19,969.0	42,030.0	69,946.7	65,556.0	81,077.7
Matsushita Electric Works		6,545.0	10,236.3	10,504.0	
May Department Stores	4,762.0	9,602.0	12,223.0	14,224.0	14,441.0
Mazda Motor	6,490.0	16,804.0	22,188.8	19,413.0	25,081.4
McDonald's		6,066.0	8,320.8	13,259.0	19,064.7
McDonnell Douglas	9,663.0	14,589.0	13,176.0		
MCI Wld Communications		6,471.0	13,338.0	37,120.0	22,615.0
McKesson	4,736.0	7,578.0	13,189.1	37,101.0	80,514.6
Medco Health Solutions					35,351.9
Mediceo Holdings					15,499.9
Meiji Yasuda Life Insurance	5,020.0		36,343.7	33,967.0	38,835.1
Melville	4,424.0	7,554.0	11,285.6		
Merck	3,560.0	6,551.0	14,969.8	32,714.0	22,938.6
Merrill Lynch	5,911.0	11,335.0	18,233.1	34,879.0	32,467.0
Metallgesellschaft	3,811.0	10,758.0	12,367.3		
MetLife			22,257.9	25,426.0	39,535.0
Metro	3,500.0			46,664.0	70,159.3
Michelin	4,942.0	8,669.0	12,120.3	15,138.0	20,148.2
Microsoft				19,747.0	36,835.0
MidCon	4,186.0				
Midland Bank	10,301.0	14,882.0			
Migros	4,302.0		11,799.1	12,444.0	16,338.4
Millea Holdings					26,978.7
Minnesota Mining & Manufacturing	7,705.0	11,990.0	15,079.0	15,659.0	
Mitsubishi	66,919.0	129,689.0	175,835.6	117,766.0	32,735.0
Mitsubishi Bank	6,739.0	27,019.0	29,990.9		
Mitsubishi Chemical / M. Kasei	4,824.0	8,649.0	13,491.4	14,998.0	20,372.3
Mitsubishi Electric	7,365.0	20,839.0	32,726.4	33,896.0	31,735.4
Mitsubishi Heavy Industries	14,088.0	15,963.0	28,676.0	25,821.0	24,106.0
Mitsubishi Materials			11,589.7		
Mitsubishi Metal		5,525.0			
Mitsubishi Motors		17,043.0	34,369.9	29,951.0	19,750.4

Mitsubishi Oil	5,395.0	5,317.0	8,540.4		
Mitsubishi Tokyo Financial Group			11,271.1		24,457.5
Mitsubishi Trust		10,956.0			
Mitsubishi Trust & Bank			9,795.0		
Mitsui	68,464.0	136,578.0	171,490.5	118,555.0	32,805.9
Mitsui Fudosan			12,504.7	10,731.0	
Mitsui Marine & Fire Ins.			9,302.5		
Mitsui Mutual Life	3,502.0		21,738.8	22,224.0	
Mitsui Real Estate		7,422.0			
Mitsui Sumitomo Insurance					18,813.3
Mitsui Taiyo Kobe		14,749.0			
Mitsui Trust & Banking	4,786.0	10,579.0	10,561.9		
Mitsukoshi		7,081.0	10,115.3		
Mittal Steel					22,197.0
Mizuho Financial Group					28,278.7
Mobil [New York]	56,047.0	50,220.0			
Mobil [Washington]			59,621.0		
Monsanto	6,691.0	8,681.0	8,272.0	10,126.0	
Monte dei Paschi di Siena	3,700.0		8,055.7		
Montedison (to Compart)	7,047.0			12,786.0	
Montgomery Ward	6,495.0				
Morgan Stanley		5,831.0	9,376.0	33,928.0	39,549.0
Motorola	5,534.0	9,620.0	22,245.0	30,931.0	35,349.0
Münchener Rückversicherungs	3,678.0	6,935.0	19,513.5	35,604.0	
Munich Re Group				38,400.0	60,705.5
Mycal				16,504.0	
Nabisco Brands	6,253.0				
National Australia Bank		7,464.0		12,487.0	21,313.9
National Coal Board	6,955.0				
National Grid Transco					15,720.2
National Intergroup	5,663.0				
National Iranian Oil	16,000.0				
National Westminster Bank	11,063.0	24,067.0	20,058.2	19,481.0	
Nationale Nederlanden	4,640.0	10,264.0			
Nationsbank Corp.			13,126.0		
Nationwide			11,183.1	13,555.0	20,558.0
NCNB		6,152.0			
NCR	4,074.0	5,956.0			
NEC	7,454.0	24,113.0	37,945.9	44,828.0	45,175.5
Neste	5,360.0	8,124.0	9,500.9		
Nestlé	13,253.0	29,341.0	41,625.7	49,694.0	69,825.7
New York Life Insurance			12,066.6	21,679.0	27,175.5
News Corp.		6,430.0	8,040.0	13,715.0	20,802.0
Nextel Communications					13,368.0
Nichii	3,657.0	7,862.0	14,781.3		
Nichimen	15,765.0	42,989.0	56,202.6	25,703.0	
Nippon Credit Bank		7,559.0	13,216.2		
Nippon Dantai Life Ins.			8,445.1		
Nippon Denso	3,494.0	9,444.0	13,818.8		
Nippon Express	4,112.0	9,592.0	16,985.4	14,709.0	16,314.0
Nippon Kokan	5,960.0				

Nippon Life Insurance	14,782.0		75,350.4	78,515.0	60,520.8
Nippon Mining Holdings	5,561.0	6,728.0			18,817.0
Nippon Mitsubishi				24,215.0	
Nippon Oil	14,779.0	14,226.0	21,988.3		34,150.7
Nippon Paper Industries			9,958.3		
Nippon Steel	11,989.0	20,543.0	29,003.8	24,074.0	31,536.9
Nippon Telegraph & Telephone	19,038.0	42,166.0	70,843.6	93,592.0	100,545.3
Nippon Yusen			8,735.2		14,944.3
Nissan Motor	18,228.0	39,525.0	58,731.8	53,680.0	79,799.6
Nissho Iwai	35,133.0	108,118.0	100,875.5	65,393.0	
Nittetsu Shoji			10,471.9		
NKK		10,759.0	18,140.6	15,136.0	
Nokia		5,312.0		21,090.0	36,401.2
Nomura Securities		8,199.0		10,222.0	
Noranda		7,735.0			
Nordea Bank					13,580.6
Norfolk Southern	3,525.0				
Norinchukin Bank	5,260.0		21,216.0	15,396.0	
Norsk Hydro	4,356.0	9,602.0	10,113.8	13,130.0	24,552.9
Nortel Networks				21,287.0	
Northern Telecom		6,106.0			
Northrop / Northrop Grumman	3,688.0	5,248.0			29,868.0
Northwestern Mutual			9,581.4	15,306.0	17,806.3
Norwich Union				19,698.0	
Novartis				21,609.0	28,247.0
NV - Naamloze Vennootschap DSM	7,034.0				
NV - Nederlandse Gasunie	9,475.0				
NWA - Northwest Airlines		6,554.0	9,142.9	10,276.0	
Nynex	9,507.0	13,211.0	13,306.6		
OAO Gazprom				12,300.0	35,089.5
Obayashi		7,399.0	14,315.0	10,167.0	13,069.7
Occidental Petroleum	15,586.0	20,068.0	9,416.0		
Office Depot				10,263.0	13,564.7
OfficeMax					13,270.2
OIAG - Oesterreichische Industrie	9,640.0				
Oil & Natural Gas					13,751.7
Oji Paper				10,826.0	
Old Mutual				14,550.0	20,892.1
Olivetti		6,582.0		30,088.0	
Onex				10,008.0	13,614.8
Österreichische Post			36,766.0		
Otto Group (f. Otto Versand)			10,488.3	14,291.0	18,870.3
Owens-Illinois	3,543.0				
Pacific Enterprises		6,762.0			
Pacific Gas & Electric	7,830.0	8,588.0	10,447.4		
Pacific Lighting	4,782.0				
Pacific Telesis Group	7,824.0	9,593.0	9,494.0		
Pan Am	3,685.0				
Paramount Communications		5,941.0			
Paribas (to BNP)	7,528.0	14,316.0	19,326.6		
PDVSA (Petroleos de Venezuela)	13,597.0	13,677.0	22,157.0	32,648.0	

Pechiney / Pechiney Ugine Kuhlmann	4,065.0	13,867.0	12,907.1	10,141.0	
Pemex / Petróleos Mexicanos	22,225.0	15,258.0	28,194.7	25,783.0	63,690.5
Peninsular & Oriental	5,555.0	7,507.0	9,176.7		
PepsiCo	7,699.0	15,242.0	28,472.4	20,367.0	29,261.0
Petro Canada	3,769.0				
Petrobrás / Petróleo Brasileiro	17,094.0	16,360.0	17,353.1	16,351.0	36,987.7
Petrofina	8,656.0	11,268.0	11,399.1		
Petronas				14,944.0	36,064.8
Peugeot	10,424.0	23,981.0	30,112.3	40,328.0	70,641.9
Pfizer	3,855.0	5,672.0	8,281.3	16,204.0	52,921.0
PG&E Corp.				20,820.0	
Pharmacia				10,126.0	
Phibro-Salomon	28,911.0				
Philips Electronics	16,768.0	26,972.0	33,516.7		
Phillips Petroleum	15,537.0	12,384.0	12,367.0	13,852.0	
Pillsbury	4,534.0				
Pinault-Printemps, Groupe			12,763.6	20,144.0	30,114.8
Pirelli	3,943.0	7,007.0			
Plains All Amer. Pipeline					20,975.5
Pohang Iron & Steel		6,472.0	9,064.1	10,684.0	
POSCO					20,929.1
Poste (PTT-France)	15,560.0			16,313.0	23,229.7
Power Corp. of Canada					18,683.8
PPG Industries	4,242.0	5,734.0			
Premcor					15,334.8
Preussag	4,826.0	8,700.0	14,864.0	19,280.0	
Price / Costco			16,480.6		
Primerica		5,695.0			
Procter & Gamble	13,394.0	22,605.0	30,296.0	38,125.0	51,407.0
Progressive					13,782.1
Promodès		8,128.0	17,143.5		
Prudential Financial / Prudential of America			36,945.7	26,618.0	28,348.0
Prudential (UK)	4,820.0	13,070.0	18,236.6	42,220.0	47,055.8
PTT Suisses			10,188.8		
PTT (Thailand)					16,023.3
Public Service Electric & Gas	4,196.0				
Publix Super Markets			8,742.5	13,069.0	18,686.4
Quaker Oats	3,496.0	5,729.0			
Qwest Communications					13,809.0
Rabobank			10,991.6	22,374.0	28,513.2
RAG				14,541.0	23,254.9
Rallye				16,554.0	
Ralston Purina	5,231.0	6,858.0			
Raytheon	5,996.0	8,796.0	10,012.9	19,841.0	20,245.0
RCA	10,112.0				
Reliance Industries					14,841.0
Reliant Energy				15,303.0	
Renault	13,455.0	27,457.0	32,188.0	40,099.0	50,639.7
Repsol YPF		9,750.0	17,716.9	28,048.0	44,857.5
REWE	8,253.0				
Reynolds Metals	3,728.0	6,143.0			

RH Macy	4,295.0				
Rhône-Poulenc	5,858.0	11,452.0	15,559.5		
Ricoh		5,846.0	10,271.3	12,997.0	16,879.7
Rio Tinto-Zinc (RTZ)	7,949.0	7,923.0			
Rite Aid				12,732.0	16,816.4
RJ Reynolds / RJR Nabisco		15,224.0	15,366.0	11,394.0	
RJR / RJ Reynolds	9,915.0				
Robert Bosch	6,455.0	16,263.0	21,257.8	29,727.0	49,759.2
Roche Group	3,518.0	6,370.0		18,349.0	25,166.3
Roche Holding		5,999.0	10,790.2		
Rockwell International [Los Angeles]		12,534.0	11,204.7		
Rockwell International [Pittsburgh]	9,658.0				
Royal & Sun Alliance				26,018.0	16,536.7
Royal Ahold					64,675.6
Royal Bank of Canada [Montreal]	7,584.0	11,111.0	9,899.0	13,146.0	
Royal Bank of Canada [Toronto]					19,103.8
Royal Bank of Scotland		5,485.0		12,174.0	59,750.0
Royal Dutch / Shell Group	84,912.0	85,536.0	94,881.3	105,366.0	268,690.0
Royal Insurance Holdings	3,961.0	9,004.0	8,458.7		
Royal KPN					14,828.1
Royal Mail Holdings					16,522.8
Royal Philips Electronics				33,557.0	37,709.6
Royal PTT Nederland			10,051.7		
Ruhrgas	5,383.0				
Ruhrkohle	7,876.0	12,422.0	15,722.0		
RWE	9,972.0	20,995.0	28,628.3	38,358.0	50,951.9
S&W Berisford Plc. (now Enodis Plc)	7,983.0				
Saab - Scania		6,965.0			
Saatchi & Saatchi		7,379.0			
Sabic					18,329.4
Sacilor	4,336.0				
Safeway (UK)				12,342.0	
Safeway (US)	19,642.0	14,325.0	15,626.6	28,860.0	35,822.9
Saint-Gobain	7,018.0	10,360.0	13,430.3	24,482.0	39,831.5
Saitama Bank		6,203.0			
Sakura Bank			26,069.0	19,373.0	
Salomon		8,999.0			
Salzgitter		5,747.0			
Samsung Electronics		35,189.0	14,577.6	26,991.0	71,555.9
Samsung Life Insurance				17,575.0	22,347.9
Samsung	10,344.0		19,387.0	29,715.0	13,919.2
San Paolo IMI			13,445.0		14,899.0
Sandoz		7,639.0	11,611.1		
Sanofi-Aventis					18,709.9
Santa Fe Southern Pacific	6,662.0				
Santander Central Hispano Group			9,630.9	25,583.0	31,803.6
Sanwa Bank	6,726.0	27,587.0	28,799.0	20,869.0	
Sanyo Electric	6,093.0	10,022.0	16,441.9	18,090.0	23,118.8
Sara Lee	7,567.0	11,746.0	15,536.0	20,012.0	19,566.0
SBC Communications			11,618.5	49,489.0	41,098.0
SCA (Svenska Cellulosa)					12,433.4

SCEcorp		6,904.0	8,345.0		
Schlumberger	5,978.0				
Schneider Electric / Empain Schneider		7,570.0	10,090.0		12,892.0
Scottish Power					12,635.2
Seagram				11,784.0	
Sears Roebuck	38,828.0	53,764.0	54,825.0	41,071.0	36,099.0
Security Pacific	5,134.0	10,018.0			
Seiko Epson					13,768.6
Seiyu	3,640.0	8,273.0	13,219.7		
Sekisui Chemical			10,298.2		
Sekisui House		6,389.0	12,389.7	11,769.0	12,719.5
Shanghai Baosteel Group					19,543.3
Sharp	4,304.0	9,416.0	16,284.5	16,658.0	23,632.6
Shell Oil	20,701.0				
Shimizu	4,079.0	10,104.0	20,961.7	14,053.0	13,811.2
Shoko Chukin Bank			8,354.5		
Showa Shell Sekiyu		10,235.0	11,711.6		
SHV Holdings	3,906.0		13,553.7		17,022.7
Siemens	16,648.0	32,676.0	51,054.9	75,337.0	91,493.2
Signal Companies	6,005.0				
Sinochem			14,981.0	15,064.0	20,380.7
Sinopec				41,883.0	75,076.7
SK Networks					13,844.3
SK (Sunkyong)	6,543.0	9,014.0	18,196.5	31,997.0	37,691.6
Skand Enskilda Bank		6,506.0			
Skandia Group				19,289.0	
Skanska					16,508.2
Smithkline Beecham		7,011.0	9,946.4	13,562.0	
SNCF	6,993.0		13,785.5	17,348.0	27,436.1
Snow Brand Milk Products		7,165.0	11,683.6	11,565.0	
Société Générale (Belgium)	4,054.0				
Société Générale (France)	9,771.0	16,334.0	20,545.0	23,399.0	32,411.2
Sodexho Alliance				10,035.0	13,899.8
Solectron				10,173.0	12,903.2
Solvay	3,883.0	6,522.0			
Sompo Japan Insurance					17,677.1
Sony	5,415.0	20,163.0	40,101.1	60,053.0	66,618.0
South African Breweries	3,824.0				
South African Transport Services	5,690.0				
Southern	6,124.0	7,492.0	8,297.0	11,585.0	
Southern California Edison	4,843.0				
Southland	11,661.0				
Southwestern Bell	7,191.0	8,730.0			
Sperry	5,370.0				
Sprint			12,661.8	19,930.0	27,428.0
Ssangyong		7,207.0	17,820.5		
St. Paul Travelers Cos.					22,934.0
Standard Chartered Bank	5,577.0	5,749.0			
Standard Life Assurance			9,308.4	17,847.0	
Standard Oil Indiana	26,949.0				
Standard Oil Ohio	11,692.0				

Staples					14,448.4
State Farm Insurance Cos			38,850.1	44,637.0	58,818.9
State Grid (State Power)				36,076.0	71,290.2
Statoil	4,369.0	8,735.0	11,852.5	17,945.0	45,440.0
STET - Societa Finanzaria Telefonica		12,920.0			
STL - Finnish Wholesalers & Importers	3,898.0				
Stone Container		5,330.0			
Stora Enso				11,345.0	15,417.4
Stora Kopparbergs Bergslags		6,561.0			
Suez (Suez Lyonnaise des Eaux)	4,202.0	22,538.0	19,567.0	33,560.0	50,670.1
Sumikin Bussan			11,143.2		
Sumitomo	49,852.0	158,221.0	162,475.9	95,702.0	19,068.1
Sumitomo Bank	7,420.0	26,815.0	29,620.6	28,241.0	
Sumitomo Chemical	3,491.0	6,821.0	9,573.9		
Sumitomo Electric Industries		7,002.0	11,275.3	11,752.0	16,192.0
Sumitomo Life Insurance	7,374.0		49,063.1	46,445.0	31,000.2
Sumitomo Marine & Fire Ins.			8,506.9		
Sumitomo Metal Industries	4,919.0	9,535.0	13,385.1	12,790.0	
Sumitomo Mitsui Financial Grp / Sumitomo				27,065.0	33,318.2
Sumitomo Trust & Banking		11,307.0	11,758.6		
Sun	14,466.0	9,805.0			
Sun Alliance		6,572.0			
Sun Life Financial Services				10,511.0	16,705.8
Sun Microsystems				11,726.0	
Sunoco					23,226.0
Supermarkets General	4,347.0				
Supervalu	6,413.0	11,000.0	16,563.8	20,339.0	19,543.2
Suzuki Motor	55,223.0	6,883.0	12,667.1	13,662.0	22,010.9
Svenska Handelsbanken		5,428.0			
Swiss Bank Corp.	3,781.0	8,119.0	11,354.3		
Swiss Life			10,389.2	16,835.0	18,434.8
Swiss Reinsurance	4,200.0	8,626.0	17,113.7	19,641.0	29,045.1
Sysco		7,326.0	10,942.5	17,423.0	29,335.4
T&D Holdings					21,556.9
Taisei	4,554.0	11,788.0	20,116.3	15,100.0	15,892.0
Taiyo Fishery	4,252.0	8,326.0			
Taiyo Kobe Bank	3,762.0				
Taiyo Mutual Life			15,820.7	13,341.0	
Takashimaya		7,308.0	11,806.0	10,618.0	
Takeda Chemical		5,356.0			
Takenaka			13,922.0		
Target				33,702.0	49,934.0
Tarmac		5,591.0			
Tate & Lyle		5,339.0			
Teachers Ins. & Annuity			10,550.8		
Tech Data				16,992.0	19,790.3
Telecom Italia					39,228.2
Teledyne	4,860.0				
Telefónica		6,006.0	11,793.5	24,488.0	38,188.0
Teléfonos de México			8,655.5	10,076.0	
Telstra				11,475.0	15,193.1

Tenet Healthcare				10,880.0	12,496.0
Tengelmann	9,500.0				
Tenneco	14,890.0	14,083.0	13,222.0		
Tesco	3,853.0	8,775.0	15,624.1	30,352.0	62,458.7
Texaco	47,334.0	32,416.0	33,768.0	35,690.0	
Texas Air		6,685.0			
Texas Eastern	6,194.0				
Texas Instruments	5,742.0	6,522.0	10,315.0		12,580.0
Textron		7,440.0	9,683.0	11,579.0	
Thales Group					12,796.3
Thomson / Thomson-Brandt (France)	6,548.0	12,027.0	13,417.2		
Thorn EMI	4,210.0	5,954.0			
Thyssen Krupp	11,783.0	18,308.0	22,219.3	32,798.0	48,756.1
TIAA-CREF				39,410.0	23,411.3
Time Warner		7,642.0		27,333.0	42,869.0
TJX					14,913.5
TNT					15,714.9
Toa Nenryo Kogyo	5,312.0				
Toho Mutual Life Insurance			12,380.2		
Tohoku Electric Power	4,496.0	8,061.0	14,330.5	14,166.0	14,994.2
Tokai Bank	4,523.0	14,290.0	15,308.1	14,784.0	
Tokio Marine & Fire			11,263.0		
Tokio Marine & Fire Ins.		6,839.0	17,547.4	18,364.0	
Tokyo Electric Power	15,705.0	28,636.0	50,359.4	45,718.0	46,962.7
Tokyo Gas		5,684.0	9,219.9		
Tomen			69,901.5	25,748.0	
Toppan Printing		7,134.0	11,381.4	11,110.0	13,152.9
Toray Industries		5,910.0	9,065.3		
Toronto Dominion Bank	4,035.0	6,118.0		10,470.0	
Tosco				14,362.0	
Toshiba	11,453.0	29,757.0	48,228.4	51,635.0	54,303.5
Toshoku		5,315.0	8,309.1		
Total (Total Fina Elf)	18,166.0	16,911.0	24,653.0	44,990.0	152,609.5
Toyo Menka Kaisha	18,555.0	45,055.0			
Toyo Seikan		5,239.0			
Toyo Trust & Bank		7,392.0			
Toyota Motor	25,214.0	61,052.0	88,158.6	115,671.0	172,616.3
Toyota Tsusho	4,898.0	13,359.0	16,598.8	15,219.0	
Toys "R" Us			8,745.6	11,862.0	
Tractebel			9,131.3		
Trafalgar House		5,460.0			
Transamerica	5,399.0	6,834.0			
Transcanada Pipelines				12,415.0	
Transco Energy	3,644.0				
Travelers Corp.	13,477.0	12,523.0			
Travelers Inc.			18,465.0		
TRW	6,062.0	7,340.0	9,087.0	16,969.0	
TUI					23,293.9
Türkiye Petrolleri	4,179.0				
TWA - Trans World Airlines	3,657.0				
TXU - Texas Utilities	3,932.0			17,118.0	

Tyco International				22,497.0	41,042.0
Tyson Foods					26,441.0
UAL - United Airlines	6,968.0	9,794.0	13,950.0	18,027.0	16,391.0
UAP - Union des Assurances de Paris		10,107.0	34,597.0		
UBS - Union Bank of Switzerland			14,714.7	27,652.0	56,917.8
UES of Russia					22,602.9
UFJ Holdings					21,450.8
Ultramar	4,356.0				
Ultramar Diamond Shamrock (bought by				11,079.0	
UniCredito Italiano				13,335.0	19,527.8
Unilever [Amsterdam]	20,815.0	31,256.0			
Unilever [London]			45,451.2	43,680.0	49,960.7
Union Bank of Switzerland	4,076.0	8,292.0			
Union Carbide	9,508.0	8,744.0			
Union Pacific [New York]	7,789.0				
Union Pacific [Philadelphia]		6,492.0	8,140.0	11,273.0	
Unisys		10,097.0			
United Energy Resources	4,001.0				
United Health Group				19,562.0	37,218.0
United Parcel Service [Atlanta]			19,575.7	27,052.0	36,582.0
United Parcel Service [New York]	6,832.0	12,381.0			
United Technologies	16,332.0	19,532.0	21,197.0	25,242.0	37,445.0
United Telecommunications		7,549.0			
Unocal	10,838.0	10,056.0			
UNY			8,662.6	10,270.0	
US Bancorp					14,705.7
US Postal Service			49,383.4	62,726.0	68,996.0
US West	7,280.0	9,691.0	11,506.0	13,182.0	
USAir		6,252.0			
Usinor	4,423.0	15,630.0	14,325.3	14,531.0	
USX - Marathon		17,533.0	16,799.0	25,610.0	
USX - US Steel	18,274.0				14,108.0
UtiliCorp United (now Aquila)				18,622.0	
Valero Energy					53,918.6
Vattenfall					15,433.1
VEBA Oil	17,074.0	26,174.0			
Vendex International	4,315.0				
Veolia Environnement					30,687.7
Verizon Communications				33,174.0	71,563.3
Viacom				12,859.0	27,054.8
VIAG	4,202.0	5,550.0	17,853.5	20,759.0	
Vinci					25,106.3
Visteon					18,657.0
Vivendi Universal				44,398.0	26,651.3
Vodafone				12,686.0	62,971.4
Volkswagen	16,047.0	34,760.0	49,350.1	80,073.0	110,648.7
Volvo	10,523.0	14,115.0	20,204.0	15,121.0	28,643.1
Wachovia					28,067.0
Walgreen		5,555.0	9,235.0	17,839.0	37,508.2
Wal-Mart Stores	6,518.0	25,922.0	83,412.4	166,809.0	287,989.0
Walt Disney			10,055.1	23,402.0	30,752.0

Warner Lambert				12,929.0	
Washington Mutual				13,571.0	15,962.0
Waste Management				13,127.0	12,516.0
Wellpoint					20,815.1
Wells Fargo		5,649.0		21,795.0	33,876.0
West Japan Railway			11,001.2	10,696.0	
Westinghouse Electric	10,265.0	12,844.0	9,208.0		
WestLB (Westdeutsche Landesbank)	4,309.0		17,385.6	24,079.0	13,548.3
Westpac Banking	4,364.0	10,475.0			12,943.3
Weyerhaeuser	5,550.0	10,106.0	10,398.0	12,262.0	22,665.0
Whirlpool		6,152.0	8,104.0	10,511.0	13,220.0
William Hill					15,185.7
William Morrison Supermarkets					22,264.3
Williams					12,814.7
Winn-Dixie Stores	7,531.0	9,486.0	11,082.2	14,137.0	
Winterthur Group		7,732.0	18,148.2		
WMX Technologies			10,097.3		
Wolseley					17,816.5
Woolworth / FW Woolworth	5,737.0	8,820.0	8,293.0		
Woolworths				11,921.0	20,334.5
WorldCom (LDDS)				37,120.0	
WR Grace	6,728.0	6,115.0			
Wyeth				13,550.2	17,358.0
Xerox	11,609.0	17,635.0	17,837.0	19,228.0	15,722.0
Yamaha Motor					12,471.5
Yasuda Fire & Marine		5,799.0	12,818.8	12,281.0	
Yasuda Mutual Life			22,663.8	19,862.0	
Yasuda Trust & Bank		8,610.0			
YPF - Yacimientos Petroliferos	4,500.0	6,975.0			
Zurich Financial Services	4,353.0	11,406.0	21,740.8	39,962.0	59,678.0

Notes:

a: sales figures in million of current dollars;
b: figures shown only if the corporation ranked 500th or lower in that particular year;
c: companies considered separately if headquarters moved to a different urban region

Sources: Fortune and Forbes magazines1985-2005 and author's research.

5.2b. The world's 500 largest corporations by sales, 1984-2004: type of activity and location of headquarters

corporation	*type of activity*	*country*	*headquarters city*	*urban region*
3M	specialized services	US	St. Paul MN 55144	Minneapolis
A.P. Møller-Mærsk Group	mail, package & shipping	Denmark	Copenhagen 1098	Copenhagen
Aachener & Münchener	insurance	Germany	Aachen 52074	Cologne
ABB / Asea Brown Boveri	electronics & sp. equipment	Switzerland	Zurich 8050	Zurich
Abbey National	banking	UK	London NW1	London
Abbott Laboratories	pharmaceuticals, personal & health care	US	Abbott Park IL 60064	Chicago
ABN-Amro Holding	banking	Netherlands	Amsterdam 1082	Amsterdam
Accenture	computers	US	New York NY 10105	New York
ACS	engineering, construction & real estate	Spain	Madrid 28036	Madrid
Adecco	specialized services	Switzerland	Glattbrugg 8152	Zurich
AEG Telefunken	electronics & sp. equipment	Germany	Frankfurt	Frankfurt
Aegon Insurance Group	insurance	Netherlands	The Hague 2591	Amsterdam
AEON	general merchandisers	Japan	Chiba 261-8515	Tokyo
Aerospatiale Matra	aerospace & defense	France	Paris 75787	Paris
Aetna	financial services	US	Hartford CT 06156	Hartford
AFLAC	insurance	US	Columbus GA 31999	Columbus, GA
AGF - Assurances Gén. de France	insurance	France	Paris 75113	Paris
Agricultural Bank of China	banking	China	Beijing 100036	Beijing
Agway	mining and oil production & refining	US	De Witt NY	Syracuse
Ahold (Koninklijke Ahold)	general merchandisers	Netherlands	Zaandam 1507	Amsterdam
Air France-KLM Group	airlines	France	Roissy 95747	Paris
Aisin Seiki	motor vehicles & parts	Japan	Kariya 448-8650	Nagoya
Akzo / Akzo Nobel	chemicals	Netherlands	Arnhem 6800	Amsterdam
Albertson's	general merchandisers	US	Boise ID 83726	Boise
Alcan	metals & metal products	Canada	Montreal H3A	Montreal
Alcatel (f. Alcatel Alsthom)	network & telecommunications	France	Paris 75008	Paris
Alco Standard	wholesalers	US	Wayne PA 19087	Philadelphia
Alcoa / Aluminium Co. of America	metals & metal products	US	Pittsburgh PA 15212	Pittsburgh
Alfred Toepfer Internationale	wholesalers	Germany	Hamburg	Hamburg
All Nippon Airways	airlines	Japan	Tokyo 100	Tokyo
Alliance Unichem	wholesalers	UK	Weybridge KT13	London
Allianz	insurance	Germany	Munich 80802	Munich
Allied Chemical	mining and oil production & refining	US	Morristown NJ	New York
Allied Domecq (Allied Lyons)	food, beverages & tobacco	UK	London W1N	London
Allied Stores	general merchandisers	US	New York NY 10036	New York
Alliedsignal	aerospace & defense	US	Morris Tnsp. NJ 28255	New York
Allstate	insurance	US	Northbrook IL 60062	Chicago
Almanij	banking	Belgium	Antwerp 2000	Brussels
Alstom	industrial & farm equipment	France	Paris 75116	Paris
Altria Group / Philip Morris	food, beverages & tobacco	US	New York NY 10017	New York
Alusuisse	metals & metal products	Switzerland	Zurich	Zurich

Amer Information Technologies	network & telecommunications	US	Chicago IL 60606	Chicago
Amerada Hess	mining and oil production & refining	US	New York NY 10036	New York
American Brands	food, beverages & tobacco	US	Old Greenwich CT 06870	New York
American Broadcasting	tourism & entertainment	US	New Yok NY 10019	New York
American Can	metals & metal products	US	Greenwich CT 06836	New York
American Cyanamid	chemicals	US	Warren NJ 07470	New York
American Electric Power	energy & energy & utilities	US	Columbus OH 43215	Columbus, OH
American Express	financial services	US	New York NY 10285	New York
American Financial	insurance	US	Cincinnati OH	Cincinnati
American General	insurance	US	Houston TX	Houston
American Home Products	pharmaceuticals, personal & health care	US	Madison NJ 07940	New York
American Hospital Supply	pharmaceuticals, personal & health care	US	Evanston IL 60201	Chicago
American International Group	insurance	US	New York NY 10270	New York
American Motors	motor vehicles & parts	US	Southfield MI 48034	Detroit
American Natural Resources	energy & utilities	US	Detroit MI 48226	Detroit
American Stores	general merchandisers	US	Salt Lake City UT 84102	Salt Lake City
AmerisourceBergen	wholesalers	US	Chesterbrook PA 19087	Philadelphia
Ameritech	network & telecommunications	US	Chicago IL 60606	Chicago
Ames Department Stores	general merchandisers	US	Rocky Hill CT 06067	Hartford
Amoco	mining and oil production & refining	US	Chicago IL 60601	Chicago
AMP	insurance	Australia	Sydney 2000	Sydney
AMR - American Airlines	airlines	US	Fort Worth TX 76155	Dallas
Anglo American	mining and oil production & refining	UK	London SW1Y	London
Anheuser-Busch	food, beverages & tobacco	US	St Louis MO 63118	St Louis
Apple Computer	computers	US	Cupertino CA 95014	San Francisco
Arbed	metals & metal products	Luxemburg	Luxembourg 2930	Luxembourg
Arbed (became part of Arcelor)	metals & metal products	Belgium	Brussels	Brussels
Arcelor	metals & metal products	Luxemburg	Luxembourg 2930	Luxembourg
Archer Daniels Midland	food, beverages & tobacco	US	Decatur IL 62525	Decatur
AREVA	energy & energy & utilities	France	Paris 75009	Paris
Argyll Group	general merchandisers	UK	Hayes UB3	London
Armco	metals & metal products	US	Middletown OH 45043	Cincinnati
Asahi Bank	banking	Japan	Tokyo 100	Tokyo
Asahi Glass	engineering, construction & real estate	Japan	Tokyo 100	Tokyo
Asahi Kasei (f. Asahi Chemical)	chemicals	Japan	Tokyo 100	Tokyo
Asahi Mutual Life	insurance	Japan	Tokyo 163	Tokyo
ASEA Group (became part of Asea Brown Boveri)	electronics & sp. equipment	Sweden	Stockholm	Stockholm
Ashland Oil	mining and oil production & refining	US	Russell KY 41169	Huntington
ASKO Deutsches Kaufhaus	general merchandisers	Germany	Saarbrücken 66121	Saarbrücken
Assicurazioni Generali	insurance	Italy	Trieste 34132	Trieste
Associated British Foods	food, beverages & tobacco	UK	London SW1	London
Associated Dry Goods	general merchandisers	US	New York NY 10016	New York

Associates First Capital	financial services	US	Irving TX	Dallas
AstraZeneca	pharmaceuticals, personal & health care	UK	London W1K	London
AT&T	network & telecommunications	US	Bedminster NJ 07921	New York
Atlantic Richfield	mining and oil production & refining	US	Los Angeles CA 90071	Los Angeles
Auchan, Groupe	general merchandisers	France	Croix 59170	Lille
Australia & New Zealand Banking	banking	Australia	Melbourne 3000	Melbourne
AutoNation	specialty products	US	Fort Lauderdale FL 33301	Miami
Aventis	pharmaceuticals, personal & health care	France	Strasbourg 67917	Strasbourg
Aviva	insurance	UK	London EC3P	London
AXA	insurance	France	Paris 75008	Paris
Axel Johnson	general merchandisers	Sweden	Stockholm	Stockholm
BAE Systems	aerospace & defense	UK	London 5W1Y	London
Banca Commerciale Italiana	banking	Italy	Milan 20121	Milan
Banca di Roma	banking	Italy	Rome	Rome
Banca Intesa	banking	Italy	Milan 20121	Milan
Banca Nazionale del Lavoro	banking	Italy	Rome 00187	Rome
Banco Bradesco	banking	Brazil	Osasco 06029	S Paulo
Banco Central Hispano Americano	banking	Spain	Madrid 28014	Madrid
Banco de la Nacion Argentina	banking	Argentina	Buenos Aires 1002	Buenos Aires
Banco de la Provincia de Buenos Aires	banking	Argentina	Buenos Aires 1004	Buenos Aires
Banco do Brasil	banking	Brazil	Brasilia 70073	Brasilia
Banco Itaú	banking	Brazil	Sao Paulo 01014	S Paulo
Banco Nacional de Mexico	banking	Mexico	Mexico 06000	Mexico
Banespa	banking	Brazil	Sao Paulo 01082	S Paulo
Bank Hapoalim BM	banking	Israel	Tel Aviv	Tel Aviv
Bank Leumi le-Israel	banking	Israel	Tel Aviv	Tel Aviv
Bank of America [Charlotte]	banking	US	Charlotte NC 28255	Charlotte
Bank of Boston	banking	US	Boston MA 02110	Boston
Bank of China	banking	China	Beijing 100818	Beijing
Bank of Montreal [Montreal]	banking	Canada	Montreal	Montreal
Bank of Montreal [Toronto]	banking	Canada	Toronto M5X	Toronto
Bank of New York	banking	US	New York NY 10286	New York
Bank of Nova Scotia	banking	Canada	Toronto M5H	Toronto
Bank of Seoul	banking	South Africa	Johannesburg	Johannesburg
Bank of Tokyo-Mitsubishi	banking	Japan	Tokyo 103	Tokyo
Bank One	banking	US	Chicago IL 60670	Chicago
BankAmerica [San Francisco]	banking	US	San Francisco CA	San Francisco
Bankers Trust NY	banking	US	New York NY 10017	New York
Bankgesellschaft Berlin	banking	Germany	Berlin 110801	Berlin
Barclays	banking	UK	London EC3P	London
Barlow Rand	food, beverages & tobacco	South Africa	Sandton	Johannesburg
BASF	chemicals	Germany	Ludwigshafen 67056	Frankfurt
Bass	food, beverages & tobacco	UK	London W1Y	London
BAT Industries	food, beverages & tobacco	UK	London SW1H	London
BATUS	general merchandisers	US	Louisville KE	Louisville
Baxter International	electronics & sp. equipment	US	Deerfield IL 60015	Chicago

Bayer	chemicals	Germany	Leverkusen 51368	Cologne
Bayerische Hypotheken Bank	banking	Germany	Munich 80333	Munich
Bayerische Landesbank	banking	Germany	Munich 80333	Munich
Bayerische Vereinsbank	banking	Germany	Munich 80311	Munich
BBC / Brown Boveri	electronics & sp. equipment	Switzerland	Baden	Zurich
BBVA - Banco Bilbao Vizcaya Argentaria	banking	Spain	Bilbao 48001	Bilbao
BCE / Bell Canada	network & telecommunications	Canada	Montreal H3B	Montreal
Beatrice	food, beverages & tobacco	US	Chicago IL 60602	Chicago
Bell Atlantic	network & telecommunications	US	Philadelphia PA 19103	Philadelphia
BellSouth	network & telecommunications	US	Atlanta GA 30306	Atlanta
Bergen Brunswig	wholesalers	US	Orange CA 92868	Los Angeles
Berkshire Hathaway	insurance	US	Omaha NE 68131	Omaha
Bertelsmann	tourism & entertainment	Germany	Gütersloh 33311	Bielefeld
Best Buy	specialty products	US	Richfield MN 55423	Minneapolis
Bethlehem Steel	metals & metal products	US	Bethlehem PA 18016	Philadelphia
Bharat Petroleum	mining and oil production & refining	India	Mumbai 400001	Mumbai
BHP Billiton / Broken Hill Prop.	mining and oil production & refining	Australia	Melbourne 3000	Melbourne
BICC	metals & metal products	UK	London W1X	London
BL	motor vehicles & parts	UK	London	London
BMW	motor vehicles & parts	Germany	Munich 80788	Munich
BNP / BNP Paribas	banking	France	Paris 75009	Paris
Boeing [Chicago]	aerospace & defense	US	Chicago IL 60606	Chicago
Boeing [Seattle]	aerospace & defense	US	Seattle WA 98124	Seattle
Boise Cascade	forest & paper products	US	Boise ID 83728	Boise
Bombardier	aerospace & defense	Canada	Montreal H3B	Montreal
Bond Corp. Holdings	food, beverages & tobacco	Australia	Perth	Perth
Borden	food, beverages & tobacco	US	New York NY 10172	New York
Borg-Warner	motor vehicles & parts	US	Chicago IL 60604	Chicago
Bouygues	engineering, construction & real estate	France	Paris 75008	Paris
BP / BP Amoco	mining and oil production & refining	UK	London SW1	London
Bridgestone	motor vehicles & parts	Japan	Tokyo 104	Tokyo
Bristol-Myers / BM Squibb	pharmaceuticals, personal & health care	US	New York NY 10154	New York
British Aerospace	aerospace & defense	UK	Farnborough GU14	London
British Airways	airlines	UK	Harmondsworth UB7	London
British American Tobacco	food, beverages & tobacco	UK	London WC2R	London
British Coal	mining and oil production & refining	UK	Mansfield	Nottingham
British Gas	energy & utilities	UK	London SW1V	London
British National Oil	mining and oil production & refining	UK	Glasgow	Glasgow
British Post Office	mail, package & shipping	UK	London EC1V	London
British Railways Board	land transportation	UK	London	London
British Steel	metals & metal products	UK	London	London
BSN	food, beverages & tobacco	France	Paris 75017	Paris

BT - British Telecom	network & telecommunications	UK	London EC1A	London
BTR	industrial & farm equipment	UK	London SW1P	London
Bunge	food, beverages & tobacco	US	White Plains NY 10606	New York
Burlington Northern	land transportation	US	Seattle WA 98104	Seattle
Burroughs	computers	US	Detroit MI 48232	Detroit
C Itoh	wholesalers	Japan	Tokyo	Tokyo
Cable & Wireless	network & telecommunications	UK	London WC1X	London
Caisse d' Épargne, Groupe	banking	France	Paris 75673	Paris
Campbell Soup	food, beverages & tobacco	US	Camden NJ 08101	Philadelphia
Campeau	engineering, construction & real estate	Canada	Toronto	Toronto
Canadian Imperial Bank of Commerce	banking	Canada	Toronto M5L	Toronto
Canadian National Railway	land transportation	Canada	Montreal	Montreal
Canadian Pacific	land transportation	Canada	Montreal	Montreal
Canadian Wheat Board	food, beverages & tobacco	Canada	Winnipeg	Winnipeg
Canon	computers	Japan	Tokyo 146	Tokyo
Cardinal Health	wholesalers	US	Dublin OH 43017	Columbus, OH
Caremark Rx	pharmaceuticals, personal & health care	US	Nashville TN 37201	Nashville
Cariplo	banking	Italy	Milan 20121	Milan
Carrefour	general merchandisers	France	Paris 75016	Paris
Carter Hawley Hale	general merchandisers	US	Los Angeles CA 90071	Los Angeles
Casino, Groupe	general merchandisers	France	Saint-Etienne 42008	Lyon
Caterpillar	industrial & farm equipment	US	Peoria IL 61629	Peoria
CBS	tourism & entertainment	US	New York NY 10019	New York
CEA-Industrie	chemicals	France	Paris 75752	Paris
Cendant	tourism & entertainment	US	New York NY 10019	New York
Centex	engineering, construction & real estate	US	Dallas TX 75201	Dallas
Central Japan Railway	land transportation	Japan	Nagoya 450-6101	Nagoya
Centrica	energy & utilities	UK	Windsor SL4	London
CEPSA	mining and oil production & refining	Spain	Madrid 28042	Madrid
CFE	energy & utilities	Mexico	Mexico 06598	Mexico
CGNU (Aviva)	insurance	UK	London EC3P	London
Champion International	forest & paper products	US	Stamford CT 06921	New York
Chase Manhattan	banking	US	New York NY 10081	New York
Chemical Banking	banking	US	New York NY 10017	New York
Chevron	mining and oil production & refining	US	San Ramon CA 94583	San Francisco
China Construction Bank	banking	China	Beijing 100032	Beijing
China First Automotive Works	motor vehicles & parts	China	Changchun Jilin 130011	Changchun
China Life Insurance	insurance	China	Beijing 100035	Beijing
China Mobile Communications	network & telecommunications	China	Beijing 100053	Beijing
China National Petroleum	mining and oil production & refining	China	Beijing 100724	Beijing
China Southern Power Grid	energy & utilities	China	Guangzhou 510620	Guangzhou
China Telecommunications	network & telecommunications	China	Beijing 100032	Beijing

Chinese Petroleum	mining and oil production & refining	Taiwan	Taipei 11010	Taipei
Chiyoda Mutual Life	insurance	Japan	Tokyo 153	Tokyo
Chori	wholesalers	Japan	Osaka	Osaka
Chrysler	motor vehicles & parts	US	Highland Park MI 48288	Detroit
Chubb	insurance	US	Warren NJ 07061	New York
Chubu Electric Power	energy & utilities	Japan	Nagoya 461	Nagoya
Chugoku Electric Power	energy & utilities	Japan	Hiroshima 730	Hiroshima
Ciba-Geigy	chemicals	Switzerland	Basel 4002	Zurich
Cie. de Suez	financial services	France	Paris 75009	Paris
Cie. Générale d'Électricité	electronics & sp. equipment	France	Paris	Paris
Cie. Générale des Eaux	engineering, construction & real estate	France	Paris 75384	Paris
CIGNA	pharmaceuticals, personal & health care	US	Philadelphia PA 19192	Philadelphia
Circuit City Group	specialty products	US	Richmond VA 23233	Richmond
Cisco Systems	network & telecommunications	US	San Jose CA 95134	San Francisco
Citgo Petroleum	mining and oil production & refining	US	Tulsa OK	Tulsa
Citigroup / Citicorp	banking	US	New York NY 10043	New York
CNP Assurances	insurance	France	Paris 75716	Paris
Co op AG	general merchandisers	Germany	Frankfurt	Frankfurt
Coastal	mining and oil production & refining	US	Houston TX 77046	Houston
Coca-Cola Enterprises	food, beverages & tobacco	US	Atlanta GA 30339	Atlanta
Coca-Cola	food, beverages & tobacco	US	Atlanta GA 30313	Atlanta
COFCO	wholesalers	China	Beijing 100005	Beijing
Coles Myer	general merchandisers	Australia	Tooronga 3146	Melbourne
Colgate-Palmolive	pharmaceuticals, personal & health care	US	New York NY 10022	New York
Columbia / HCA Healthcare	pharmaceuticals, personal & health care	US	Nashville TN 37203	Nashville
Columbia Gas System	energy & utilities	US	Wilmington DE 19807	Philadelphia
Comcast	network & telecommunications	US	Philadelphia PA 19102	Philadelphia
Commercial Union	insurance	UK	London EC3P	London
Commerzbank	banking	Germany	Frankfurt 60261	Frankfurt
Commonwealth Bank of Australia	banking	Australia	Sydney 1155	Sydney
Commonwealth Edison	energy & utilities	US	Chicago IL 60690	Chicago
Compaq Computer	computers	US	Houston TX 77070	Houston
Compass	food, beverages & tobacco	UK	Chertsey KT16	London
Computer Sciences	computers	US	El Segundo CA 90245	Los Angeles
ConAgra Foods	food, beverages & tobacco	US	Omaha NE 68102	Omaha
ConocoPhillips	mining and oil production & refining	US	Houston TX 77079	Houston
Consolidated Edison	energy & utilities	US	New York NY 10003	New York
Consolidated Foods	food, beverages & tobacco	US	Chicago IL	Chicago
Consolidated Natural Gas	energy & utilities	US	Pittsburgh 15222	Pittsburgh
Constellation Energy	energy & utilities	US	Baltimore 21202	Washington
Continental Corp	insurance	US	New York NY 10038	New York
Continental Illinois	banking	US	Chicago IL 60697	Chicago
Continental	motor vehicles & parts	Germany	Hanover 30165	Hanover

Control Data	computers	US	Minneapolis MN 55440	Minneapolis
Coop (France)	general merchandisers	France	Paris 75116	Paris
Coop Suisse	general merchandisers	Switzerland	Basel	Zurich
Corus	metals & metal products	UK	London SW1P	London
Cosmo Oil	mining and oil production & refining	Japan	Tokyo 105	Tokyo
Costco Wholesale	specialty products	US	Issaquah WA 98027	Seattle
Countrywide Financial	financial services	US	Calabasas CA 91302	Los Angeles
CPC International	food, beverages & tobacco	US	Englewood Cliffs NJ 07632	New York
Crédit Agricole	banking	France	Paris 75710	Paris
Crédit Commercial	banking	France	Paris	Paris
Crédit Lyonnais	banking	France	Paris 75002	Paris
CRH	engineering, construction & real estate	Ireland	Dublin 22	Dublin
CS - Credit Suisse	banking	Switzerland	Zurich 8070	Zurich
CSX	land transportation	US	Richmond VA 23219	Richmond
CVS	general merchandisers	US	Woonsocket RI 02895	Boston
Daewoo Corp.	wholesalers	South Korea	Seoul 100	Seoul
Dai Nippon Printing	specialized services	Japan	Tokyo 162	Tokyo
Daido Life	insurance	Japan	Osaka 550	Osaka
Daiei	general merchandisers	Japan	Kobe 650-0046	Osaka
Daihatsu Motor	motor vehicles & parts	Japan	Osaka 563	Osaka
Daihyaku Mutual Life Ins.	insurance	Japan	Tokyo 182	Tokyo
Dai-ichi Kangyo Bank	banking	Japan	Tokyo 100	Tokyo
Dai-ichi Mutual Life Insurance	insurance	Japan	Tokyo 100	Tokyo
Daikyo Oil	energy & utilities	Japan	Tokyo 104	Tokyo
Daimaru	general merchandisers	Japan	Osaka	Osaka
DaimlerChrysler / Daimler Benz	motor vehicles & parts	Germany	Stuttgart 70546	Stuttgart
Dainippon Ink & Chemicals	chemicals	Japan	Tokyo 103	Tokyo
Daiwa Bank	banking	Japan	Osaka 541	Osaka
Daiwa House Industry	engineering, construction & real estate	Japan	Osaka 530-8241	Osaka
Daiwa Securities	financial services	Japan	Tokyo	Tokyo
Dalgety	food, beverages & tobacco	UK	London W1	London
Dana	motor vehicles & parts	US	Toledo OH 43615	Detroit
Danone, Groupe	food, beverages & tobacco	France	Paris 75009	Paris
Danske Bank Group	banking	Danemark	Copenhagen 1092	Copenhagen
Dart & Kraft	food, beverages & tobacco	US	Northbrook IL 60062	Chicago
Dayton Hudson	general merchandisers	US	Minneapolis MN 55402	Minneapolis
DDI	network & telecommunications	Japan	Yokohama 231-0012	Tokyo
Deere	industrial & farm equipment	US	Moline IL 61265	Davenport
Degussa	metals & metal products	Germany	Frankfurt 60311	Frankfurt
Delhaize Group (Delhaize le Lion)	general merchandisers	Belgium	Brussels 1080	Brussels
Dell / Dell Computer	computers	US	Round Rock TX 78682	Austin
Delphi Automotive Systems	motor vehicles & parts	US	Troy MI 48098	Detroit
Delta Air Lines	airlines	US	Atlanta GA 30320	Atlanta
Denso	motor vehicles & parts	Japan	Kariya 448-8661	Nagoya
Dentsu	specialized services	Japan	Tokyo 105	Tokyo
Deutsche Bahn	land transportation	Germany	Berlin 10785	Berlin

Deutsche Bank	banking	Germany	Frankfurt 60262	Frankfurt
Deutsche Post	mail, package & shipping	Germany	Bonn 53113	Cologne
Deutsche Telekom	network & telecommunications	Germany	Bonn 53113	Cologne
Dexia Group	banking	Belgium	Brussels 1000	Brussels
DG Bank	banking	Germany	Frankfurt 60265	Frankfurt
Diageo	food, beverages & tobacco	UK	London W1G	London
Diamond Shamrock	mining and oil production & refining	US	Dallas TX 75201	Dallas
Digital Equipment	computers	US	Maynard MA 01754	Boston
Dior (Christian Dior)	pharmaceuticals, personal & health care	France	Paris 75008	Paris
Docks de France	general merchandisers	France	Tours 37018	Tours
Dominion Resources	energy & utilities	US	Richmond VA 23219	Richmond
Dow Chemical	chemicals	US	Midland MI 48674	Saginaw
Dresdner Bank	banking	Germany	Frankfurt 60301	Frankfurt
Dresser Industries	mining and oil production & refining	US	Dallas TX 75221	Dallas
Duke Energy	energy & utilities	US	Charlotte NC 28202	Charlotte
DuPont / E.I. DuPont de Nemours	chemicals	US	Wilmington DE 19898	Philadelphia
Dynegy	energy & utilities	US	Houston TX 77002	Houston
DZ Bank	insurance	Germany	Frankfurt 60325	Frankfurt
E.On (formerly VEBA Group)	wholesalers	Germany	Düsseldorf 40479	Cologne
EADS	aerospace & defense	Netherlands	Schiphol-Rijk 1119	Amsterdam
East Japan Railway	land transportation	Japan	Tokyo 151	Tokyo
Eastern Airlines	airlines	US	Miami FL 33148	Miami
Eastman Kodak	electronics & sp. equipment	US	Rochester NY 14650	Rochester
Eaton	motor vehicles & parts	US	Cleveland OH 44114	Cleveland
Edeka Zentrale	wholesalers	Germany	Hamburg 22297	Hamburg
El Paso Energy	energy & utilities	US	Houston TX 77002	Houston
Elders IXL	general merchandisers	Australia	Melbourne 3000	Melbourne
Électricité de France	energy & utilities	France	Paris 75382	Paris
Electricity Council	energy & utilities	UK	London	London
Electrolux	electronics & sp. equipment	Sweden	Stockholm 10545	Stockholm
Electronic Data Systems	computers	US	Plano TX 75024	Dallas
Elf Aquitaine	mining and oil production & refining	France	La Defense 92078	Paris
Eli Lilly	pharmaceuticals, personal & health care	US	Indianapolis IN 46285	Indianapolis
Emerson Electric	electronics & sp. equipment	US	St. Louis MO 63136	St Louis
EnCana	mining and oil production & refining	Canada	Calgary T2P	Calgary
Endesa	energy & utilities	Spain	Madrid 28042	Madrid
ENEL	energy & utilities	Italy	Rome 00198	Rome
ENI - Ente Nazionali Idrocarburi	mining and oil production & refining	Italy	Rome 00144	Rome
EniMont (Enichen Montedison)	chemicals	Italy	Ravenna	Bologna
Enron	energy & utilities	US	Houston TX	Houston
Enserch	energy & utilities	US	Dallas TX 75201	Dallas
Eurohypo	banking	Germany	Eschborn 60329	Frankfurt
Exelon	energy & utilities	US	Chicago IL 60680	Chicago
Express Scripts	pharmaceuticals, personal & health care	US	Maryland Heights MO 63043	St Louis

Exxon	mining and oil production & refining	US	New York NY 10020	New York
Exxon Mobil	mining and oil production & refining	US	Irving TX 75039	Dallas
Fannie Mae	financial services	US	Washington DC 20016	Washington
Farmland Industries	food, beverages & tobacco	US	Kansas City MO	Kansas City
Federal Express	mail, package & shipping	US	Memphis TN 38132	Memphis
Federal Natl. Mortgage Association	financial services	US	Washington DC 20016	Washington
Federated Department Stores	general merchandisers	US	Cincinnati OH 45202	Cincinnati
FedEx	mail, package & shipping	US	Memphis TN 38120	Memphis
Ferruzzi Financiaria (to Montedison)	food, beverages & tobacco	Italy	Milan 20121	Milan
Fiat	motor vehicles & parts	Italy	Turin 10126	Turin
Firestone	motor vehicles & parts	US	Akron OH 44317	Cleveland
First Chicago	banking	US	Chicago IL 60670	Chicago
First Interstate Bancorp	banking	US	Los Angeles CA 90054	Los Angeles
First Union	banking	US	Charlotte NC	Charlotte
FirstEnergy	energy & utilities	US	Akron OH 44308	Cleveland
FleetBoston	banking	US	Boston MA 02110	Boston
Fleming	wholesalers	US	Oklahoma City OK	Oklahoma
Fletcher Challenge	forest & paper products	New Zealand	Penrose	Auckland
Flextronics International	electronics & sp. equipment	Singapore	Singapore 018989	Singapore
Fluor	engineering, construction & real estate	US	Irvine CA 92730	Los Angeles
Foncière Euris	general merchandisers	France	Paris 75008	Paris
Ford Motor	motor vehicles & parts	US	Dearborn MI 48126	Detroit
Fortis	banking	Belgium	Brussels 1000	Brussels
Fortum	mining and oil production & refining	Finland	Espoo 02150	Helsinki
FPL Group	energy & utilities	US	Miami FL 33152	Miami
France Télécom	network & telecommunications	France	Paris 75505	Paris
Franz Haniel	wholesalers	Germany	Duisburg 47119	Cologne
Freddie Mac	financial services	US	McLean VA 22102	Washington
Friedrich Flick	chemicals	Germany	Düsseldorf	Cologne
Friedrich Krupp	metals & metal products	Germany	Essen 45143	Cologne
Fuji Bank	banking	Japan	Tokyo 100	Tokyo
Fuji Electric	electronics & sp. equipment	Japan	Tokyo 100	Tokyo
Fuji Heavy Industries	motor vehicles & parts	Japan	Tokyo 160	Tokyo
Fuji Photo Film	electronics & sp. equipment	Japan	Tokyo 106	Tokyo
Fujitsu	computers	Japan	Tokyo 105	Tokyo
Fukoku Mutual Life Ins.	insurance	Japan	Tokyo 100	Tokyo
Furukawa Electric	metals & metal products	Japan	Tokyo	Tokyo
GAN	insurance	France	Paris 75448	Paris
Gap	specialty products	US	San Francisco CA	San Francisco
Gasunie	energy & utilities	Netherlands	Groningen 9700	Groningen
Gaz de France	energy & utilities	France	Paris 75840	Paris
GEC / General Electric (UK)	electronics & sp. equipment	UK	London W1A	London
GEDELFI	general merchandisers	Germany	Cologne	Cologne
Gehe	pharmaceuticals, personal & health care	Germany	Bonn	Cologne
Gencor - General Mining Union	mining and oil production & refining	South Africa	Johannesburg	Johannesburg

General Accident	insurance	UK	Perth PH2	Glasgow
General Dynamics [St. Louis]	aerospace & defense	US	St. Louis MO 63105	St. Louis
General Dynamics [Washington]	aerospace & defense	US	Falls Church VA 22042	Washington
General Electric	electronics & sp. equipment	US	Fairfield CT 08628	New York
General Foods	food, beverages & tobacco	US	White Plains NY 10625	New York
General Mills	food, beverages & tobacco	US	Minneapolis MN 55423	Minneapolis
General Motors	motor vehicles & parts	US	Detroit MI 48265	Detroit
Generale Bank	banking	Belgium	Brussels 1001	Brussels
George Weston	general merchandisers	Canada	Toronto M4T	Toronto
Georgia-Pacific	forest & paper products	US	Atlanta GA 30303	Atlanta
GIB	specialty products	Belgium	Brussels	Brussels
Glaxo Wellcome	pharmaceuticals, personal & health care	UK	London W1X	London
GlaxoSmithKline	pharmaceuticals, personal & health care	UK	Brentford TW8	London
Goldman Sachs Group	financial services	US	New York NY 10004	New York
Goodyear Tire & Rubber	motor vehicles & parts	US	Akron OH 44316	Cleveland
Grand Metropolitan	food, beverages & tobacco	UK	London SW17	London
Great Atlantic & Pacific Tea	general merchandisers	US	Montvale NJ 07645	New York
Groupama	insurance	France	Paris 75383	Paris
Grupo Financiero Bancomer	banking	Mexico	Mexico 03339	Mexico
GTE	network & telecommunications	US	Stamford CT 06904	New York
Guardian Royal Exchange	insurance	UK	London EC3V	London
Gulf & Western Industries	engineering, construction & real estate	US	New York NY 10023	New York
GUS	specialty products	UK	London W1K	London
Gutehoffnungshütte	industrial & farm equipment	Germany	Oberhausen	Cologne
Halifax (H. Buildings Society)	banking	UK	Halifax HX1	Leeds
Halliburton [Dallas]	mining and oil production & refining	US	Dallas TX	Dallas
Halliburton [Houston]	mining and oil production & refining	US	Houston TX 77010	Houston
Hanson	engineering, Construction & real estate	UK	London SW1X	London
Hanwa	general merchandisers	Japan	Tokyo	Tokyo
Hanwha	chemicals	South Korea	Seoul 100-797	Seoul
Hartford Financial Services	insurance	US	Hartford CT 06115	Hartford
Harvest States	general merchandisers	US	St. Paul MN	Minneapolis
HBOS	banking	UK	Edinburgh EH10	Glasgow
HCA	pharmaceuticals, personal & health care	US	Nashville TN 37203	Nashville
Heineken	food, beverages & tobacco	Netherlands	Amsterdam 1017	Amsterdam
Henkel	pharmaceuticals, personal & health care	Germany	Duesseldorf 40191	Cologne
Hewlett-Packard	computers	US	Palo Alto CA 94304	San Francisco
Hillsdown Holdings	general merchandisers	UK	London NW3	London
Hilton Group	tourism & entertainment	UK	Watford WD24	London
Hindustan Petroleum	mining and oil production & refining	India	Mumbai 400020	Mumbai
Hitachi	electronics & Sp. equipment	Japan	Tokyo 101	Tokyo
HJ Heinz	food, beverages & tobacco	US	Pittsburgh 15230	Pittsburgh
Hochteif	engineering, construction & real estate	Germany	Essen 45128	Cologne

Hoechst	chemicals	Germany	Frankfurt 65926	Frankfurt
Hoesch	industrial & farm equipment	Germany	Dueren	Cologne
Home Depot	specialty products	US	Atlanta GA 30339	Atlanta
Hon Hai Precision Industry	electronics & sp. equipment	Taiwan	Taipei	Taipei
Honda Motor	motor vehicles & parts	Japan	Tokyo 107	Tokyo
Honeywell	computers	US	Minneapolis MN	Minneapolis
Honeywell Intl.	aerospace & defense	US	Morristown NJ 07962	New York
Hospital Corporation	pharmaceuticals, personal & health care	US	Nashville TN 37203	Nashville
Household International	general merchandisers	US	Prospect Heights IL 60070	Chicago
Houston Industries	energy & utilities	US	Houston TX 77210	Houston
HSBC Holdings	banking	UK	London E14	London
Hudson's Bay	general merchandisers	Canada	Toronto	Toronto
Humana	pharmaceuticals, personal & health care	US	Louisville KY 40202	Louisville
Hutchison Whampoa	general merchandisers	China	Hong Kong	Hong Kong
HVB Group (Hypovereinsbank)	banking	Germany	Munich 80538	Munich
Hyundai	wholesalers	South Korea	Seoul 110	Seoul
Hyundai Motor	motor vehicles & parts	South Korea	Seoul 137	Seoul
Iberdrola	energy & utilities	Spain	Bilbao 48008	Bilbao
IBM - Intl. Business Machines	computers	US	Armonk NY 10504	New York
IBP	food, beverages & tobacco	US	Dakota City NE 68731	Sioux City
IC Industries	food, beverages & tobacco	US	Chicago IL 60601	Chicago
IDB Bankholding	banking	Israel	Tel Aviv	Tel Aviv
Idemitsu Kosan	mining and oil production & refining	Japan	Tokyo 100	Tokyo
IEL – Industrial Equity Ltd	engineering, construction & real estate	Australia	Sydney	Sydney
Imperial Chemical Inds.	chemicals	UK	London SW1	London
Inchcape	general merchandisers	UK	London SW1Y	London
Indian Oil	mining and oil production & refining	India	New Delhi 110003	Delhi
Industrial & Commercial Bank of China	banking	China	Beijing 100032	Beijing
Industrial Bank of Japan	banking	Japan	Tokyo 100	Tokyo
ING Group (Int'l Nederlanden Grp.)	insurance	Netherlands	Amsterdam 1081	Amsterdam
Ingram Micro	wholesalers	US	Santa Ana CA 92705	Los Angeles
INH - Inst. Nacional de Hidrocarburos	energy & utilities	Spain	Madrid	Madrid
INI	industrial & farm equipment	Spain	Madrid 28071	Madrid
Intel	electronics & sp. equipment	US	Santa Clara CA 95052	San Francisco
International Harvester	industrial & farm equipment	US	Chicago IL 60611	Chicago
International Paper	forest & paper products	US	Stamford CT 06921	New York
InterNorth	energy & utilities	US	Omaha NE 68102	Omaha
Invensys	industrial & farm equipment	UK	London SW1P	London
IRI	industrial & farm equipment	Italy	Rome 00187	Rome
Ishikawajima-Harima	industrial & farm equipment	Japan	Tokyo 100	Tokyo
Istituto Banc. San Paolo	banking	Italy	Turin 10121	Turin
Isuzu Motors	motor vehicles & parts	Japan	Tokyo 140	Tokyo
Itochu	wholesalers	Japan	Osaka 541-8577	Osaka
Itoman	wholesalers	Japan	Osaka	Osaka
Ito-Yokado	general merchandisers	Japan	Tokyo 102	Tokyo

ITT - International Telephone & Telegraph	electronics & sp. equipment	US	New York NY 10019	New York
J Sainsbury	general merchandisers	UK	London EC1N	London
James River of Virginia	forest & paper products	US	Richmond VA 23217	Richmond
Japan Airlines	airlines	Japan	Tokyo 140	Tokyo
Japan Energy	mining and oil production & refining	Japan	Tokyo 105	Tokyo
Japan Post	mail, package & shipping	Japan	Tokyo 100	Tokyo
Japan Tobacco	food, beverages & tobacco	Japan	Tokyo 105	Tokyo
Japan Travel Bureau	tourism & entertainment	Japan	Tokyo 100	Tokyo
Jardine Matheson	general merchandisers	China	Hong Kong	Hong Kong
JC Penney [Dallas]	general merchandisers	US	Plano TX 75023	Dallas
JC Penney [New York]	general merchandisers	US	New York NY	New York
JFE Holdings	metals & metal products	Japan	Tokyo 100	Tokyo
Johnson & Johnson	pharmaceuticals, personal & health care	US	New Brunswick NJ 08933	New York
Johnson Controls	motor vehicles & parts	US	Milwaukee WI 53201	Milwaukee
JP Morgan Chase & Co.	banking	US	New York NY 10017	New York
Jusco	general merchandisers	Japan	Chiba 261	Tokyo
K mart	general merchandisers	US	Troy MI 48084	Detroit
Kaiser Aluminum & Chemical	chemicals	US	Oakland	San Francisco
Kajima	engineering, construction & real estate	Japan	Tokyo 107	Tokyo
Kanematsu / Kanematsu-Gosho	wholesalers	Japan	Tokyo 105	Tokyo
Kansai Electric Power	energy & utilities	Japan	Osaka 530-8270	Osaka
Karstadt Quelle	general merchandisers	Germany	Essen 45133	Cologne
Kaufhof	general merchandisers	Germany	Cologne 50676	Cologne
Kawasaki Heavy Industries	industrial & farm equipment	Japan	Kobe 650	Osaka
Kawasaki Steel	metals & metal products	Japan	Tokyo 100	Tokyo
Kawasho	wholesalers	Japan	Tokyo 105	Tokyo
KBC Bankassurance	banking	Belgium	Brussels	Brussels
KDDI	network & telecommunications	Japan	Tokyo 163	Tokyo
Kerr-McGee	mining and oil production & refining	US	Oklahoma City OK 73125	Oklahoma
Kesko	wholesalers	Finland	Helsinki	Helsinki
KF / Konsum Coop	general merchandisers	Sweden	Stockholm	Stockholm
KFW Bankengruppe	banking	Germany	Frankfurt 60325	Frankfurt
Kimberly-Clark [Appleton]	pharmaceuticals, personal & health care	US	Neenah WI 54956	Appleton
Kimberly-Clark [Dallas]	pharmaceuticals, personal & health care	US	Irving TX 75038	Dallas
Kingfisher	specialty products	UK	London W2	London
Kinki Nippon Railway	land transportation	Japan	Osaka 543	Osaka
Kirin Brewery	food, beverages & tobacco	Japan	Tokyo 104	Tokyo
Kloeckner & Co	metals & metal products	Germany	Duisburg	Cologne
Kobe Steel	metals & metal products	Japan	Kobe 651	Osaka
Koç Holding	motor vehicles & parts	Turkey	Istanbul 34674	Istanbul
Komatsu	industrial & farm equipment	Japan	Tokyo 107	Tokyo
Koor Industries	network & telecommunications	Israel	Tel Aviv	Tel Aviv
Korea Electric Power	energy & utilities	South Korea	Seoul 135	Seoul
Kroger	general merchandisers	US	Cincinnati OH 45201	Cincinnati

KT	network & telecommunications	South Korea	Seongnam 463	Seoul
Kubota	industrial & farm equipment	Japan	Osaka 556	Osaka
Kumagai Gumi	engineering, construction & real estate	Japan	Tokyo 162	Tokyo
Kuwait Petroleum	mining and oil Production & refining	Kuwait	Kuwait	Kuwait
Kyobo Life Insurance	insurance	South Korea	Seoul 110-714	Seoul
Kyoei Life	insurance	Japan	Tokyo 103	Tokyo
Kyowa Bank	banking	Japan	Tokyo	Tokyo
Kyushu Electric Power	energy & utilities	Japan	Fukuoka 810	Fukuoka
Ladbroke	tourism & entertainment	UK	London NW1	London
Lafarge	engineering, construction & real estate	France	Paris 75116	Paris
Lagardère Groupe	specialized services	France	Paris 75016	Paris
Landesbank Baden-Württemberg	banking	Germany	Stuttgart 70173	Stuttgart
Lear	motor vehicles & parts	US	Southfield MI 48034	Detroit
Leclerc	general merchandisers	France	Issy-les-Moulineaux	Paris
Legal & General Group	insurance	UK	London EC4N	London
Lehman Brothers Hldgs.	financial services	US	New York NY 10019	New York
LG Electronics / Lucky-Gold Star	electronics & sp. equipment	South Korea	Seoul 150	Seoul
LG International	wholesalers	South Korea	Seoul 150	Seoul
Liberty Mutual Ins. Group	insurance	US	Boston MA 02116	Boston
Lincoln National	insurance	US	Fort Wayne IN 46801	Fort Wayne
Litton Industries	electronics & sp. equipment	US	Beverly Hills CA 90210	Los Angeles
Lloyds TSB Group	banking	UK	London EC2V	London
LM Ericsson	network & telecommunications	Sweden	Stockholm 16483	Stockholm
Lockheed	aerospace & defense	US	Burbank CA	Los Angeles
Lockheed Martin	aerospace & defense	US	Bethesda MD 20817	Washington
Loews	insurance	US	New York NY 10021	New York
Long-Term Credit Bank	banking	Japan	Tokyo 100	Tokyo
Lonrho Group	wholesalers	UK	London SW1	London
L'Oréal	pharmaceuticals, personal & health care	France	Clichy 92117	Paris
Lowe's	specialty products	US	Mooresville NC 28117	Charlotte
LTV	metals & metal products	US	Dallas TX 75265	Dallas
Lucent Technologies	network & telecommunications	US	Murray Hill NJ 07974	New York
Lucky Stores	general merchandisers	US	Dublin CA 94568	San Francisco
Lufthansa Group	airlines	Germany	Cologne 50679	Cologne
Lukoil	mining and oil production & refining	Russia	Moscow 101000	Moscow
Lyondell Petrochemicals	chemicals	US	Houston TX 77253	Houston
Lyonnaise des Eaux	engineering, construction & real estate	France	Nanterre 92753	Paris
Magna International	motor vehicles & parts	Canada	Aurora ON L4G	Toronto
MAN Group	motor vehicles & parts	Germany	Munich 80805	Munich
Mannesmann	industrial & farm equipment	Germany	Düsseldorf 40213	Cologne
Manpower	specialized services	US	Milwaukee WI 53217	Milwaukee
Manufacturers Hanover	banking	US	New York NY 10019	New York
Manulife Financial	insurance	Canada	Toronto M4W	Toronto

Marathon Oil	mining and oil production & refining	US	Houston TX 77056	Houston
Marks & Spencer	general merchandisers	UK	London W2	London
Marriott International	tourism & entertainment	US	Washington DC 20058	Washington
Martin Marietta	aerospace & defense	US	Bethesda MD 20817	Washington
Marubeni	wholesalers	Japan	Tokyo 100	Tokyo
Maruha	general merchandisers	Japan	Tokyo 100	Tokyo
Maruzen Oil	mining and oil production & refining	Japan	Osaka	Osaka
Masco	pharmaceuticals, personal & health care	US	Taylor MI 48180	Detroit
Massachusetts Mutual Life Ins.	insurance	US	Springfield MA 01111	Hartford
Matsushita Electric Industrial	electronics & sp. equipment	Japan	Kadoma 571	Osaka
Matsushita Electric Works	electronics & sp. equipment	Japan	Osaka 571	Osaka
May Department Stores	general merchandisers	US	St Louis MO 63101	St Louis
Mazda Motor	motor vehicles & parts	Japan	Hiroshima 730	Hiroshima
McDonald's	food, beverages & tobacco	US	Oak Brook IL 60523	Chicago
McDonnell Douglas	aerospace & defense	US	Berkeley MO 63134	St. Louis
MCI Wld Communications	network & telecommunications	US	Ashburn VA 20147	Washington
McKesson	wholesalers	US	San Francisco CA 94104	San Francisco
Medco Health Solutions	pharmaceuticals, personal & health care	US	Franklin Lakes NJ 07417	New York
Mediceo Holdings	wholesalers	Japan	Tokyo 104	Tokyo
Meiji Yasuda Life Insurance	insurance	Japan	Tokyo 169	Tokyo
Melville	specialty products	US	Rye NY 10580	New York
Merck	pharmaceuticals, personal & health care	US	Whitehouse Station NJ 08889	New York
Merrill Lynch	financial services	US	New York NY 10080	New York
Metallgesellschaft	metals & metal products	Germany	Frankfurt 60271	Frankfurt
MetLife	insurance	US	New York NY 10010	New York
Metro	general merchandisers	Germany	Düsseldorf 40235	Cologne
Michelin	motor vehicles & parts	France	Clermont-Ferrand 63000	Clermont
Microsoft	computers	US	Redmond WA 98052	Seattle
MidCon	mining and oil production & refining	US	Lombard IL 60148	Chicago
Midland Bank	banking	UK	London EC2	London
Migros	general merchandisers	Switzerland	Zurich 8005	Zurich
Millea Holdings	insurance	Japan	Tokyo 100	Tokyo
Minnesota Mining & Manufacturing	electronics & sp. equipment	US	St. Paul MN 55144	Minneapolis
Mitsubishi	wholesalers	Japan	Tokyo 100	Tokyo
Mitsubishi Bank	banking	Japan	Tokyo 100	Tokyo
Mitsubishi Chemical / M. Kasei	chemicals	Japan	Tokyo 108	Tokyo
Mitsubishi Electric	electronics & sp. equipment	Japan	Tokyo 100	Tokyo
Mitsubishi Heavy Industries	industrial & farm equipment	Japan	Tokyo 108	Tokyo
Mitsubishi Materials	metals & metal products	Japan	Tokyo 100	Tokyo
Mitsubishi Metal	metals & metal products	Japan	Tokyo	Tokyo
Mitsubishi Motors	motor vehicles & parts	Japan	Tokyo 108	Tokyo
Mitsubishi Oil	mining and oil production & refining	Japan	Tokyo 108	Tokyo
Mitsubishi Tokyo Financial Group	banking	Japan	Tokyo 100	Tokyo
Mitsubishi Trust	financial services	Japan	Tokyo	Tokyo

Mitsubishi Trust & Bank	banking	Japan	Tokyo	Tokyo
Mitsui	wholesalers	Japan	Tokyo 100	Tokyo
Mitsui Fudosan	engineering, construction & real estate	Japan	Tokyo 103	Tokyo
Mitsui Marine & Fire Ins.	insurance	Japan	Tokyo 101	Tokyo
Mitsui Mutual Life	insurance	Japan	Tokyo 100	Tokyo
Mitsui Real Estate	engineering, construction & real estate	Japan	Tokyo	Tokyo
Mitsui Sumitomo Insurance	insurance	Japan	Tokyo 104	Tokyo
Mitsui Taiyo Kobe	banking	Japan	Tokyo	Tokyo
Mitsui Trust & Banking	banking	Japan	Tokyo 103	Tokyo
Mitsukoshi	general merchandisers	Japan	Tokyo 103	Tokyo
Mittal Steel	metals & metal products	Netherlands	Rotterdam 3032	Amsterdam
Mizuho Financial Group	banking	Japan	Tokyo 100	Tokyo
Mobil [New York]	mining and oil production & refining	US	New York NY 10017	New York
Mobil [Washington]	mining and oil production & refining	US	Fairfax VA 22037	Washington
Monsanto	chemicals	US	St. Louis MO 63167	St. Louis
Monte dei Paschi di Siena	banking	Italy	Siena 53100	Siena
Montedison (to Compart)	food, beverages & tobacco	Italy	Milan	Milan
Montgomery Ward	general merchandisers	US	Chicago IL	Chicago
Morgan Stanley	financial services	US	New York NY 10036	New York
Motorola	network & telecommunications	US	Schaumburg IL 60196	Chicago
Münchener Rückversicherungs	insurance	Germany	Munich 80791	Munich
Munich Re Group	insurance	Germany	Munich 80802	Munich
Mycal	general merchandisers	Japan	Osaka 541-0056	Osaka
Nabisco Brands	food, beverages & tobacco	US	Parsippany NJ 07054	New York
National Australia Bank	banking	Australia	Melbourne 3000	Melbourne
National Coal Board	energy & utilities	UK	London	London
National Grid Transco	energy & utilities	UK	London WC2N	London
National Intergroup	metals & metal products	US	Pittsburgh PA 15222	Pittsburgh
National Iranian Oil	mining and oil production & refining	Iran	Tehran	Tehran
National Westminster Bank	banking	UK	London EC2P	London
Nationale Nederlanden	insurance	Netherlands	Den Haag 2517	Amsterdam
Nationsbank Corp.	banking	US	Charlotte NC 28255	Charlotte
Nationwide	insurance	US	Columbus OH 43215	Columbus, OH
NCNB	banking	US	Charlotte NC 28255	Charlotte
NCR	computers	US	Dayton OH 45479	Cincinnati
NEC	electronics & sp. equipment	Japan	Tokyo 108	Tokyo
Neste	wholesalers	Finland	Espoo 02151	Helsinki
Nestlé	food, beverages & tobacco	Switzerland	Vevey 1800	Geneva
New York Life Insurance	insurance	US	New York NY 10010	New York
News Corp.	tourism & entertainment	Australia	Sydney 2010	Sydney
Nextel Communications	network & telecommunications	US	Reston VA 20191	Washington
Nichii	general merchandisers	Japan	Osaka 541	Osaka
Nichimen	wholesalers	Japan	Tokyo 104	Tokyo
Nippon Credit Bank	banking	Japan	Tokyo 102	Tokyo
Nippon Dantai Life Ins.	insurance	Japan	Tokyo 150	Tokyo

Nippon Denso	motor vehicles & parts	Japan	Kariya 448	Nagoya
Nippon Express	mail, package & shipping	Japan	Tokyo 105	Tokyo
Nippon Kokan	metals & metal products	Japan	Tokyo	Tokyo
Nippon Life Insurance	insurance	Japan	Osaka 541	Osaka
Nippon Mining Holdings	mining and oil production & refining	Japan	Tokyo 105	Tokyo
Nippon Mitsubishi	mining and oil production & refining	Japan	Tokyo 105	Tokyo
Nippon Oil	mining and oil production & refining	Japan	Tokyo 105	Tokyo
Nippon Paper Industries	forest & paper products	Japan	Tokyo 100	Tokyo
Nippon Steel	metals & metal products	Japan	Tokyo 100	Tokyo
Nippon Telegraph & Telephone	network & telecommunications	Japan	Tokyo 100	Tokyo
Nippon Yusen	mail, package & shipping	Japan	Tokyo 100	Tokyo
Nissan Motor	motor vehicles & parts	Japan	Tokyo 104	Tokyo
Nissho Iwai	wholesalers	Japan	Osaka 541	Osaka
Nittetsu Shoji	wholesalers	Japan	Tokyo 136	Tokyo
NKK	metals & metal products	Japan	Tokyo 100	Tokyo
Nokia	network & telecommunications	Finland	Espoo 02150	Helsinki
Nomura Securities	financial services	Japan	Tokyo 103	Tokyo
Noranda	forest & paper products	Canada	Toronto	Toronto
Nordea Bank	banking	Sweden	Stockholm 10571	Stockholm
Norfolk Southern	land transportation	US	Norfolk VA 23514	Norfolk
Norinchukin Bank	banking	Japan	Tokyo 100	Tokyo
Norsk Hydro	energy & Utilities	Norway	Oslo 0240	Oslo
Nortel Networks	network & telecommunications	Canada	Brampton ON L6T	Toronto
Northern Telecom	electronics & sp. equipment	Canada	Mississauga	Toronto
Northrop / Northrop Grumman	aerospace & defense	US	Los Angeles CA 90067	Los Angeles
Northwestern Mutual	insurance	US	Milwaukee WI 53202	Milwaukee
Norwich Union	insurance	UK	London EC3P	London
Novartis	pharmaceuticals, personal & health care	Switzerland	Basel 4056	Zurich
NV - Naamloze Vennootschap DSM	chemicals	Netherlands	Heerlen	Aachen-Heerlen
NV - Nederlandse Gasunie	energy & utilities	Netherlands	Groningen	Groningen
NWA - Northwest Airlines	airlines	US	St. Paul MN 55111	Minneapolis
Nynex	network & telecommunications	US	New York NY 10036	New York
OAO Gazprom	energy & utilities	Russia	Moscow 117997	Moscow
Obayashi	engineering, construction & real estate	Japan	Tokyo 108	Tokyo
Occidental Petroleum	mining and oil production & refining	US	Los Angeles CA 90024	Los Angeles
Office Depot	specialty products	US	Delray Beach FL 33445	Miami
OfficeMax	specialty products	US	Itasca IL 60143	Chicago
OIAG - Oesterreichische Industrie Verwaltungs AG	metals & metal products	Austria	Vienna	Vienna
Oil & Natural Gas	mining and oil production & refining	India	Dehradun 248003	Dehradun
Oji Paper	forest & paper products	Japan	Tokyo 104	Tokyo
Old Mutual	Insurance	UK	London EC4V	London
Olivetti	network & telecommunications	Italy	Ivrea 10015	Turin

Onex	electronics & sp. equipment	Canada	Toronto M5J	Toronto
Österreichische Post	network & telecommunications	Austria	Vienna 1011	Vienna
Otto Group (f. Otto Versand)	specialty products	Germany	Hamburg 22179	Hamburg
Owens-Illinois	engineering, construction & real estate	US	Toledo OH 43666	Detroit
Pacific Enterprises	energy & utilities	US	Los Angeles CA 90017	Los Angeles
Pacific Gas & Electric	energy & utilities	US	San Francisco CA	San Francisco
Pacific Lighting	energy & utilities	US	Los Angeles CA 90017	Los Angeles
Pacific Telesis Group	network & telecommunications	US	San Francisco CA 94108	San Francisco
Pan Am	airlines	US	New York NY 10166	New York
Paramount Communications	tourism & entertainment	US	New York NY	New York
Paribas (to BNP)	banking	France	Paris	Paris
PDVSA (Petroleos de Venezuela)	mining and oil production & refining	Venezuela	Caracas	Caracas
Pechiney / Pechiney Ugine Kuhlmann	metals & metal products	France	Courbevoie 92400	Paris
Pemex / Petróleos Mexicanos	mining and oil production & refining	Mexico	Mexico City 11311	Mexico
Peninsular & Oriental	mail, package & shipping	UK	London SW1Y	London
PepsiCo	food, beverages & tobacco	US	Purchase NY 10577	New York
Petro Canada	mining and oil production & refining	Canada	Calgary	Calgary
Petrobrás / Petróleo Brasileiro	mining and oil production & refining	Brazil	Rio de Janeiro 20035	Rio
Petrofina	mining and oil production & refining	Belgium	Brussels 1040	Brussels
Petronas	mining and oil production & refining	Malaysia	Kuala Lumpur 50088	K Lumpur
Peugeot	motor vehicles & parts	France	Paris 75116	Paris
Pfizer	pharmaceuticals, personal & health care	US	New York NY 10017	New York
PG&E Corp.	energy & utilities	US	San Francisco CA	San Francisco
Pharmacia	chemicals	US	Peapack NJ 07977	New York
Phibro-Salomon	mining and oil production & refining	US	New York NY 10020	New York
Philips Electronics	electronics & sp. equipment	Netherlands	Eindhoven 5621	Amsterdam
Phillips Petroleum	mining and oil production & refining	US	Bartlesville OK 74004	Tulsa
Pillsbury	food, beverages & tobacco	US	Minneapolis MN 55402	Minneapolis
Pinault-Printemps, Groupe	general merchandisers	France	Paris 75381	Paris
Pirelli	motor vehicles & parts	Italy	Milan	Milan
Plains All Amer. Pipeline	energy & utilities	US	Houston TX 77002	Houston
Pohang Iron & Steel	metals & metal products	South Korea	Pohang City 790-600	Pohang
POSCO	metals & metal products	South Korea	Pohang City 790-600	Pohang
Poste (PTT-France)	mail, package & shipping	France	Paris 75757	Paris
Power Corp. of Canada	insurance	Canada	Montreal H2Y 2J3	Montreal
PPG Industries	chemicals	US	Pittsburg PA 15272	Pittsburgh
Premcor	mining and oil production & refining	US	Old Greenwich CT 06870	New York
Preussag	metals & metal products	Germany	Hanover 30625	Hanover
Price / Costco	specialty products	US	Kirkland WA 98033	Seattle
Primerica	financial services	US	New York NY 10022	New York
Procter & Gamble	pharmaceuticals, personal & health care	US	Cincinnati OH 45202	Cincinnati

Progressive	insurance	US	Mayfield Village OH 44143	Cleveland
Promodès	general merchandisers	France	Mondeville 14120	Caen
Prudential Financial / Prudential of America	insurance	US	Newark NJ 07102	New York
Prudential (UK)	insurance	UK	London EC4R	London
PTT Suisses	network & telecommunications	Switzerland	Bern 3030	Zurich
PTT (Thailand)	mining and oil production & refining	Thailand	Ladyao Chatuchak 10900	Bangkok
Public Service Electric & Gas	energy & utilities	US	Newark NJ 07101	New York
Publix Super Markets	general merchandisers	US	Lakeland FL 33811	Tampa
Quaker Oats	food, beverages & tobacco	US	Chicago IL 60654	Chicago
Qwest Communications	network & telecommunications	US	Denver CO 80202	Denver
Rabobank	banking	Netherlands	Utrecht 3521	Amsterdam
RAG	mining and oil production & refining	Germany	Essen 45128	Cologne
Rallye	specialty products	France	Paris 75008	Paris
Ralston Purina	food, beverages & tobacco	US	St. Louis MO 63164	St. Louis
Raytheon	aerospace & defense	US	Waltham MA 02451	Boston
RCA	network & telecommunications	US	New York NY 10020	New York
Reliance Industries	mining and oil production & refining	India	Mumbai 400021	Mumbai
Reliant Energy	energy & utilities	US	Houston TX 77002	Houston
Renault	motor vehicles & parts	France	Boulogne-Billancourt	Paris
Repsol YPF	mining and oil production & refining	Spain	Madrid 28046	Madrid
REWE	general merchandisers	Germany	Cologne	Cologne
Reynolds Metals	metals & metal products	US	Richmond VA 23261	Richmond
RH Macy	general merchandisers	US	New York NY 10116	New York
Rhône-Poulenc	chemicals	France	Courbevoie 92400	Paris
Ricoh	computers	Japan	Tokyo 107	Tokyo
Rio Tinto-Zinc (RTZ)	metals & metal products	UK	London	London
Rite Aid	general merchandisers	US	Camp Hill PA 17011	Harrisburg
RJ Reynolds / RJR Nabisco	food, beverages & tobacco	US	New York NY 10019	New York
RJR / RJ Reynolds	food, beverages & tobacco	US	Winston-Salem NC	Greensboro
Robert Bosch	motor vehicles & parts	Germany	Gerlingen-Schillerhõhe 70839	Stuttgart
Roche Group	pharmaceuticals, personal & health care	Switzerland	Basel 4070	Zurich
Roche Holding	pharmaceuticals, personal & health care	Switzerland	Basel 4058	Zurich
Rockwell International [Los Angeles]	electronics & sp. equipment	US	Seal Beach CA 90740	Los Angeles
Rockwell International [Pittsburgh]	electronics & sp. equipment	US	Pittsburg PA	Pittsburgh
Royal & Sun Alliance	insurance	UK	London W1J	London
Royal Ahold	general merchandisers	Netherlands	Zaandam 1507	Amsterdam
Royal Bank of Canada [Montreal]	banking	Canada	Toronto M5J	Toronto
Royal Bank of Canada [Toronto]	banking	Canada	Montreal	Montreal
Royal Bank of Scotland	banking	UK	Edinburgh EH2	Glasgow
Royal Dutch / Shell Group	mining and oil production & refining	Netherlands	The Hague 2596	Amsterdam
Royal Insurance Holdings	insurance	UK	London EC3V	London

Royal KPN	network & telecommunications	Netherlands	The Hague 2516	Amsterdam
Royal Mail Holdings	mail, package & shipping	UK	London EC1V	London
Royal Philips Electronics	electronics & sp. equipment	Netherlands	Amsterdam 1096	Amsterdam
Royal PTT Nederland	network & telecommunications	Netherlands	Groningen 9726	Groningen
Ruhrgas	energy & utilities	Germany	Essen	Cologne
Ruhrkohle	mining and oil production & refining	Germany	Essen 45128	Cologne
RWE	energy & utilities	Germany	Essen 45128	Cologne
S&W Berisford Plc. (now Enodis Plc)	wholesalers	UK	London W1S	London
Saab - Scania	motor vehicles & parts	Sweden	Linkoping	Linkoping
Saatchi & Saatchi	specialized services	UK	London W1A	London
Sabic	chemicals	Saudi Arabia	Riyadh 11422	Riyadh
Sacilor	metals & metal products	France	Paris 92072	Paris
Safeway (UK)	general merchandisers	UK	Hayes, Middlesex UB3	London
Safeway (US)	general merchandisers	US	Pleasanton CA 94588	San Francisco
Saint-Gobain	engineering, construction & real estate	France	Paris 92096	Paris
Saitama Bank	banking	Japan	Tokyo	Tokyo
Sakura Bank	banking	Japan	Tokyo 100	Tokyo
Salomon	financial services	US	New York NY 10004	New York
Salzgitter	metals & metal products	Germany	Salzgitter	Hanover
Samsung Electronics	electronics & sp. equipment	South Korea	Seoul 100-742	Seoul
Samsung Life Insurance	insurance	South Korea	Seoul 100-716	Seoul
Samsung	wholesalers	South Korea	Seoul 463-721	Seoul
San Paolo IMI	banking	Italy	Turin 10121	Turin
Sandoz	pharmaceuticals, personal & health care	Switzerland	Basel 4002	Zurich
Sanofi-Aventis	pharmaceuticals, personal & health care	France	Paris 75013	Paris
Santa Fe Southern Pacific	land transportation	US	Chicago IL 60604	Chicago
Santander Central Hispano Group	banking	Spain	Madrid 28014	Madrid
Sanwa Bank	banking	Japan	Osaka 541	Osaka
Sanyo Electric	electronics & sp. equipment	Japan	Moriguchi 570-8677	Osaka
Sara Lee	food, beverages & tobacco	US	Chicago IL 60602	Chicago
SBC Communications	network & telecommunications	US	San Antonio TX 78205	San Antonio
SCA (Svenska Cellulosa)	pharmaceuticals, personal & health care	Sweden	Stockholm	Stockholm
SCEcorp	energy & utilities	US	Rosemead CA 91770	Los Angeles
Schlumberger	electronics & sp. equipment	Neth. Antilles	Willelmstad	Willelmstad
Schneider Electric / Empain Schneider	electronics & sp. equipment	France	Rueil 92500	Paris
Scottish Power	energy & utilities	UK	Glasgow G2	Glasgow
Seagram	tourism & entertainment	Canada	Montreal H3G 9Z9	Montreal
Sears Roebuck	general merchandisers	US	Hoffman Estates IL 60179	Chicago
Security Pacific	banking	US	Los Angeles CA 90071	Los Angeles
Seiko Epson	computers	Japan	Suwa 392-8502	Suwa
Seiyu	general merchandisers	Japan	Tokyo 170	Tokyo
Sekisui Chemical	engineering, construction & real estate	Japan	Osaka 530	Osaka

Sekisui House	engineering, construction & real estate	Japan	Osaka 531	Osaka
Shanghai Baosteel Group	metals & metal products	China	Shanghai 200012	Shanghai
Sharp	electronics & sp. equipment	Japan	Osaka 545-8522	Osaka
Shell Oil	mining and oil production & refining	US	Houston TX 77002	Houston
Shimizu	engineering, construction & real estate	Japan	Tokyo 105	Tokyo
Shoko Chukin Bank	banking	Japan	Tokyo 104	Tokyo
Showa Shell Sekiyu	mining and oil production & refining	Japan	Tokyo 100	Tokyo
SHV Holdings	wholesalers	Netherlands	Utrecht 3511	Amsterdam
Siemens	electronics & sp. equipment	Germany	Munich 80333	Munich
Signal Companies	aerospace & defense	US	La Jolla CA 92037	San Diego
Sinochem	wholesalers	China	Beijing 100045	Beijing
Sinopec	mining and oil production & refining	China	Beijing 100029	Beijing
SK Networks	wholesalers	South Korea	Seoul 110-192	Seoul
SK (Sunkyong)	mining and oil production & refining	South Korea	Seoul 110-110	Seoul
Skand Enskilda Bank	banking	Sweden	Stockholm	Stockholm
Skandia Group	insurance	Sweden	Stockholm 103-50	Stockholm
Skanska	engineering, construction & real estate	Sweden	Stockholm 11191	Stockholm
Smithkline Beecham	pharmaceuticals, personal & health care	UK	Brentford TW8	London
SNCF	land transportation	France	Paris 75014	Paris
Snow Brand Milk Products	food, beverages & tobacco	Japan	Tokyo 160	Tokyo
Société Générale (Belgium)	banking	Belgium	Brussels	Brussels
Société Générale (France)	banking	France	Paris 75009	Paris
Sodexho Alliance	food, beverages & tobacco	France	Montigny-le-Bretonneux 78180	Paris
Solectron	electronics & sp. equipment	US	Milpitas CA 95035	San Francisco
Solvay	chemicals	Belgium	Brussels	Brussels
Sompo Japan Insurance	insurance	Japan	Tokyo 160	Tokyo
Sony	electronics & sp. equipment	Japan	Tokyo 141	Tokyo
South African Breweries	food, beverages & tobacco	South Africa	Johannesburg	Johannesburg
South African Transport Services	land transportation	South Africa	Woodmead	Johannesburg
Southern	energy & utilities	US	Atlanta GA 30346	Atlanta
Southern California Edison	energy & utilities	US	Rosemead CA 91770	Los Angeles
Southland	general merchandisers	US	Dallas TX 75221	Dallas
Southwestern Bell	network & telecommunications	US	St. Louis MO 63101	St. Louis
Sperry	computers	US	New York NY 10104	New York
Sprint	network & telecommunications	US	Overland Park KS 66251	Kansas City
Ssangyong	wholesalers	South Korea	Seoul 100	Seoul
St. Paul Travelers Cos.	insurance	US	St. Paul MN 55102	Minneapolis
Standard Chartered Bank	banking	UK	London EC2V	London
Standard Life Assurance	insurance	UK	Edinburgh EH2	Glasgow
Standard Oil Indiana	mining and oil production & refining	US	Chicago IL 60601	Chicago
Standard Oil Ohio	mining and oil production & refining	US	Cleveland OH 44115	Cleveland
Staples	specialty products	US	Framingham MA	Boston

State Farm Insurance Cos	insurance	US	Bloomington IL 61710	Peoria
State Grid (State Power)	energy & utilities	China	Beijing 100031	Beijing
Statoil	mining and oil production & refining	Norway	Stavanger 4035	Stavanger
STET - Societa Finanzaria Telefonica	network & telecommunications	Italy	Turin	Turin
STL - Finnish Wholesalers & Importers	wholesalers	Finland	Helsinki	Helsinki
Stone Container	forest & paper products	US	Chicago IL 60601	Chicago
Stora Enso	forest & paper products	Finland	Helsinki 00101	Helsinki
Stora Kopparbergs Bergslags	forest & paper products	Sweden	Falun	Falun
Suez (Suez Lyonnaise des Eaux)	energy & utilities	France	Paris 75008	Paris
Sumikin Bussan	wholesalers	Japan	Osaka 541	Osaka
Sumitomo	wholesalers	Japan	Tokyo 104	Tokyo
Sumitomo Bank	banking	Japan	Osaka 541	Osaka
Sumitomo Chemical	chemicals	Japan	Osaka 541	Osaka
Sumitomo Electric Industries	electronics & sp. equipment	Japan	Osaka 541	Osaka
Sumitomo Life Insurance	insurance	Japan	Osaka 540-8512	Osaka
Sumitomo Marine & Fire Ins.	insurance	Japan	Tokyo 104	Tokyo
Sumitomo Metal Industries	metals & metal products	Japan	Osaka 541	Osaka
Sumitomo Mitsui Financial Grp / Sumitomo Bank	banking	Japan	Tokyo 100	Tokyo
Sumitomo Trust & Banking	banking	Japan	Osaka 541	Osaka
Sun	mining and oil production & refining	US	Radnor PA 19087	Philadelphia
Sun Alliance	insurance	UK	London EC2V	London
Sun Life Financial Services	insurance	Canada	Toronto M5H	Toronto
Sun Microsystems	computers	US	Santa Clara CA 95054	San Francisco
Sunoco	mining and oil production & refining	US	Philadelphia PA 19103	Philadelphia
Supermarkets General	general merchandisers	US	Woodbridge NJ 07095	New York
Supervalu	wholesalers	US	Eden Prairie MN 55344	Minneapolis
Suzuki Motor	motor vehicles & parts	Japan	Hamamatsu 432-8611	Nagoya
Svenska Handelsbanken	banking	Sweden	Stockholm	Stockholm
Swiss Bank Corp.	banking	Switzerland	Basel 4002	Zurich
Swiss Life	insurance	Switzerland	Zurich 8022	Zurich
Swiss Reinsurance	insurance	Switzerland	Zurich 8022	Zurich
Sysco	wholesalers	US	Houston TX 77077	Houston
T&D Holdings	insurance	Japan	Tokyo 103	Tokyo
Taisei	engineering, construction & real estate	Japan	Tokyo 163	Tokyo
Taiyo Fishery	food, beverages & tobacco	Japan	Tokyo	Tokyo
Taiyo Kobe Bank	banking	Japan	Kobe 650	Osaka
Taiyo Mutual Life	insurance	Japan	Tokyo 103	Tokyo
Takashimaya	general merchandisers	Japan	Osaka 542	Osaka
Takeda Chemical	pharmaceuticals, personal & health care	Japan	Osaka	Osaka
Takenaka	engineering, construction & real estate	Japan	Osaka 541	Osaka
Target	general merchandisers	US	Minneapolis MN 55403	Minneapolis
Tarmac	engineering, construction & real estate	UK	Wolverhampton WV11	Birmingham
Tate & Lyle	general merchandisers	UK	London EC3R	London
Teachers Ins. & Annuity	insurance	US	New York NY 10017	New York

Tech Data	wholesalers	US	Clearwater FL 33760	Tampa
Telecom Italia	network & telecommunications	Italy	Roma 00198	Rome
Teledyne	industrial & farm equipment	US	Los Angeles CA 90067	Los Angeles
Telefónica	network & telecommunications	Spain	Madrid 28013	Madrid
Teléfonos de México	network & telecommunications	Mexico	Mexico City 06599	Mexico
Telstra	network & telecommunications	Australia	Melbourne 3000	Melbourne
Tenet Healthcare	pharmaceuticals, personal & health care	US	Santa Barbara CA 93105	Santa Barbara
Tengelmann	specialty products	Germany	Mulheim	Cologne
Tenneco	mining and oil production & refining	US	Houston TX 77002	Houston
Tesco	general merchandisers	UK	Cheshunt EN8	London
Texaco	mining and oil production & refining	US	White Plains NY 10650	New York
Texas Air	airlines	US	Houston TX 77002	Houston
Texas Eastern	energy & utilities	US	Houston TX 77252	Houston
Texas Instruments	electronics & sp. equipment	US	Dallas TX 75266	Dallas
Textron	aerospace & defense	US	Providence RI 02809	Boston
Thales Group	aerospace & defense	France	Paris 75008	Paris
Thomson / Thomson-Brandt (France)	electronics & sp. equipment	France	Paris 75415	Paris
Thorn EMI	electronics & sp. equipment	UK	Chertsey KT16	London
Thyssen Krupp	industrial & farm equipment	Germany	Düsseldorf 40211	Cologne
TIAA-CREF	insurance	US	New York NY 10017	New York
Time Warner	tourism & entertainment	US	New York NY 10019	New York
TJX	specialty products	US	Framingham MA 01701	Boston
TNT	mail, package & shipping	Netherlands	Hoofddorp 2132	Amsterdam
Toa Nenryo Kogyo	energy & utilities	Japan	Kobe	Osaka
Toho Mutual Life Insurance	insurance	Japan	Tokyo 150	Tokyo
Tohoku Electric Power	energy & utilities	Japan	Sendai 980	Sendai
Tokai Bank	banking	Japan	Nagoya 460	Nagoya
Tokio Marine & Fire	insurance	Japan	Tokyo 100	Tokyo
Tokio Marine & Fire Ins.	insurance	Japan	Tokyo 100	Tokyo
Tokyo Electric Power	energy & utilities	Japan	Tokyo 100	Tokyo
Tokyo Gas	energy & utilities	Japan	Tokyo 105	Tokyo
Tomen	wholesalers	Japan	Osaka 541	Osaka
Toppan Printing	specialized services	Japan	Tokyo 101	Tokyo
Toray Industries	chemicals	Japan	Tokyo 103	Tokyo
Toronto Dominion Bank	banking	Canada	Toronto M5K	Toronto
Tosco	mining and oil production & refining	US	Stamford CT	New York
Toshiba	electronics & sp. equipment	Japan	Tokyo 105	Tokyo
Toshoku	wholesalers	Japan	Tokyo 103	Tokyo
Total (Total Fina Elf)	mining and oil production & refining	France	Courbevoie 92400	Paris
Toyo Menka Kaisha	wholesalers	Japan	Osaka	Osaka
Toyo Seikan	metals & metal products	Japan	Tokyo 100	Tokyo
Toyo Trust & Bank	financial services	Japan	Tokyo	Tokyo
Toyota Motor	motor vehicles & parts	Japan	Toyota 471	Nagoya

Toyota Tsusho	wholesalers	Japan	Nagoya 450	Nagoya
Toys "R" Us	specialty products	US	Paramus NJ 07652	New York
Tractebel	energy & utilities	Belgium	Brussels 1000	Brussels
Trafalgar House	mining and oil production & refining	UK	London SW1Y	London
Transamerica	insurance	US	San Francisco CA	San Francisco
Transcanada Pipelines	energy & utilities	Canada	Calgary T2P 4K5	Calgary
Transco Energy	energy & utilities	US	Houston TX 77251	Houston
Travelers Corp.	insurance	US	Hartford CT	Hartford
Travelers Inc.	insurance	US	New York NY 10013	New York
TRW	motor vehicles & parts	US	Cleveland OH 44124	Cleveland
TUI	tourism & entertainment	Germany	Hanover 30625	Hanover
Türkiye Petrolleri	mining and oil production & refining	Turkey	Ankara	Ankara
TWA - Trans World Airlines	airlines	US	New York NY 10158	New York
TXU - Texas Utilities	energy & utilities	US	Dallas TX 75201	Dallas
Tyco International	electronics & sp. equipment	US	Portsmouth NH 03801	Boston
Tyson Foods	food, beverages & tobacco	US	Springdale AR 72762	Fayetteville
UAL - United Airlines	airlines	US	Elk Grove IL 60007	Chicago
UAP - Union des Assurances de Paris	insurance	France	Paris 75001	Paris
UBS - Union Bank of Switzerland	banking	Switzerland	Zurich 8098	Zurich
UES of Russia	energy & utilities	Russia	Moscow 119526	Moscow
UFJ Holdings	banking	Japan	Osaka 541-8530	Osaka
Ultramar	energy & utilities	UK	London EC2M	London
Ultramar Diamond Shamrock (bought by Valero)	mining and oil production & refining	US	San Antonio TX 78249	San Antonio
UniCredito Italiano	banking	Italy	Milan 20123	Milan
Unilever [Amsterdam]	food, beverages & tobacco	Netherlands	Rotterdam	Amsterdam
Unilever [London]	food, beverages & tobacco	UK	London EC4P	London
Union Bank of Switzerland	banking	Switzerland	Zurich	Zurich
Union Carbide	chemicals	US	Danbury CT 06817	New York
Union Pacific [New York]	land transportation	US	New York NY	New York
Union Pacific [Philadelphia]	land transportation	US	Bethlehem PA 18018	Philadelphia
Unisys	computers	US	Blue Bell PA 19424	Philadelphia
United Energy Resources	energy & utilities	US	Houston TX 77251	Houston
United Health Group	pharmaceuticals, personal & health care	US	Minnetonka MN 55343	Minneapolis
United Parcel Service [Atlanta]	mail, package & shipping	US	Atlanta GA 30328	Atlanta
United Parcel Service [New York]	mail, package & shipping	US	Greenwich CT	New York
United Technologies	aerospace & defense	US	Hartford CT 06103	Hartford
United Telecommunications	network & telecommunications	US	Kansas City MO 64112	Kansas City
Unocal	mining and oil Production & refining	US	Los Angeles CA 90017	Los Angeles
UNY	general merchandisers	Japan	Inazawa 492	Nagoya
US Bancorp	banking	US	Minneapolis MN 55402	Minneapolis
US Postal Service	mail, package & shipping	US	Washington DC 20260	Washington
US West	network & telecommunications	US	Englewood CO 80111	Denver
USAir	airlines	US	Arlington VA 22227	Washington
Usinor	metals & metal products	France	La Defense 92070	Paris

USX - Marathon	mining and oil production & refining	US	Pittsburgh PA 15219	Pittsburgh
USX - US Steel	metals & metal products	US	Pittsburgh PA 15219	Pittsburgh
UtiliCorp United (now Aquila)	energy & utilities	US	Kansas City MO 64105	Kansas City
Valero Energy	mining and oil production & refining	US	San Antonio TX 78212	San Antonio
Vattenfall	energy & utilities	Sweden	Stockholm 16287	Stockholm
VEBA Oil	mining and oil production & refining	Germany	Düsseldorf	Cologne
Vendex International	specialty products	Netherlands	Rotterdam	Amsterdam
Veolia Environnement	energy & utilities	France	Paris 75116	Paris
Verizon Communications	network & telecommunications	US	New York NY 10036	New York
Viacom	tourism & entertainment	US	New York NY 10036	New York
VIAG	wholesalers	Germany	Munich 80335	Munich
Vinci	engineering, construction & real estate	France	Rueil-Malmaison 92851	Paris
Visteon	motor vehicles & parts	US	Dearborn MI 48120	Detroit
Vivendi Universal	network & telecommunications	France	Paris 75380	Paris
Vodafone	network & telecommunications	UK	Newbury RG14	London
Volkswagen	motor vehicles & parts	Germany	Wolfsburg 38436	Hanover
Volvo	motor vehicles & parts	Sweden	Gothenburg 40508	Gothenburg
Wachovia	banking	US	Charlotte NC 28288	Charlotte
Walgreen	general merchandisers	US	Deerfield IL 60015	Chicago
Wal-Mart Stores	general merchandisers	US	Bentonville AR 72716	Fayetteville
Walt Disney	tourism & entertainment	US	Burbank CA 91521	Los Angeles
Warner Lambert	pharmaceuticals, personal & health Care	US	Morris Plains NJ 07950	New York
Washington Mutual	banking	US	Seattle WA 98101	Seattle
Waste Management	engineering, construction & real estate	US	Houston TX 77002	Houston
Wellpoint	pharmaceuticals, personal & health care	US	Indianapolis IN 46204	Indianapolis
Wells Fargo	banking	US	San Francisco CA 94163	San Francisco
West Japan Railway	land transportation	Japan	Osaka 530	Osaka
Westinghouse Electric	electronics & sp. equipment	US	Pittsburgh PA 15222	Pittsburgh
WestLB (Westdeutsche Landesbank)	banking	Germany	Duesseldorf 40217	Cologne
Westpac Banking	banking	Australia	Sydney 2000	Sydney
Weyerhaeuser	forest & paper products	US	Federal Way WA 98063	Seattle
Whirlpool	electronics & sp. equipment	US	Benton Harbor MI 49022	Niles
William Hill	tourism & entertainment	UK	London N22	London
William Morrison Supermarkets	general merchandisers	UK	Bradford BD8	Leeds
Williams	energy & utilities	US	Tulsa OK 74172	Tulsa
Winn-Dixie Stores	general merchandisers	US	Jacksonville FL 32254	Jacksonville
Winterthur Group	insurance	Switzerland	Winterthur 8401	Zurich
WMX Technologies	engineering, construction & real estate	US	Oak Brook IL 60521	Chicago
Wolseley	wholesalers	UK	Theale RG7	London
Woolworth / FW Woolworth	specialty products	US	New York NY 10279	New York
Woolworths	general merchandisers	Australia	Sydney 2000	Sydney

WorldCom (LDDS)	network & telecommunications	US	Clinton MS	Jackson
WR Grace	chemicals	US	New York NY 10036	New York
Wyeth	pharmaceuticals, personal & health care	US	Madison NJ 07940	New York
Xerox	computers	US	Stamford CT 06904	New York
Yamaha Motor	motor vehicles & parts	Japan	Iwata 438	Nagoya
Yasuda Fire & Marine	insurance	Japan	Tokyo 160	Tokyo
Yasuda Mutual Life	insurance	Japan	Tokyo 169	Tokyo
Yasuda Trust & Bank	financial services	Japan	Tokyo	Tokyo
YPF - Yacimientos Petroliferos	mining and oil production & refining	Argentina	Buenos Aires 1364	Buenos Aires
Zurich Financial Services	insurance	Switzerland	Zurich 8002	Zurich

Notes:

a: companies considered separately if headquarters moved to a different urban region

Sources: Fortune and Forbes magazines1985-2005 and author's research.

5.3. Number of companies by type of activity listed among the world's 500 largest corporations, 1984-2004

type of activities	*all lists*	*1984*	*1989*	*1994*	*1999*	*2004*
aerospace & defense	21	10	13	10	8	11
airlines	14	9	9	9	9	7
banking	135	61	67	67	65	55
chemicals	29	21	22	16	10	9
computers	22	10	12	9	11	12
electronics & specialized equipment	47	29	32	32	26	28
energy & utilities	73	41	20	20	25	34
engineering, construction & real estate	32	8	17	18	12	17
financial services	19	4	12	7	10	8
food, beverages & tobacco	56	37	30	22	21	19
forest & paper products	13	5	8	4	5	4
general merchandisers	83	48	40	43	39	34
industrial & farm equipment	18	13	13	12	9	6
insurance	90	21	27	52	51	49
land transportation	16	11	4	8	8	4
mail, package & shipping	15	6	4	9	8	11
metals & metal products	42	26	25	15	13	11
mining and oil production & refining	86	52	44	34	33	39
motor vehicles & parts	46	27	29	28	29	34
network & telecommunications	51	16	20	24	30	29
pharmaceuticals, personal & health care	42	12	15	16	26	28
specialized services	8	0	3	4	5	6
specialty products	22	4	3	6	12	13
tourism & entertainment	16	3	6	5	7	9
wholesalers	50	26	25	30	28	23
TOTAL	*1,045*	*500*	*500*	*500*	*500*	*500*

Notes:

a: figures express number of corporations per list and type of activities, irrelevant of their sales.

Sources: Fortune and Forbes magazines1985-2005 and author's research.

5.4. Aggregate sales by type of activity of the world's 500 largest corporations, 1984-2004

type of activity	*1984*	*1989*	*1994*	*1999*	*2004*
aerospace & defense	77,984	140,245	131,719	189,309	305,593
airlines	39,299	71,618	108,232	127,193	129,382
banking	415,656	812,495	1,059,834	1,489,081	1,699,117
chemicals	185,462	272,809	267,019	182,444	234,562
computers	97,967	173,250	202,370	352,081	435,552
electronics & specialized equipment	275,460	559,696	752,006	826,147	1,081,110
energy & utilities	257,239	228,939	337,342	527,999	851,808
engineering, construction & real estate	38,039	149,388	263,554	167,779	295,926
financial services	43,301	129,663	108,075	244,480	218,739
food, beverages & tobacco	253,114	344,283	408,548	433,422	520,539
forest & paper products	25,886	63,880	48,060	76,802	84,680
general merchandisers	341,992	459,471	738,279	1,014,063	1,365,882
industrial & farm equipment	104,014	171,231	213,727	180,475	153,644
insurance	117,285	240,712	1,018,850	1,454,074	1,845,094
land transportation	76,296	29,244	107,384	110,506	93,965
mail, package & shipping	53,803	36,249	157,289	192,291	318,329
metals & metal products	157,159	219,608	200,534	179,551	251,312
mining and oil production & refining	885,878	807,023	837,529	1,015,782	2,254,209
motor vehicles & parts	415,913	734,924	1,003,896	1,292,036	1,732,943
network & telecommunications	168,039	267,172	526,123	881,764	955,822
pharmaceuticals, personal & health care	69,376	125,855	196,352	442,253	668,557
specialized services	0	22,005	45,718	62,432	100,178
specialty products	23,976	22,008	67,770	213,318	324,593
tourism & entertainment	12,060	40,266	52,174	115,538	222,893
wholesalers	476,587	1,079,476	1,445,115	1,078,604	653,658
TOTAL	*4,611,785*	*7,201,510*	*10,297,500*	*12,849,424*	*16,798,086*

Notes:

a: aggregate sales in millions of current dollars.

Sources: Fortune and Forbes magazines1985-2005 and author's research.

5.5. First and last time cities appeared as headquarters of Top 500 corporations, 1984-2004 (first entries in 1984 and last entries in 2004 not considered)

cities	*1984*	*1989*	*1994*	*1999*	*2004*
listed for the first time	n/a	*Auckland* BIELEFELD BILBAO *Birmingham* *Bologna* CHARLOTTE *Falun* ISTANBUL *Linköping* LUXEMBURG MEMPHIS NILES *Nottingham* *Perth* POHANG TAIPEI	HONG KONG LEEDS MILWAUKEE *Saarbrücken* SAN ANTONIO Sioux City TAMPA *Tours*	AUSTIN HARRISBURG INDIANAPOLIS *Jackson* KUALA LUMPUR LILLE MOSCOW SANTA BARBARA *Strasbourg*	*BANGKOK* *CHANGCHUN* *COLUMBUS, GA* *COPENHAGEN* *DEHRADUN* *DUBLIN* *GUANGZHOU* *MUMBAI* *RIYADH* *SHANGHAI* *SINGAPORE* *SUWA*
listed for the last time	*Aachen-Heerlen* *Ankara* *Appleton* *Greensboro* *Norfolk* *San Diego* *Syracuse* *Tehran* *Tel Aviv* *Willemstad* *Winnipeg*	*Auckland* *Birmingham* *Bologna* Buenos Aires *Falun* Fort Wayne Johannesburg Kuwait *Linköping* *Nottingham* *Perth*	Caen Huntington Lyon *Saarbrücken* Salt Lake City Siena *Tours* Vienna	Caracas *Jackson* Jacksonville Oklahoma Sioux City *Strasbourg*	n/a

Notes:

a: cities in small capitals remained in all further lists after the first entry;
b: cities in italic appeared only in one list over the whole period;
c: cities in small capitals and italic were first listed in 2004.

Sources: Fortune and Forbes magazines1985-2005 and author's research.

5.6. Number of headquarters of Top 500 corporations per city, 1984-2004

city	*country*	*1984*	*1989*	*1994*	*1999*	*2004*
Aachen-Heerlen	Netherlands	1	-	-	-	-
Amsterdam	Netherlands	7	7	9	8	14
Ankara	Turkey	1	-	-	-	-
Appleton	US	1	-	-	-	-
Atlanta	US	5	5	7	8	7
Auckland	New Zealand	-	1	-	-	-
Austin	US	-	-	-	1	1
Bangkok	Thailand	-	-	-	-	1
Beijing	China	2	-	3	10	12
Berlin	Germany	1	-	1	2	1
Bielefeld	Germany	-	1	1	1	1
Bilbao	Spain	-	1	1	1	2
Birmingham	UK	-	1	-	-	-
Boise	US	2	1	1	1	1
Bologna	Italy	-	1	-	-	-
Boston	US	2	4	4	6	6
Brasilia	Brazil	1	1	1	1	1
Brussels	Belgium	3	5	5	6	4
Buenos Aires	Argentina	3	1	-	-	-
Caen	France	-	1	1	-	-
Calgary	Canada	1	-	-	1	1
Caracas	Venezuela	1	1	1	1	-
Changchun	China	-	-	-	-	1
Charlotte	US	-	1	1	4	4
Chicago	US	21	14	11	9	11
Cincinnati	US	5	4	3	3	3
Clermont	France	1	1	1	1	1
Cleveland	US	5	2	2	2	3
Cologne	Germany	20	12	17	15	14
Columbus, GA	US	-	-	-	-	1
Columbus, OH	US	1	-	1	2	3
Copenhagen	Denmark	-	-	-	-	2
Dallas	US	9	7	4	8	7
Davenport	US	1	1	1	1	1
Decatur	US	1	1	1	1	1
Dehradun	India	-	-	-	-	1
Delhi	India	1	1	1	1	1
Denver	US	1	1	1	1	1
Detroit	US	9	4	4	6	7
Dublin	Ireland	-	-	-	-	1
Falun	Sweden	-	1	-	-	-
Fayetteville	US	1	1	1	1	2
Fort Wayne	US	1	1	-	-	-
Frankfurt	Germany	9	8	8	5	6
Fukuoka	Japan	1	1	1	1	1
Geneva	Switzerland	1	1	1	1	1
Glasgow	UK	1	2	2	2	3
Gothenburg	Sweden	1	1	1	1	1
Greensboro	US	1	-	-	-	-

Groningen	Netherlands	1	-	1	-	1
Guangzhou	China	-	-	-	-	1
Hamburg	Germany	2	-	2	1	2
Hanover	Germany	2	3	2	2	3
Harrisburg	US	-	-	-	1	1
Hartford	US	3	4	2	3	4
Helsinki	Finland	2	3	1	2	3
Hiroshima	Japan	2	2	2	1	1
Hong Kong	China	-	-	1	1	1
Houston	US	8	6	5	9	6
Huntington	US	1	1	1	-	-
Indianapolis	US	-	-	-	1	2
Istanbul	Turkey		1	1	-	1
Jackson	US	-	-	-	1	-
Jacksonville	US	1	1	1	1	-
Johannesburg	South Africa	4	1	-	-	-
Kansas City	US	1	1	1	3	1
Kuala Lumpur	Malaysia	-	-	-	1	1
Kuwait	Kuwait	1	1	-	-	-
Leeds	UK	-	-	1	1	1
Lille	France	-	-	-	1	1
Linkoping	Sweden	-	1	-	-	-
London	UK	33	41	31	34	32
Los Angeles	US	13	11	7	5	5
Louisville	US	1	-	-	1	1
Luxembourg	Luxemburg	-	1	-	1	1
Lyon	France	-	1	1	-	-
Madrid	Spain	2	4	5	4	6
Melbourne	Australia	3	5	2	4	5
Memphis	US	-	1	1	1	1
Mexico	Mexico	2	1	3	2	2
Miami	US	2	1	-	2	2
Milan	Italy	4	2	3	3	2
Milwaukee	US	-	-	1	2	3
Minneapolis	US	7	6	5	6	7
Montreal	Canada	6	5	3	2	4
Moscow	Russia	-	-	-	2	3
Mumbai	India	-	-	-	-	3
Munich	Germany	6	8	9	9	7
Nagoya	Japan	6	6	8	8	7
Nashville	US	1	-	1	2	2
New York	US	63	48	38	40	36
Niles	US	-	1	1	1	1
Norfolk	US	1	-	-	-	-
Nottingham	UK	-	1	-	-	-
Oklahoma	US	2	1	1	1	-
Omaha	US	2	1	1	2	2
Osaka	Japan	19	27	32	23	13
Oslo	Norway	1	1	1	1	1
Paris	France	26	27	39	35	37
Peoria	US	1	1	2	2	2
Perth	Australia	-	1	-	-	-
Philadelphia	US	8	8	4	4	5

Pittsburgh	US	8	5	3	2	2
Pohang	South Korea	-	1	1	1	1
Richmond	US	2	3	1	2	1
Rio	Brazil	1	1	1	1	1
Riyadh	Saudi Arabia	-	-	-	-	1
Rochester	US	1	1	1	1	1
Rome	Italy	4	2	5	3	3
S Paulo	Brazil	3	3	-	1	1
Saarbrücken	Germany	-	-	1	-	-
Saginaw	US	1	1	1	1	1
Salt Lake City	US	1	1	1	-	-
San Antonio	US	-	-	1	2	2
San Diego	US	1	-	-	-	-
San Francisco	US	10	10	9	11	9
Santa Barbara	US	-	-	-	1	1
Seattle	US	3	2	3	5	4
Sendai	Japan	1	1	1	1	1
Seoul	South Korea	6	7	9	11	10
Shanghai	China	-	-	-	-	1
Siena	Italy	1	-	1	-	-
Singapore	Singapore	-	-	-	-	1
Sioux City	US	-	-	1	1	-
St. Louis	US	8	8	5	4	4
Stavanger	Norway	1	1	1	1	1
Stockholm	Sweden	5	4	2	3	6
Strasbourg	France	-	-	-	1	-
Stuttgart	Germany	2	2	2	3	3
Suwa	Japan	-	-	-	-	1
Sydney	Australia	1	3	1	3	5
Syracuse	US	1	-	-	-	-
Taipei	Taiwan	-	1	1	-	2
Tampa	US	-	-	1	2	2
Tehran	Iran	1	-	-	-	-
Tel Aviv	Israel	4	-	-	-	-
Tokyo	Japan	51	83	102	74	57
Toronto	Canada	5	7	2	8	8
Tours	France	-	-	1	-	-
Trieste	Italy	1	1	1	1	1
Tulsa	US	1	2	1	1	1
Turin	Italy	1	3	3	2	2
Vienna	Austria	1	-	1	-	-
Washington	US	3	5	6	5	7
Willemstad	Neth. Antilles	1	-	-	-	-
Winnipeg	Canada	1	-	-	-	-
Zurich	Switzerland	10	11	13	10	10

Sources: Fortune and Forbes magazines1985-2005 and author's research.

5.7. Total sales of Top 500 corporations per city, 1984-2004

city	*country*	*1984*	*1989*	*1994*	*1999*	*2004*
Aachen-Heerlen	Netherlands	7,034.0	-	-	-	-
Amsterdam	Netherlands	140,504.0	176,456.0	240,876.0	337,668.0	720,747.6
Ankara	Turkey	4,179.0	-	-	-	-
Appleton	US	3,616.0	-	-	-	-
Atlanta	US	34,148.0	49,197.0	98,462.9	169,013.0	207,403.0
Auckland	New Zealand	-	6,528.0	-	-	-
Austin	US	-	-	-	25,265.0	49,205.0
Bangkok	Thailand	-	-	-	-	16,023.3
Beijing	China	10,511.0		41,255.4	210,135.0	394,898.3
Berlin	Germany	9,585.0		20,008.6	28,923.0	29,803.0
Bielefeld	Germany	-	6,717.0	10,915.1	14,811.0	21,163.8
Bilbao	Spain	-	7,988.0	9,006.7	14,486.0	34,164.3
Birmingham	UK	-	5,591.0	-	-	-
Boise	US	8,553.0	7,423.0	11,894.6	37,478.0	40,052.0
Bologna	Italy	-	11,185.0	-	-	-
Boston	US	12,226.0	36,017.0	42,132.2	107,540.0	140,997.2
Brasilia	Brazil	8,413.0	23,120.0	11,384.6	17,982.0	14,768.5
Brussels	Belgium	16,593.0	37,395.0	59,828.2	114,233.0	143,004.2
Buenos Aires	Argentina	12,959.0	6,975.0	-	-	-
Caen	France	-	8,128.0	17,143.5	-	-
Calgary	Canada	3,769.0	-	-	12,415.0	12,433.0
Caracas	Venezuela	13,597.0	13,677.0	22,157.0	32,648.0	-
Changchun	China	-	-	-	-	13,825.4
Charlotte	US	-	6,152.0	13,126.0	111,124.0	150,634.0
Chicago	US	180,224.0	165,862.0	192,211.6	207,262.0	298,725.2
Cincinnati	US	47,606.0	54,679.0	61,571.0	101,193.0	123,471.4
Clermont	France	4,942.0	8,669.0	12,120.3	15,138.0	20,148.2
Cleveland	US	35,471.0	18,209.0	21,375.2	29,850.0	45,101.5
Cologne	Germany	156,553.0	154,841.0	321,519.2	398,550.0	524,079.1
Columbus, GA	US	-	-	-	-	13,281.0
Columbus, OH	US	4,952.0	-	11,183.1	38,589.0	100,045.6
Copenhagen	Denmark	-	-	-	-	40,811.0
Dallas	US	51,050.0	56,329.0	148,993.0	292,341.0	376,968.6
Davenport	US	4,275.0	7,488.0	9,029.8	11,751.0	19,986.1
Decatur	US	4,610.0	7,745.0	11,374.4	14,283.0	36,151.4
Dehradun	India	-	-	-	-	13,751.7
Delhi	India	10,045.0	10,610.0	8,235.7	18,729.0	29,643.2
Denver	US	7,280.0	9,691.0	11,506.0	13,182.0	13,809.0
Detroit	US	196,559.0	287,792.0	369,927.2	430,014.0	462,199.0
Dublin	Ireland	-	-	-	-	15,273.5
Falun	Sweden	-	6,561.0	-	-	-
Fayetteville	US	6,518.0	25,922.0	83,412.4	166,809.0	314,430.0
Fort Wayne	US	4,345.0	8,081.0	-	-	-
Frankfurt	Germany	61,251.0	109,059.0	153,182.1	151,799.0	182,253.0
Fukuoka	Japan	4,418.0	8,100.0	13,707.6	12,830.0	13,107.8
Geneva	Switzerland	13,253.0	29,341.0	41,625.7	49,694.0	69,825.7
Glasgow	UK	12,777.0	11,782.0	18,853.8	30,021.0	120,140.9
Gothenburg	Sweden	10,523.0	14,115.0	20,204.0	15,121.0	28,643.1
Greensboro	US	9,915.0	-	-	-	-
Groningen	Netherlands	9,475.0	-	10,051.7	-	15,117.2

Guangzhou	China	-	-	-	-	18,928.8
Hamburg	Germany	7,973.0		19,969.5	14,291.0	33,288.8
Hanover	Germany	20,873.0	49,207.0	64,214.1	99,353.0	149,610.8
Harrisburg	US	-	-	-	12,732.0	16,816.4
Hartford	US	45,220.0	57,021.0	38,721.7	65,223.0	103,201.3
Helsinki	Finland	9,258.0	20,318.0	9,500.9	32,435.0	66,327.1
Hiroshima	Japan	10,129.0	23,049.0	32,642.1	19,413.0	25,081.4
Hong Kong	China	-	-	9,558.8	10,675.0	17,280.8
Houston	US	65,234.0	51,559.0	54,026.9	181,997.0	250,399.9
Huntington	US	8,267.0	8,017.0	9,505.3	-	-
Indianapolis	US	-	-	-	10,003.0	34,673.0
Istanbul	Turkey		6,415.0	8,212.3	-	15,578.8
Jackson	US	-	-	-	37,120.0	-
Jacksonville	US	7,531.0	9,486.0	11,082.2	14,137.0	-
Johannesburg	South Africa	20,518.0	9,800.0	-	-	-
Kansas City	US	5,238.0	7,549.0	12,661.8	49,261.0	27,428.0
Kuala Lumpur	Malaysia	-	-	-	14,944.0	36,064.8
Kuwait	Kuwait	14,997.0	11,796.0	-	-	-
Leeds	UK	-	-	8,259.5	14,456.0	22,264.3
Lille	France	-	-	-	23,494.0	37,370.1
Linkoping	Sweden	-	6,965.0	-	-	-
London	UK	270,265.0	453,639.0	473,199.9	748,864.0	1,200,754.5
Los Angeles	US	99,273.0	110,100.0	76,389.1	94,309.0	115,981.9
Louisville	US	5,669.0	-	-	10,113.0	13,104.3
Luxembourg	Luxemburg	-	5,634.0	-	11,363.0	37,531.7
Lyon	France	-	5,494.0	11,268.1	-	-
Madrid	Spain	19,421.0	40,315.0	67,886.2	92,495.0	166,621.8
Melbourne	Australia	14,604.0	45,805.0	22,826.5	52,278.0	95,196.8
Memphis	US	-	6,769.0	8,479.5	16,773.0	24,710.0
Mexico	Mexico	26,439.0	15,258.0	44,896.2	35,859.0	78,155.5
Miami	US	8,305.0	6,180.0		34,470.0	33,298.8
Milan	Italy	20,079.0	19,083.0	34,831.6	38,512.0	37,683.0
Milwaukee	US	-	-	9,581.4	31,445.0	59,289.7
Minneapolis	US	40,906.0	56,609.0	70,613.6	112,032.0	191,778.9
Montreal	Canada	42,687.0	52,309.0	34,089.0	24,930.0	74,249.3
Moscow	Russia	-	-	-	23,081.0	86,502.4
Mumbai	India	-	-	-	-	43,392.8
Munich	Germany	39,700.0	97,833.0	202,917.4	343,052.0	388,443.8
Nagoya	Japan	100,526.0	117,001.0	186,649.1	216,959.0	283,134.2
Nashville	US	3,499.0	-	11,132.0	33,314.0	49,303.1
New York	US	715,401.0	801,926.0	800,901.9	1,221,457.2	1,433,659.2
Niles	US	-	6,152.0	8,104.0	10,511.0	13,220.0
Norfolk	US	3,525.0	-	-	-	-
Nottingham	UK	-	7,596.0	-	-	-
Oklahoma	US	9,049.0	12,045.0	15,753.5	14,646.0	-
Omaha	US	12,287.0	14,467.0	23,512.2	48,622.0	92,560.7
Osaka	Japan	172,163.0	424,097.0	910,181.9	652,487.0	355,721.7
Oslo	Norway	4,356.0	9,602.0	10,113.8	13,130.0	24,552.9
Paris	France	218,619.0	382,111.0	742,258.7	886,782.0	1,399,871.2
Peoria	US	6,576	11,126	53,178.1	64,339.0	89,069.9
Perth	Australia		6,921.0			
Philadelphia	US	90,646.0	99,850.0	75,291.4	92,983.0	142,883.0
Pittsburgh	US	61,460.0	53,043.0	36,398.5	42,056.0	38,068.0
Pohang	South Korea	-	6,472.0	9,064.1	10,684.0	20,929.1
Richmond	US	11,662.0	19,959.0	9,608.0	23,425.0	13,980.0

Rio	Brazil	17,094.0	16,360.0	17,353.1	16,351.0	36,987.7
Riyadh	Saudi Arabia	-	-	-	-	18,329.4
Rochester	US	10,600.0	18,398.0	16,862.0	14,089.0	13,829.0
Rome	Italy	64,625.0	76,196.0	119,074.0	80,356.0	158,986.3
S Paulo	Brazil	15,534.0	34,068.0		15,164.0	15,899.0
Saarbrücken	Germany	-	-	11,417.3	-	-
Saginaw	US	11,418.0	17,600.0	20,015.0	18,929.0	40,161.0
Salt Lake City	US	12,119.0	22,004.0	18,355.1	-	-
San Antonio	US	-	-	11,618.5	60,568.0	95,016.6
San Diego	US	6,005.0	-	-	-	-
San Francisco	US	106,670.0	111,116.0	142,052.8	264,582.0	463,509.7
Santa Barbara	US	-	-	-	10,880.0	12,496.0
Seattle	US	25,060.0	30,382.0	48,802.6	131,029.0	123,569.0
Sendai	Japan	4,496.0	8,061.0	14,330.5	14,166.0	14,994.2
Seoul	South Korea	48,044.0	92,126.0	153,536.6	231,129.0	294,696.2
Shanghai	China	-	-	-	-	19,543.3
Siena	Italy	3,700.0	-	8,055.7	-	-
Singapore	Singapore	-	-	-	-	15,908.2
Sioux City	US	-	-	12,075.4	14,075.0	-
St. Louis	US	52,199.0	74,982.0	54,332.0	50,324.0	60,104.9
Stavanger	Norway	4,369.0	8,735.0	11,852.5	17,945.0	45,440.0
Stockholm	Sweden	21,339.0	31,230.0	24,930.6	60,255.0	92,346.3
Strasbourg	France	-	-	-	13,438.0	-
Stuttgart	Germany	21,741.0	56,896.0	85,426.4	206,171.0	247,254.2
Suwa	Japan	-	-	-	-	13,768.6
Sydney	Australia	4,364.0	22,996.0	8,040.0	43,396.0	83,764.5
Syracuse	US	4,101.0	-	-	-	-
Taipei	Taiwan	-	8,008.0	8,511.5	-	31,429.0
Tampa	US	-	-	8,742.5	30,061.0	38,476.7
Tehran	Iran	16,000.0	-	-	-	-
Tel Aviv	Israel	45,079.0	-	-	-	-
Tokyo	Japan	645,205.0	1,731,173.0	2,629,653.5	2,044,688.0	1,686,309.4
Toronto	Canada	24,912.0	56,014.0	17,782.2	102,009.0	139,114.2
Tours	France	-	-	8,344.7	-	-
Trieste	Italy	4,200.0	11,629.0	20,764.9	53,723.0	83,267.6
Tulsa	US	15,537.0	28,038.0	12,367.0	13,852.0	12,814.7
Turin	Italy	13,553.0	57,546.0	67,747.4	81,420.0	74,871.9
Vienna	Austria	9,640.0		36,766.0		
Washington	US	16,529.0	37,612.0	159,203.5	186,613.0	205,170.7
Willemstad	Neth. Antilles	5,978.0	-	-	-	-
Winnipeg	Canada	4,111.0	-	-	-	-
Zurich	Switzerland	43,479.0	104,337.0	203,731.4	242,829.0	335,979.6

Notes:

a: aggregate sales in millions of current dollars.

Sources: Fortune and Forbes magazines1985-2005 and author’s research.

5.8. City shares of total sales of Top 500 corporations, 1984-2004

city	*country*	*1984*	*1989*	*1994*	*1999*	*2004*	*1984-2004*
Aachen-Heerlen	Netherlands	0.15 %	0.00 %	0.00 %	0.00 %	0.00 %	-0.15 %
Amsterdam	Netherlands	3.05 %	2.45 %	2.34 %	2.62 %	4.29 %	1.24 %
Ankara	Turkey	0.09 %	0.00 %	0.00 %	0.00 %	0.00 %	-0.09 %
Appleton	US	0.08 %	0.00 %	0.00 %	0.00 %	0.00 %	-0.08 %
Atlanta	US	0.74 %	0.68 %	0.96 %	1.31 %	1.23 %	0.49 %
Auckland	New Zealand	0.00 %	0.09 %	0.00 %	0.00 %	0.00 %	0.00 %
Austin	US	0.00 %	0.00 %	0.00 %	0.20 %	0.29 %	0.29 %
Bangkok	Thailand	0.00 %	0.00 %	0.00 %	0.00 %	0.10 %	0.10 %
Beijing	China	0.23 %	0.00 %	0.40 %	1.63 %	2.35 %	2.12 %
Berlin	Germany	0.21 %	0.00 %	0.19 %	0.22 %	0.18 %	-0.03 %
Bielefeld	Germany	0.00 %	0.09 %	0.11 %	0.12 %	0.13 %	0.13 %
Bilbao	Spain	0.00 %	0.11 %	0.09 %	0.11 %	0.20 %	0.20 %
Birmingham	UK	0.00 %	0.08 %	0.00 %	0.00 %	0.00 %	0.00 %
Boise	US	0.19 %	0.10 %	0.12 %	0.29 %	0.24 %	0.05 %
Bologna	Italy	0.00 %	0.16 %	0.00 %	0.00 %	0.00 %	0.00 %
Boston	US	0.27 %	0.50 %	0.41 %	0.84 %	0.84 %	0.57 %
Brasilia	Brazil	0.18 %	0.32 %	0.11 %	0.14 %	0.09 %	-0.09 %
Brussels	Belgium	0.36 %	0.52 %	0.58 %	0.89 %	0.85 %	0.49 %
Buenos Aires	Argentina	0.28 %	0.10 %	0.00 %	0.00 %	0.00 %	-0.28 %
Caen	France	0.00 %	0.11 %	0.17 %	0.00 %	0.00 %	0.00 %
Calgary	Canada	0.08 %	0.00 %	0.00 %	0.10 %	0.07 %	-0.01 %
Caracas	Venezuela	0.29 %	0.19 %	0.22 %	0.25 %	0.00 %	-0.29 %
Changchun	China	0.00 %	0.00 %	0.00 %	0.00 %	0.08 %	0.08 %
Charlotte	US	0.00 %	0.09 %	0.13 %	0.86 %	0.90 %	0.90 %
Chicago	US	3.91 %	2.30 %	1.87 %	1.61 %	1.78 %	-2.13 %
Cincinnati	US	1.03 %	0.76 %	0.60 %	0.79 %	0.74 %	-0.30 %
Clermont	France	0.11 %	0.12 %	0.12 %	0.12 %	0.12 %	0.01 %
Cleveland	US	0.77 %	0.25 %	0.21 %	0.23 %	0.27 %	-0.50 %
Cologne	Germany	3.39 %	2.15 %	3.12 %	3.10 %	3.12 %	-0.27 %
Columbus, GA	US	0.00 %	0.00 %	0.00 %	0.00 %	0.08 %	0.08 %
Columbus, OH	US	0.11 %	0.00 %	0.11 %	0.30 %	0.60 %	0.49 %
Copenhagen	Denmark	0.00 %	0.00 %	0.00 %	0.00 %	0.24 %	0.24 %
Dallas	US	1.11 %	0.78 %	1.45 %	2.27 %	2.24 %	1.14 %
Davenport	US	0.09 %	0.10 %	0.09 %	0.09 %	0.12 %	0.03 %
Decatur	US	0.10 %	0.11 %	0.11 %	0.11 %	0.22 %	0.12 %
Dehradun	India	0.00 %	0.00 %	0.00 %	0.00 %	0.08 %	0.08 %
Delhi	India	0.22 %	0.15 %	0.08 %	0.15 %	0.18 %	-0.04 %
Denver	US	0.16 %	0.13 %	0.11 %	0.10 %	0.08 %	-0.08 %
Detroit	US	4.26 %	4.00 %	3.59 %	3.34 %	2.75 %	-1.51 %
Dublin	Ireland	0.00 %	0.00 %	0.00 %	0.00 %	0.09 %	0.09 %
Falun	Sweden	0.00 %	0.09 %	0.00 %	0.00 %	0.00 %	0.00 %
Fayetteville	US	0.14 %	0.36 %	0.81 %	1.30 %	1.87 %	1.73 %
Fort Wayne	US	0.09 %	0.11 %	0.00 %	0.00 %	0.00 %	-0.09 %
Frankfurt	Germany	1.33 %	1.51 %	1.49 %	1.18 %	1.08 %	-0.24 %
Fukuoka	Japan	0.10 %	0.11 %	0.13 %	0.10 %	0.08 %	-0.02 %
Geneva	Switzerland	0.29 %	0.41 %	0.40 %	0.39 %	0.42 %	0.13 %
Glasgow	UK	0.28 %	0.16 %	0.18 %	0.23 %	0.72 %	0.44 %
Gothenburg	Sweden	0.23 %	0.20 %	0.20 %	0.12 %	0.17 %	-0.06 %

Greensboro	US	0.21 %	0.00 %	0.00 %	0.00 %	0.00 %	-0.21 %
Groningen	Netherlands	0.21 %	0.00 %	0.10 %	0.00 %	0.09 %	-0.12 %
Guangzhou	China	0.00 %	0.00 %	0.00 %	0.00 %	0.11 %	0.11 %
Hamburg	Germany	0.17 %	0.00 %	0.19 %	0.11 %	0.20 %	0.03 %
Hanover	Germany	0.45 %	0.68 %	0.62 %	0.77 %	0.89 %	0.44 %
Harrisburg	US	0.00 %	0.00 %	0.00 %	0.10 %	0.10 %	0.10 %
Hartford	US	0.98 %	0.79 %	0.38 %	0.51 %	0.61 %	-0.37 %
Helsinki	Finland	0.20 %	0.28 %	0.09 %	0.25 %	0.39 %	0.19 %
Hiroshima	Japan	0.22 %	0.32 %	0.32 %	0.15 %	0.15 %	-0.07 %
Hong Kong	China	0.00 %	0.00 %	0.09 %	0.08 %	0.10 %	0.10 %
Houston	US	1.41 %	0.72 %	0.52 %	1.41 %	1.49 %	0.08 %
Huntington	US	0.18 %	0.11 %	0.09 %	0.00 %	0.00 %	-0.18 %
Indianapolis	US	0.00 %	0.00 %	0.00 %	0.08 %	0.21 %	0.21 %
Istanbul	Turkey	0.00 %	0.09 %	0.08 %	0.00 %	0.09 %	0.09 %
Jackson	US	0.00 %	0.00 %	0.00 %	0.29 %	0.00 %	0.00 %
Jacksonville	US	0.16 %	0.13 %	0.11 %	0.11 %	0.00 %	-0.16 %
Johannesburg	South Africa	0.44 %	0.14 %	0.00 %	0.00 %	0.00 %	-0.44 %
K Lumpur	Malaysia	0.00 %	0.00 %	0.00 %	0.12 %	0.21 %	0.21 %
Kansas City	US	0.11 %	0.10 %	0.12 %	0.38 %	0.16 %	0.05 %
Kuwait	Kuwait	0.33 %	0.16 %	0.00 %	0.00 %	0.00 %	-0.33 %
Leeds	UK	0.00 %	0.00 %	0.08 %	0.11 %	0.13 %	0.13 %
Lille	France	0.00 %	0.00 %	0.00 %	0.18 %	0.22 %	0.22 %
Linkoping	Sweden	0.00 %	0.10 %	0.00 %	0.00 %	0.00 %	0.00 %
London	UK	5.86 %	6.30 %	4.60 %	5.82 %	7.15 %	1.29 %
Los Angeles	US	2.15 %	1.53 %	0.74 %	0.73 %	0.69 %	-1.46 %
Louisville	US	0.12 %	0.00 %	0.00 %	0.08 %	0.08 %	-0.04 %
Luxembourg	Luxemburg	0.00 %	0.08 %	0.00 %	0.09 %	0.22 %	0.22 %
Lyon	France	0.00 %	0.08 %	0.11 %	0.00 %	0.00 %	0.00 %
Madrid	Spain	0.42 %	0.56 %	0.66 %	0.72 %	0.99 %	0.57 %
Melbourne	Australia	0.32 %	0.64 %	0.22 %	0.41 %	0.57 %	0.25 %
Memphis	US	0.00 %	0.09 %	0.08 %	0.13 %	0.15 %	0.15 %
Mexico	Mexico	0.57 %	0.21 %	0.44 %	0.28 %	0.47 %	-0.11 %
Miami	US	0.18 %	0.09 %	0.00 %	0.27 %	0.20 %	0.02 %
Milan	Italy	0.44 %	0.26 %	0.34 %	0.30 %	0.22 %	-0.21 %
Milwaukee	US	0.00 %	0.00 %	0.09 %	0.24 %	0.35 %	0.35 %
Minneapolis	US	0.89 %	0.79 %	0.69 %	0.87 %	1.14 %	0.25 %
Montreal	Canada	0.93 %	0.73 %	0.33 %	0.19 %	0.44 %	-0.48 %
Moscow	Russia	0.00 %	0.00 %	0.00 %	0.18 %	0.51 %	0.51 %
Mumbai	India	0.00 %	0.00 %	0.00 %	0.00 %	0.26 %	0.26 %
Munich	Germany	0.86 %	1.36 %	1.97 %	2.67 %	2.31 %	1.45 %
Nagoya	Japan	2.18 %	1.62 %	1.81 %	1.69 %	1.69 %	-0.49 %
Nashville	US	0.08 %	0.00 %	0.11 %	0.26 %	0.29 %	0.22 %
New York	US	15.51 %	11.14 %	7.78 %	9.51 %	8.53 %	-6.98 %
Niles	US	0.00 %	0.09 %	0.08 %	0.08 %	0.08 %	0.08 %
Norfolk	US	0.08 %	0.00 %	0.00 %	0.00 %	0.00 %	-0.08 %
Nottingham	UK	0.00 %	0.11 %	0.00 %	0.00 %	0.00 %	0.00 %
Oklahoma	US	0.20 %	0.17 %	0.15 %	0.11 %	0.00 %	-0.20 %
Omaha	US	0.27 %	0.20 %	0.23 %	0.38 %	0.55 %	0.28 %
Osaka	Japan	3.73 %	5.89 %	8.84 %	5.07 %	2.12 %	-1.62 %
Oslo	Norway	0.09 %	0.13 %	0.10 %	0.10 %	0.15 %	0.05 %
Paris	France	4.74 %	5.31 %	7.21 %	6.89 %	8.33 %	3.59 %
Peoria	US	0.14 %	0.15 %	0.52 %	0.50 %	0.53 %	0.39 %
Perth	Australia	0.00 %	0.10 %	0.00 %	0.00 %	0.00 %	0.00 %

Philadelphia	US	1.97 %	1.39 %	0.73 %	0.72 %	0.85 %	-1.11 %
Pittsburgh	US	1.33 %	0.74 %	0.35 %	0.33 %	0.23 %	-1.11 %
Pohang	South Korea	0.00 %	0.09 %	0.09 %	0.08 %	0.12 %	0.12 %
Richmond	US	0.25 %	0.28 %	0.09 %	0.18 %	0.08 %	-0.17 %
Rio	Brazil	0.37 %	0.23 %	0.17 %	0.13 %	0.22 %	-0.15 %
Riyadh	Saudi Arabia	0.00 %	0.00 %	0.00 %	0.00 %	0.11 %	0.11 %
Rochester	US	0.23 %	0.26 %	0.16 %	0.11 %	0.08 %	-0.15 %
Rome	Italy	1.40 %	1.06 %	1.16 %	0.62 %	0.95 %	-0.45 %
S Paulo	Brazil	0.34 %	0.47 %	0.00 %	0.12 %	0.09 %	-0.24 %
Saarbrücken	Germany	0.00 %	0.00 %	0.11 %	0.00 %	0.00 %	0.00 %
Saginaw	US	0.25 %	0.24 %	0.19 %	0.15 %	0.24 %	-0.01 %
Salt Lake City	US	0.26 %	0.31 %	0.18 %	0.00 %	0.00 %	-0.26 %
San Antonio	US	0.00 %	0.00 %	0.11 %	0.47 %	0.57 %	0.57 %
San Diego	US	0.13 %	0.00 %	0.00 %	0.00 %	0.00 %	-0.13 %
San Francisco	US	2.31 %	1.54 %	1.38 %	2.06 %	2.76 %	0.45 %
Santa Barbara	US	0.00 %	0.00 %	0.00 %	0.08 %	0.07 %	0.07 %
Seattle	US	0.54 %	0.42 %	0.47 %	1.02 %	0.74 %	0.19 %
Sendai	Japan	0.10 %	0.11 %	0.14 %	0.11 %	0.09 %	-0.01 %
Seoul	South Korea	1.04 %	1.28 %	1.49 %	1.80 %	1.75 %	0.71 %
Shanghai	China	0.00 %	0.00 %	0.00 %	0.00 %	0.12 %	0.12 %
Siena	Italy	0.08 %	0.00 %	0.08 %	0.00 %	0.00 %	-0.08 %
Singapore	Singapore	0.00 %	0.00 %	0.00 %	0.00 %	0.09 %	0.09 %
Sioux City	US	0.00 %	0.00 %	0.12 %	0.11 %	0.00 %	0.00 %
St. Louis	US	1.13 %	1.04 %	0.53 %	0.39 %	0.36 %	-0.77 %
Stavanger	Norway	0.09 %	0.12 %	0.12 %	0.14 %	0.27 %	0.18 %
Stockholm	Sweden	0.46 %	0.43 %	0.24 %	0.47 %	0.55 %	0.09 %
Strasbourg	France	0.00 %	0.00 %	0.00 %	0.10 %	0.00 %	0.00 %
Stuttgart	Germany	0.47 %	0.79 %	0.83 %	1.60 %	1.47 %	1.00 %
Suwa	Japan	0.00 %	0.00 %	0.00 %	0.00 %	0.08 %	0.08 %
Sydney	Australia	0.09 %	0.32 %	0.08 %	0.34 %	0.50 %	0.40 %
Syracuse	US	0.09 %	0.00 %	0.00 %	0.00 %	0.00 %	-0.09 %
Taipei	Taiwan	0.00 %	0.11 %	0.08 %	0.00 %	0.19 %	0.19 %
Tampa	US	0.00 %	0.00 %	0.08 %	0.23 %	0.23 %	0.23 %
Tehran	Iran	0.35 %	0.00 %	0.00 %	0.00 %	0.00 %	-0.35 %
Tel Aviv	Israel	0.98 %	0.00 %	0.00 %	0.00 %	0.00 %	-0.98 %
Tokyo	Japan	13.99 %	24.04 %	25.54 %	15.89 %	10.04 %	-3.95 %
Toronto	Canada	0.54 %	0.78 %	0.17 %	0.79 %	0.83 %	0.29 %
Tours	France	0.00 %	0.00 %	0.08 %	0.00 %	0.00 %	0.00 %
Trieste	Italy	0.09 %	0.16 %	0.20 %	0.42 %	0.50 %	0.40 %
Tulsa	US	0.34 %	0.39 %	0.12 %	0.11 %	0.08 %	-0.26 %
Turin	Italy	0.29 %	0.80 %	0.66 %	0.63 %	0.45 %	0.15 %
Vienna	Austria	0.21 %	0.00 %	0.36 %	0.00 %	0.00 %	-0.21 %
Washington	US	0.36 %	0.52 %	1.55 %	1.45 %	1.22 %	0.86 %
Willelmstad	Neth. Antilles	0.13 %	0.00 %	0.00 %	0.00 %	0.00 %	-0.13 %
Winnipeg	Canada	0.09 %	0.00 %	0.00 %	0.00 %	0.00 %	-0.09 %
Zurich	Switzerland	0.94 %	1.45 %	1.98 %	1.89 %	2.00 %	1.06 %

Notes:

a: shares expressed as percent of total sales of Top 500 corporations.
b: cities with share increases equal or larger than 1% between 1984 and 2004 were shaded.

Sources: Fortune and Forbes magazines1985-2005 and author's research.

5.9. Texas-based corporations appearing and disappearing from the lists of Top 500 corporations, 1984-2004

cities	*1984*	*1989*	*1994*	*1999*	*2004*
Austin: entering list in	n/a	n/a	n/a	**Dell**	
Austin: leaving list after	n/a	n/a	n/a		
Dallas: entering list in	**AMR** *Diamond Shamrock.* *Dresser Inds.* *Ensearch* Halliburton LTV *Southland* Texas Instruments TXU	Elec. D. Systems **J.C. Penney** Kimberly Clark	**Exxon Mobil**	*Ass. First Capital* Elec. D. Systems Halliburton Kimberly Clark TXU	***Centex*** Texas Instruments
Dallas: leaving list after	*Diamond Shamrock.* *Dresser Inds.* *Ensearch* *Southland* TXU	Elec. D. Systems Halliburton Kimberly Clark LTV	Texas Instruments	*Ass. First Capital* Halliburton TXU	
Houston: entering list in	American General Coastal *Houston Inds.* *Shell Oil* Tenneco *Texas Eastern* *Transco Energy* *United Energy Res.*	Enron *Lyondell Petro* **Sysco** *Texas Air*	Compaq	American General **ConocoPhillips** *Dynegy* *El Paso Energy* *Reliant Energy* **Waste Management**	***Halliburton*** ***Marathon Oil*** ***Plains All Am.***
Houston: leaving list after	American General *Houston Inds.* *Shell Oil* *Texas Eastern* *Transco Energy* *United Energy Res.*	*Lyondell Petro* *Texas Air*	Coastal Tenneco	American General Compaq *Dynegy* *El Paso Energy* Enron *Reliant Energy*	
San Antonio: entering list in	n/a	n/a	**SBC Communicatns.**	*Ultramar D. Sh.*	***Valero Energy***
San Antonio: leaving list after	n/a	n/a		*Ultramar D. Sh.*	n/a

Notes:

a: companies in bold remained in every further list after first entry;
b: companies in italic appeared only in one list over the whole period;
c: companies in bold and italic were first listed in 2004..

Sources: Fortune and Forbes magazines1985-2005 and author's research.

6.1. Summarized output for a Principal Component Analysis (PCA) run with city employment by NAICS two-digit segments in the largest United States cities, 2004

CATPCA - Principal Components Analysis for Categorical Data

Discretization for string variable Metro was not specified. It is set to RANKING.

Discretization for real variables @11_Employees, @21_Employees, @22_Employees, @23_Employees, @31_Employees, @42_Employees, @44_Employee, @48_Employees, @51_Employees, @52_Employees, @53_Employees, @54_Employees, @55_Employees, @56_Employees, @61_Employees, @62_Employees, @71_Employees, @72_Employees, @81_Employees.

Case Processing Summary

Valid Active Cases – 19.

Active Cases with Missing Values – 0.

Supplementary Cases – 0.

Total – 19.

Cases Used in Analysis – 19.

Model Summary			
Dimension	Cronbach's Alpha	Variance Accounted For	
		Total (Eigenvalue)	% of Variance
1	0.806412742	4.236748961	22.298678741
2	0.657883535	2.654336993	13.970194701
3	0.571629422	2.181232800	11.480172629
4	0.511378954	1.939729774	10.209104072
5	0.277961570	1.357463631	7.144545429
6	0.115288395	1.122612381	5.908486215
7	0.055465475	1.055460479	5.555055154
8	-0.211470856	0.833096726	4.384719611
9	-0.510189687	0.674155365	3.548186132
10	-0.723032549	0.593479487	3.123576247
11	-1.204654808	0.467016510	2.457981630
12	-1.364953332	0.436088279	2.295201470
13	-1.720785416	0.380196657	2.001035036
14	-2.845148899	0.270606391	1.424244164
15	-3.427057472	0.235477733	1.239356492
16	-3.547122353	0.229335091	1.207026793
17	-6.131873004	0.146861363	0.772954543
18	-7.264051220	0.126875655	0.667766603
19	-16.767030247	0.059225724	0.311714339
Total	1	19	100
[a]	Total Cronbach's Alpha is based on the total Eigenvalue.		

Correlations Transformed Variables

	11_Empl	21_Empl	22_Empl	23_Empl	31_Empl	42_Empl	44_Empl	48_Empl	51_Empl	52_Empl	53_Empl	54_Empl	55_Empl	56_Empl	61_Empl	62_Empl	71_Empl	72_Empl	81_Empl
11_Empl	1.0000	-0.0650	0.1660	0.2740	-0.0798	0.1488	0.2945	-0.0278	0.0511	0.0982	0.1277	-0.1012	-0.2000	-0.0080	-0.0282	-0.0401	0.0900	-0.0611	0.1801
21_Empl	-0.0650	1.0000	0.3822	0.0747	-0.1856	-0.0817	0.0593	-0.0535	0.0168	-0.0576	0.0699	0.0652	-0.0412	-0.0601	-0.0785	0.1697	0.0696	0.2249	0.2182
22_Empl	0.1660	0.3822	1.0000	0.0901	-0.1057	0.1071	-0.0292	-0.0913	-0.0641	0.3431	-0.1199	0.0141	0.0286	-0.2421	-0.0165	0.1431	-0.0441	-0.1995	0.1324
23_Empl	0.2740	0.0747	0.0901	1.0000	-0.4614	-0.0450	0.2371	0.1147	0.0446	0.0581	0.5371	0.0062	-0.1809	0.3177	-0.5921	-0.6329	0.3412	0.3696	0.2456
31_Empl	-0.0798	-0.1856	-0.1057	-0.4614	1.0000	0.1855	-0.3376	0.0299	-0.3479	-0.3393	-0.5993	-0.3115	0.1795	-0.4180	0.2566	0.2001	-0.4172	-0.5065	-0.2497
42_Empl	0.1488	-0.0817	0.1071	-0.0450	0.1855	1.0000	-0.4238	0.4424	0.1936	0.1664	0.0701	-0.0796	0.3661	0.0223	-0.1847	-0.3194	-0.2722	-0.3240	-0.1280
44_Empl	0.2945	0.0593	-0.0292	0.2371	-0.3376	-0.4238	1.0000	-0.1807	-0.0887	0.0608	0.1392	-0.1108	-0.4831	0.1587	-0.1487	0.1776	0.2002	0.3122	0.4064
48_Empl	-0.0278	-0.0535	-0.0913	0.1147	0.0299	0.4424	-0.1807	1.0000	-0.0967	0.1308	-0.0345	-0.3922	0.3125	0.0092	-0.2759	-0.2697	-0.1199	0.0533	0.0957
51_Empl	0.0511	0.0168	-0.0641	0.0446	-0.3479	0.1936	-0.0887	-0.0967	1.0000	0.1758	0.3825	0.5572	0.1060	0.0837	0.0510	-0.2467	-0.0351	-0.1486	0.0765
52_Empl	0.0982	-0.0576	0.3431	0.0581	-0.3393	0.1664	0.0608	0.1308	0.1758	1.0000	-0.1217	-0.2103	0.0191	-0.1095	-0.1185	0.1428	-0.0636	-0.3294	0.1144
53_Empl	0.1277	0.0699	-0.1199	0.5371	-0.5993	0.0701	0.1392	-0.0345	0.3825	-0.1217	1.0000	0.4663	-0.0845	0.4885	-0.3667	-0.5341	0.4817	0.5643	0.0258
54_Empl	-0.1012	0.0652	0.0141	0.0062	-0.3115	-0.0796	-0.1108	-0.3922	0.5572	-0.2103	0.4663	1.0000	0.0466	0.2056	0.1739	-0.1831	0.0672	0.0596	-0.1214
55_Empl	-0.2000	-0.0412	0.0286	-0.1809	0.1795	0.3661	-0.4831	0.3125	0.1060	0.0191	-0.0845	0.0466	1.0000	-0.0375	-0.0127	-0.1094	-0.2961	-0.2654	-0.1327
56_Empl	-0.0080	-0.0601	-0.2421	0.3177	-0.4180	0.0223	0.1587	0.0092	0.0837	-0.1095	0.4885	0.2056	-0.0375	1.0000	-0.3942	-0.5105	0.1125	0.4431	0.0921
61_Empl	-0.0282	-0.0785	-0.0165	-0.5921	0.2566	-0.1847	-0.1487	-0.2759	0.0510	-0.1185	-0.3667	0.1739	-0.0127	-0.3942	1.0000	0.5362	-0.1323	-0.3422	-0.1977
62_Empl	-0.0401	0.1697	0.1431	-0.6329	0.2001	-0.3194	0.1776	-0.2697	-0.2467	0.1428	-0.5341	-0.1831	-0.1094	-0.5105	0.5362	1.0000	-0.0937	-0.2974	0.0238
71_Empl	0.0900	0.0696	-0.0441	0.3412	-0.4172	-0.2722	0.2002	-0.1199	-0.0351	-0.0636	0.4817	0.0672	-0.2961	0.1125	-0.1323	-0.0937	1.0000	0.4626	-0.0439
72_Empl	-0.0611	0.2249	-0.1995	0.3696	-0.5065	-0.3240	0.3122	0.0533	-0.1486	-0.3294	0.5643	0.0596	-0.2654	0.4431	-0.3422	-0.2974	0.4626	1.0000	0.0738
81_Empl	0.1801	0.2182	0.1324	0.2456	-0.2497	-0.1280	0.4064	0.0957	0.0765	0.1144	0.0258	-0.1214	-0.1327	0.0921	-0.1977	0.0238	-0.0439	0.0738	1.0000
Dimension	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Eigenvalue	4.23675	2.65434	2.18123	1.93973	1.35746	1.12261	1.05546	0.83310	0.67416	0.59348	0.46702	0.43609	0.38020	0.27061	0.23548	0.22934	0.14686	0.12688	0.05923

Component Loadings

	Dimension																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
11_Forestry, Fishing, Hunting, & Agr. Support	0.1739	-0.1046	0.3570	0.2290	-0.5129	0.3732	-0.3959	0.2585	0.2296	0.1777	-0.0284	-0.0927	0.1767	-0.0910	0.0810	0.1103	0.0027	-0.0311	-0.0122
21_Mining	0.1360	-0.2394	0.1238	0.2732	0.7561	-0.0135	-0.2746	0.1588	0.0944	-0.2289	-0.1365	-0.0597	0.2389	0.1150	-0.0533	0.0225	0.0110	-0.0624	-0.0258
22_Utilities	-0.0931	-0.1072	0.3800	0.5720	0.3884	0.3397	-0.1212	-0.2659	0.0981	0.1340	0.2017	0.0356	-0.2224	0.0302	0.1556	-0.0764	0.0501	0.0635	0.0071
23_Construction	0.7523	0.1247	0.3211	-0.0061	-0.0407	0.2136	-0.1152	-0.1824	-0.3251	0.0797	0.0675	-0.1364	0.1389	0.0929	-0.1950	-0.0234	-0.0317	0.0890	0.1041
31_Manufacturing	-0.7484	0.1296	-0.0176	-0.3841	-0.0701	0.1457	-0.3617	-0.0734	-0.1200	-0.0865	-0.1324	0.0687	-0.0529	0.0789	0.0525	-0.0081	0.1902	-0.0996	0.1041
42_Wholesale Trade	-0.1458	0.7659	0.2101	0.1742	-0.0672	0.1632	-0.1181	0.1771	0.2596	-0.2363	-0.0708	0.1765	-0.1649	-0.0098	-0.1471	-0.0992	-0.1447	-0.0061	0.0451
44_Retail Trade	0.3931	-0.6229	0.2846	-0.0219	-0.2804	-0.2477	-0.0764	0.0343	0.1165	0.0170	-0.1749	-0.2041	-0.2620	0.2416	-0.0130	-0.1086	-0.0335	-0.0534	-0.0046
48_Transportation and Warehousing	-0.0029	0.5492	0.4781	-0.2495	0.1203	-0.1411	0.1707	0.4381	-0.0272	-0.0298	0.2533	-0.1324	-0.0954	0.1513	0.0570	0.1677	0.0679	0.0289	0.0017
51_Information	0.2307	0.2873	-0.3679	0.6504	-0.2118	-0.2204	-0.0037	0.2017	-0.1905	-0.2002	-0.1033	-0.0666	0.0740	0.0322	0.2272	-0.1056	0.0215	0.0879	0.0526
52_Finance and Insurance	-0.0558	0.0613	0.4913	0.5465	-0.1561	-0.0646	0.5801	-0.1655	0.0665	-0.0600	-0.0243	-0.0165	0.1002	-0.0386	-0.0552	0.0164	0.0886	-0.1646	0.0437
53_Real Estate and Rental and Leasing	0.8348	0.1853	-0.2692	0.1185	-0.0021	0.1374	0.0020	0.1623	0.0489	0.0088	-0.0885	0.0091	-0.1404	-0.0883	-0.1696	-0.0614	0.2477	0.0389	-0.0616
54_Professional, Scientific, and Technical Services	0.2785	0.0658	-0.7331	0.4544	0.0346	-0.0368	-0.1611	-0.0725	-0.0155	0.0631	0.0913	-0.0517	-0.1810	0.0392	-0.0610	0.2654	-0.0506	-0.1097	0.0462
55_Management of Companies and Enterprises	-0.2868	0.6276	-0.0671	0.0791	0.2786	-0.1542	0.0414	0.0884	0.0148	0.5696	-0.2460	-0.0908	0.0294	0.0227	-0.0010	-0.0774	-0.0209	-0.0291	0.0112
Support and Waste Management and	0.6362	0.2183	-0.1329	-0.1827	-0.0798	-0.3014	-0.0401	-0.2556	0.4606	0.0670	0.0616	0.2189	0.1614	0.1617	0.0540	0.0309	0.0579	0.0549	0.0400
61_Educational Services	-0.5736	-0.3324	-0.4369	0.1810	-0.1219	0.0407	0.0136	0.2874	0.0710	0.1226	0.3618	0.0235	0.1190	0.1244	-0.1264	-0.1947	0.0258	-0.0404	0.0179
62_Health Care and Social Assistance	-0.5956	-0.6389	0.0314	0.1475	0.0885	-0.0905	0.1655	0.1859	0.1739	0.0473	-0.1614	0.0214	-0.0494	-0.0707	-0.0996	0.1309	0.0332	0.1795	0.0979
71_Arts, Entertainment, and Recreation	0.5388	-0.2981	-0.1001	-0.0994	0.0653	0.4605	0.3410	0.2611	-0.1498	0.1027	-0.1359	0.3344	-0.0104	0.1536	0.0920	0.0313	-0.0431	-0.0398	0.0164
72_Accommodation and Food Services	0.7219	-0.2019	-0.0944	-0.3963	0.2938	-0.0215	0.0583	0.1643	0.1580	-0.0053	0.1061	-0.1343	-0.0448	-0.2382	0.1019	-0.1090	-0.0256	-0.0836	0.1100
81_Other Services (except Public Administration)	0.2542	-0.2263	0.4662	0.2038	0.0001	-0.5320	-0.3201	0.1487	-0.2503	0.1273	0.0819	0.3384	-0.0423	-0.1125	-0.0351	-0.0011	0.0073	-0.0421	0.0049

Variable Principal Normalization.

Note: PCA run at the Department of Geography of Texas A&M University using SPSS 13.0 for Windows and data obtained from the CenStats database (U.S. Bureau of Census).

6.2. Standardized city scores for a PCA run with city employment by NAICS two-digit segments in the largest United States cities, 2004

Metro	COMP1	COMP2	COMP3	COMP4	COMP5	COMP6	COMP7
Albany	-2.76	-7.67	0.10	2.88	-1.10	-1.35	1.77
Atlanta	4.76	6.33	-1.02	1.60	-0.28	-0.98	-0.38
Austin	6.80	-0.06	-3.87	1.13	-0.25	-1.23	-1.40
Birmingham	1.06	-0.88	3.28	3.60	-0.73	-0.31	0.07
Boston	-5.96	-2.66	-3.67	4.00	-0.78	-0.11	1.61
Buffalo	-6.69	-4.33	0.81	-2.27	-0.71	0.08	-0.77
Charlotte	-1.07	5.60	5.43	1.37	-0.89	1.22	2.14
Chicago	-3.06	3.26	-0.23	0.00	-0.28	0.17	-0.52
Cincinnati	-3.80	0.74	1.26	-2.65	0.50	0.80	-1.09
Cleveland	-9.45	-0.18	0.49	-2.16	0.25	0.87	-1.42
Columbus	-1.09	1.81	3.04	1.34	0.31	-0.97	2.62
Dallas	2.90	5.89	-0.38	1.19	-0.07	-0.88	0.15
Dayton	-8.86	-3.55	-2.26	-3.61	-0.07	0.18	-3.10
Denver	7.36	3.39	-2.65	4.13	-0.21	-0.71	0.50
Detroit	-4.29	0.96	-4.11	-0.44	0.19	-0.07	-2.35
Grand Rapids	-14.50	1.40	0.03	-7.93	-1.58	2.82	-6.93
Greensboro	-10.63	1.81	2.39	-5.68	-0.62	1.94	-2.84
Greenville	-6.59	3.32	0.58	-7.78	-0.57	1.21	-5.66
Hartford	-8.40	-1.75	4.54	3.67	-1.87	0.84	4.03
Houston	3.39	3.55	0.10	-0.37	1.96	0.47	-1.58
Indianapolis	-1.56	0.71	2.02	-1.55	0.11	-0.29	-0.35
Jacksonville	5.67	-0.47	4.58	2.47	-1.06	-1.76	4.21
Kansas City	0.95	2.42	0.21	3.28	-0.87	-0.52	0.80
Las Vegas	29.88	-3.32	-1.23	-10.85	6.87	1.60	2.53
Los Angeles	-0.02	3.58	-3.23	0.07	-0.56	1.38	-1.86
Louisville	-4.51	-0.42	3.23	-3.42	0.44	0.49	-0.92
Memphis	1.42	4.53	4.19	-3.93	1.98	-1.80	1.17
Miami	7.44	-1.25	0.16	1.43	-0.21	-1.48	1.70
Milwaukee	-12.23	0.41	0.86	-1.90	-0.46	1.19	-1.24
Minneapolis	-4.79	2.85	1.11	0.60	0.08	0.57	0.18
Nashville	-2.49	0.03	-0.06	-1.53	-0.30	-0.35	-0.12
New Orleans	5.06	-4.74	0.26	-2.04	2.52	0.26	1.49
New York	-3.16	0.35	-1.69	6.02	-0.68	-0.90	2.69
Norfolk	9.58	-2.73	-1.14	-0.86	0.03	-0.84	-0.58
Oklahoma City	1.50	-4.33	0.61	0.57	1.27	-1.35	-0.10
Orlando	15.12	-0.83	-0.77	-1.67	1.36	0.37	1.84
Philadelphia	-4.50	-1.48	-1.03	3.79	-0.68	-0.37	1.50
Phoenix	7.19	2.10	1.93	-0.45	-0.24	0.43	1.27
Pittsburgh	-4.87	-4.38	-0.05	1.15	1.15	0.25	1.07
Portland	-2.74	2.61	-0.38	-0.81	-0.11	0.90	-1.18
Providence	-9.89	-6.55	0.82	-2.56	-0.50	0.93	-0.61
Raleigh	1.89	-1.40	-5.42	2.83	0.02	-0.25	-1.55
Richmond	1.92	-0.55	5.83	2.93	-1.00	-0.13	2.51
Rochester	-13.31	-2.83	-4.61	-2.05	-0.87	1.99	-3.06
Sacramento	8.58	-2.33	2.37	2.06	-0.73	-0.48	1.64
Salt Lake City	1.99	2.25	2.92	-1.20	-0.40	-0.63	-0.63
San Antonio	3.42	-2.41	1.01	1.79	0.84	-1.91	3.82
San Diego	8.21	-1.28	-3.19	-0.11	0.01	0.74	-0.90
San Francisco	1.52	3.45	-5.56	3.63	-0.15	0.74	-1.04
Seattle	0.69	1.55	-1.00	1.42	-0.86	0.50	-0.46
St. Louis	-0.68	1.41	0.31	-0.52	0.73	0.17	-0.67
Tampa	4.72	-2.53	0.35	2.49	-0.75	-1.25	2.44
Washington	8.90	-1.40	-7.25	6.87	-0.19	-2.14	-0.41

Note: PCA run at the Department of Geography of Texas A&M University using SPSS 13.0 for Windows and data obtained from the CenStats database (U.S. Bureau of Census).

6.3. Inter-city correlations for a PCA run with city employment by NAICS two-digit segments in the largest United States cities, 2004

Correlations Transformed Variables

	ALB	ATL	AUS	BIR	BOS	BUF	CHA	CHI	CIN	CLE	COL	DAL	DAY	DEN	DET	GRA	GRB	GRV
Albany	1	0.822	0.872	0.906	0.951	0.911	0.835	0.897	0.894	0.886	0.904	0.843	0.897	0.879	0.911	0.814	0.832	0.805
Atlanta	0.822	1	0.951	0.904	0.884	0.891	0.908	0.913	0.912	0.835	0.896	0.983	0.874	0.921	0.884	0.873	0.842	0.880
Austin	0.872	0.951	1	0.893	0.914	0.898	0.840	0.902	0.898	0.841	0.863	0.950	0.902	0.949	0.930	0.880	0.801	0.863
Birmingham	0.906	0.904	0.893	1	0.920	0.949	0.947	0.931	0.934	0.916	0.937	0.928	0.891	0.920	0.908	0.885	0.898	0.894
Boston	0.951	0.884	0.914	0.920	1	0.929	0.890	0.951	0.914	0.894	0.937	0.888	0.891	0.880	0.928	0.861	0.850	0.848
Buffalo	0.911	0.891	0.898	0.949	0.929	1	0.897	0.939	0.982	0.969	0.904	0.892	0.960	0.843	0.954	0.965	0.955	0.947
Charlotte	0.835	0.908	0.840	0.947	0.890	0.897	1	0.936	0.898	0.869	0.937	0.928	0.824	0.868	0.852	0.841	0.901	0.870
Chicago	0.897	0.913	0.902	0.931	0.951	0.939	0.936	1	0.922	0.930	0.925	0.915	0.902	0.870	0.935	0.902	0.893	0.886
Cincinnati	0.894	0.912	0.898	0.934	0.914	0.982	0.898	0.922	1	0.954	0.922	0.909	0.962	0.846	0.930	0.953	0.969	0.956
Cleveland	0.886	0.835	0.841	0.916	0.894	0.969	0.869	0.930	0.954	1	0.896	0.836	0.953	0.801	0.948	0.936	0.951	0.923
Columbus	0.904	0.896	0.863	0.937	0.937	0.904	0.937	0.925	0.922	0.896	1	0.913	0.848	0.873	0.874	0.822	0.886	0.830
Dallas	0.843	0.983	0.950	0.928	0.888	0.892	0.928	0.915	0.909	0.836	0.913	1	0.856	0.941	0.879	0.852	0.847	0.858
Dayton	0.897	0.874	0.902	0.891	0.891	0.960	0.824	0.902	0.962	0.953	0.848	0.856	1	0.849	0.955	0.950	0.917	0.932
Denver	0.879	0.921	0.949	0.920	0.880	0.843	0.868	0.870	0.846	0.801	0.873	0.941	0.849	1	0.880	0.786	0.755	0.798
Detroit	0.911	0.884	0.930	0.908	0.928	0.954	0.852	0.935	0.930	0.948	0.874	0.879	0.955	0.880	1	0.924	0.871	0.904
Grand Rapids	0.814	0.873	0.880	0.885	0.861	0.965	0.841	0.902	0.953	0.936	0.822	0.852	0.950	0.786	0.924	1	0.929	0.960
Greensboro	0.832	0.842	0.801	0.898	0.850	0.955	0.901	0.893	0.969	0.951	0.886	0.847	0.917	0.755	0.871	0.929	1	0.949
Greenville	0.805	0.880	0.863	0.894	0.848	0.947	0.870	0.886	0.956	0.923	0.830	0.858	0.932	0.798	0.904	0.960	0.949	1
Hartford	0.884	0.765	0.768	0.902	0.882	0.888	0.907	0.911	0.869	0.897	0.913	0.822	0.812	0.796	0.842	0.794	0.882	0.782
Houston	0.878	0.927	0.898	0.947	0.890	0.917	0.911	0.917	0.936	0.890	0.900	0.928	0.917	0.907	0.909	0.887	0.879	0.913
Indianapolis	0.889	0.923	0.912	0.943	0.924	0.971	0.908	0.933	0.991	0.945	0.934	0.924	0.952	0.861	0.924	0.944	0.959	0.947
Jacksonville	0.879	0.841	0.805	0.920	0.839	0.822	0.868	0.809	0.846	0.778	0.912	0.880	0.768	0.896	0.777	0.712	0.779	0.751
Kansas City	0.902	0.934	0.905	0.933	0.913	0.902	0.918	0.923	0.924	0.891	0.945	0.937	0.904	0.932	0.898	0.838	0.876	0.847
Las Vegas	0.648	0.700	0.698	0.679	0.652	0.591	0.597	0.540	0.670	0.514	0.698	0.697	0.621	0.757	0.559	0.546	0.536	0.590
Los Angeles	0.888	0.924	0.950	0.888	0.908	0.933	0.871	0.935	0.930	0.903	0.855	0.920	0.955	0.900	0.960	0.924	0.871	0.904
Louisville	0.897	0.894	0.882	0.931	0.911	0.960	0.899	0.921	0.982	0.953	0.925	0.896	0.961	0.849	0.915	0.926	0.964	0.932
Memphis	0.809	0.894	0.800	0.836	0.836	0.819	0.842	0.825	0.880	0.802	0.904	0.872	0.806	0.789	0.792	0.767	0.832	0.823
Miami	0.898	0.900	0.906	0.878	0.878	0.861	0.788	0.847	0.864	0.795	0.851	0.899	0.847	0.894	0.857	0.803	0.746	0.791
Milwaukee	0.915	0.837	0.843	0.938	0.916	0.968	0.910	0.951	0.953	0.976	0.916	0.860	0.930	0.826	0.925	0.913	0.954	0.901
Minneapolis	0.915	0.852	0.859	0.950	0.930	0.958	0.917	0.940	0.941	0.972	0.944	0.873	0.920	0.846	0.934	0.896	0.935	0.881
Nashville	0.918	0.920	0.905	0.940	0.919	0.968	0.886	0.908	0.991	0.932	0.932	0.919	0.950	0.870	0.919	0.924	0.941	0.932
New Orleans	0.892	0.892	0.880	0.889	0.869	0.896	0.821	0.840	0.941	0.836	0.885	0.893	0.900	0.866	0.833	0.848	0.863	0.858
New York	0.942	0.920	0.927	0.940	0.940	0.902	0.886	0.929	0.883	0.860	0.912	0.940	0.866	0.936	0.897	0.821	0.814	0.809
Norfolk	0.912	0.879	0.931	0.916	0.894	0.900	0.826	0.842	0.909	0.849	0.874	0.881	0.908	0.938	0.903	0.855	0.818	0.871
Oklahoma City	0.945	0.922	0.953	0.938	0.938	0.925	0.849	0.909	0.932	0.885	0.916	0.926	0.930	0.939	0.926	0.872	0.837	0.860
Orlando	0.794	0.850	0.836	0.846	0.763	0.808	0.761	0.735	0.836	0.738	0.803	0.850	0.796	0.864	0.767	0.766	0.733	0.781
Philadelphia	0.961	0.892	0.920	0.930	0.990	0.938	0.898	0.960	0.920	0.904	0.944	0.893	0.900	0.887	0.934	0.872	0.863	0.858
Phoenix	0.850	0.861	0.847	0.938	0.854	0.860	0.889	0.826	0.868	0.815	0.875	0.884	0.826	0.917	0.821	0.797	0.812	0.836
Pittsburgh	0.957	0.894	0.903	0.928	0.949	0.959	0.881	0.941	0.946	0.943	0.909	0.877	0.962	0.887	0.962	0.906	0.894	0.894
Portland	0.898	0.945	0.933	0.932	0.932	0.957	0.911	0.957	0.972	0.934	0.916	0.943	0.957	0.886	0.943	0.936	0.929	0.936
Providence	0.925	0.841	0.866	0.900	0.920	0.969	0.849	0.910	0.970	0.961	0.893	0.839	0.971	0.813	0.920	0.933	0.949	0.916
Raleigh	0.926	0.915	0.961	0.937	0.937	0.924	0.863	0.925	0.922	0.896	0.887	0.913	0.944	0.952	0.952	0.892	0.839	0.897
Richmond	0.934	0.850	0.836	0.949	0.929	0.893	0.917	0.899	0.877	0.854	0.944	0.871	0.817	0.885	0.850	0.791	0.832	0.805
Rochester	0.905	0.808	0.858	0.841	0.928	0.936	0.799	0.920	0.924	0.940	0.846	0.811	0.942	0.775	0.941	0.901	0.889	0.865
Sacramento	0.872	0.872	0.857	0.954	0.853	0.877	0.879	0.842	0.877	0.841	0.883	0.889	0.842	0.928	0.828	0.807	0.825	0.839
Salt Lake City	0.850	0.943	0.911	0.959	0.875	0.925	0.928	0.888	0.953	0.885	0.916	0.947	0.909	0.917	0.884	0.897	0.912	0.932
San Antonio	0.934	0.830	0.856	0.929	0.908	0.893	0.858	0.858	0.898	0.854	0.944	0.871	0.837	0.885	0.850	0.791	0.832	0.781
San Diego	0.902	0.901	0.949	0.900	0.900	0.906	0.849	0.890	0.908	0.847	0.833	0.900	0.930	0.938	0.920	0.884	0.828	0.892
San Francisco	0.867	0.904	0.971	0.845	0.904	0.850	0.797	0.874	0.852	0.813	0.819	0.904	0.894	0.941	0.924	0.826	0.748	0.812
Seattle	0.933	0.889	0.916	0.932	0.911	0.937	0.857	0.900	0.937	0.925	0.880	0.886	0.962	0.926	0.928	0.892	0.886	0.900
St. Louis	0.911	0.923	0.932	0.943	0.943	0.931	0.889	0.933	0.932	0.923	0.934	0.904	0.933	0.921	0.943	0.897	0.865	0.902
Tampa	0.937	0.911	0.938	0.933	0.933	0.917	0.858	0.901	0.917	0.859	0.922	0.929	0.880	0.927	0.908	0.848	0.817	0.833
Washington	0.845	0.794	0.883	0.791	0.791	0.748	0.685	0.739	0.733	0.693	0.725	0.791	0.781	0.914	0.833	0.693	0.610	0.711

Correlations Transformed Variables (continued)

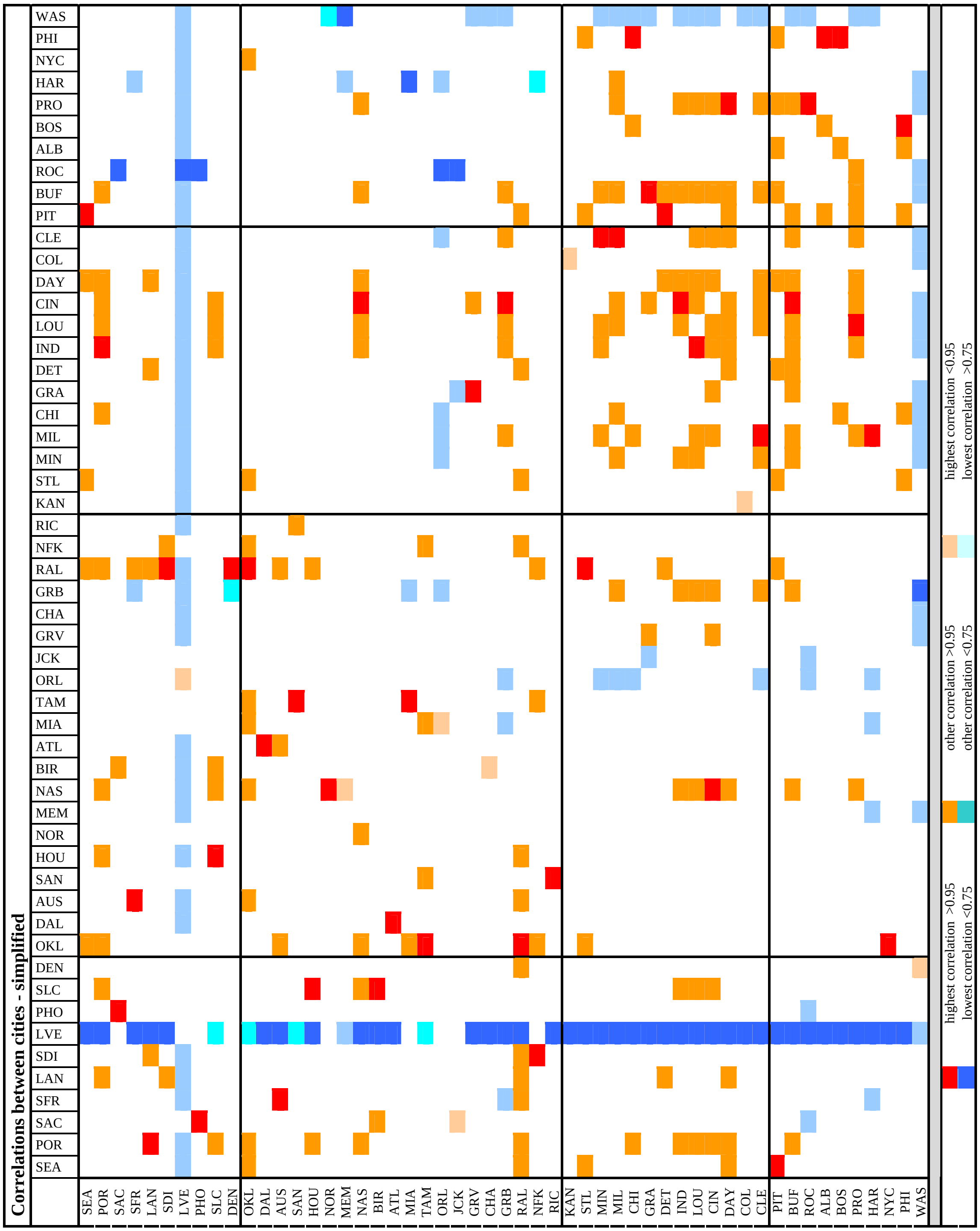
	HAR	HOU	IND	JCK	KAN	LVE	LAN	LOU	MEM	MIA	MIL	MIN	NAS	NOR	NYC	NFK	OKL	ORL
Albany	0.884	0.878	0.889	0.879	0.902	0.648	0.888	0.897	0.809	0.898	0.915	0.915	0.918	0.892	0.942	0.912	0.945	0.794
Atlanta	0.765	0.927	0.923	0.841	0.934	0.700	0.924	0.894	0.894	0.900	0.837	0.852	0.920	0.892	0.920	0.879	0.922	0.850
Austin	0.768	0.898	0.912	0.805	0.905	0.698	0.950	0.882	0.800	0.906	0.843	0.859	0.905	0.880	0.927	0.931	0.953	0.836
Birmingham	0.902	0.947	0.943	0.920	0.933	0.679	0.888	0.931	0.836	0.878	0.938	0.950	0.940	0.889	0.940	0.916	0.938	0.846
Boston	0.882	0.890	0.924	0.839	0.913	0.652	0.908	0.911	0.836	0.878	0.916	0.930	0.919	0.869	0.940	0.894	0.938	0.763
Buffalo	0.888	0.917	0.971	0.822	0.902	0.591	0.933	0.960	0.819	0.861	0.968	0.958	0.968	0.896	0.902	0.900	0.925	0.808
Charlotte	0.907	0.911	0.908	0.868	0.918	0.597	0.871	0.899	0.842	0.788	0.910	0.917	0.886	0.821	0.886	0.826	0.849	0.761
Chicago	0.911	0.917	0.933	0.809	0.923	0.540	0.935	0.921	0.825	0.847	0.951	0.940	0.908	0.840	0.929	0.842	0.909	0.735
Cincinnati	0.869	0.936	0.991	0.846	0.924	0.670	0.930	0.982	0.880	0.864	0.953	0.941	0.991	0.941	0.883	0.909	0.932	0.836
Cleveland	0.897	0.890	0.945	0.778	0.891	0.514	0.903	0.953	0.802	0.795	0.976	0.972	0.932	0.836	0.860	0.849	0.885	0.738
Columbus	0.913	0.900	0.934	0.912	0.945	0.698	0.855	0.925	0.904	0.851	0.916	0.944	0.932	0.885	0.912	0.874	0.916	0.803
Dallas	0.822	0.928	0.924	0.880	0.937	0.697	0.920	0.896	0.872	0.899	0.860	0.873	0.919	0.893	0.940	0.881	0.926	0.850
Dayton	0.812	0.917	0.952	0.768	0.904	0.621	0.955	0.961	0.806	0.847	0.930	0.920	0.950	0.900	0.866	0.908	0.930	0.796
Denver	0.796	0.907	0.861	0.896	0.932	0.757	0.900	0.849	0.789	0.894	0.826	0.846	0.870	0.866	0.936	0.938	0.939	0.864
Detroit	0.842	0.909	0.924	0.777	0.898	0.559	0.960	0.915	0.792	0.857	0.925	0.934	0.919	0.833	0.897	0.903	0.926	0.767
Grand Rapids	0.794	0.887	0.944	0.712	0.838	0.546	0.924	0.926	0.767	0.803	0.913	0.896	0.924	0.848	0.821	0.855	0.872	0.766
Greensboro	0.882	0.879	0.959	0.779	0.876	0.536	0.871	0.964	0.832	0.746	0.954	0.935	0.941	0.863	0.814	0.818	0.837	0.733
Greenville	0.782	0.913	0.947	0.751	0.847	0.590	0.904	0.932	0.823	0.791	0.901	0.881	0.932	0.858	0.809	0.871	0.860	0.781
Hartford	1	0.813	0.863	0.837	0.875	0.494	0.822	0.872	0.713	0.730	0.963	0.930	0.853	0.788	0.853	0.785	0.815	0.681
Houston	0.813	1	0.945	0.887	0.918	0.726	0.928	0.936	0.899	0.906	0.889	0.898	0.947	0.917	0.907	0.911	0.948	0.858
Indianapolis	0.863	0.945	1	0.841	0.934	0.673	0.924	0.991	0.894	0.859	0.944	0.951	0.983	0.932	0.899	0.901	0.943	0.810
Jacksonville	0.837	0.887	0.841	1	0.893	0.813	0.777	0.829	0.849	0.894	0.826	0.825	0.892	0.908	0.892	0.892	0.896	0.906
Kansas City	0.875	0.918	0.934	0.893	1	0.690	0.898	0.942	0.887	0.851	0.912	0.922	0.932	0.903	0.932	0.891	0.932	0.801
Las Vegas	0.494	0.726	0.673	0.813	0.690	1	0.614	0.649	0.712	0.773	0.531	0.551	0.732	0.828	0.644	0.821	0.766	0.874
Los Angeles	0.822	0.928	0.924	0.777	0.898	0.614	1	0.915	0.792	0.878	0.903	0.893	0.919	0.873	0.897	0.903	0.926	0.809
Louisville	0.872	0.936	0.991	0.829	0.942	0.649	0.915	1	0.884	0.826	0.951	0.960	0.972	0.920	0.887	0.886	0.930	0.776
Memphis	0.713	0.899	0.894	0.849	0.887	0.712	0.792	0.884	1	0.847	0.782	0.822	0.908	0.882	0.845	0.802	0.872	0.778
Miami	0.730	0.906	0.859	0.894	0.851	0.773	0.878	0.826	0.847	1	0.798	0.801	0.911	0.927	0.934	0.912	0.959	0.925
Milwaukee	0.963	0.889	0.944	0.826	0.912	0.531	0.903	0.951	0.782	0.798	1	0.971	0.933	0.860	0.886	0.853	0.887	0.743
Minneapolis	0.930	0.898	0.951	0.825	0.922	0.551	0.893	0.960	0.822	0.801	0.971	1	0.927	0.837	0.905	0.859	0.906	0.729
Nashville	0.853	0.947	0.983	0.892	0.932	0.732	0.919	0.972	0.908	0.911	0.933	0.927	1	0.970	0.909	0.932	0.958	0.880
New Orleans	0.788	0.917	0.932	0.908	0.903	0.828	0.873	0.920	0.882	0.927	0.860	0.837	0.970	1	0.883	0.927	0.948	0.917
New York	0.853	0.907	0.899	0.892	0.932	0.644	0.897	0.887	0.845	0.934	0.886	0.905	0.909	0.883	1	0.884	0.958	0.814
Norfolk	0.785	0.911	0.901	0.892	0.891	0.821	0.903	0.886	0.802	0.912	0.853	0.859	0.932	0.927	0.884	1	0.956	0.923
Oklahoma City	0.815	0.948	0.943	0.896	0.932	0.766	0.926	0.930	0.872	0.959	0.887	0.906	0.958	0.948	0.958	0.956	1	0.882
Orlando	0.681	0.858	0.810	0.906	0.801	0.874	0.809	0.776	0.778	0.925	0.743	0.729	0.880	0.917	0.814	0.923	0.882	1
Philadelphia	0.889	0.898	0.932	0.846	0.922	0.634	0.914	0.920	0.842	0.885	0.926	0.939	0.927	0.877	0.948	0.904	0.948	0.771
Phoenix	0.815	0.908	0.861	0.939	0.871	0.823	0.842	0.847	0.789	0.872	0.841	0.843	0.891	0.885	0.869	0.932	0.891	0.925
Pittsburgh	0.869	0.921	0.935	0.844	0.944	0.626	0.941	0.941	0.843	0.884	0.943	0.939	0.949	0.896	0.926	0.919	0.945	0.806
Portland	0.848	0.966	0.983	0.827	0.939	0.644	0.962	0.976	0.896	0.885	0.932	0.938	0.966	0.918	0.925	0.891	0.951	0.798
Providence	0.878	0.887	0.961	0.792	0.893	0.617	0.920	0.971	0.809	0.830	0.960	0.949	0.957	0.908	0.870	0.892	0.917	0.779
Raleigh	0.816	0.955	0.934	0.853	0.926	0.725	0.952	0.925	0.827	0.912	0.895	0.905	0.932	0.905	0.932	0.961	0.977	0.843
Richmond	0.908	0.878	0.870	0.948	0.902	0.704	0.830	0.858	0.819	0.882	0.901	0.896	0.902	0.875	0.924	0.900	0.904	0.851
Rochester	0.867	0.840	0.914	0.708	0.861	0.492	0.920	0.920	0.755	0.791	0.941	0.917	0.902	0.829	0.855	0.819	0.877	0.668
Sacramento	0.829	0.898	0.872	0.949	0.905	0.781	0.828	0.862	0.800	0.885	0.865	0.859	0.905	0.900	0.905	0.931	0.911	0.919
Salt Lake City	0.815	0.968	0.963	0.896	0.932	0.766	0.905	0.950	0.892	0.872	0.887	0.906	0.958	0.927	0.891	0.932	0.934	0.882
San Antonio	0.908	0.858	0.891	0.948	0.902	0.761	0.830	0.878	0.799	0.882	0.901	0.896	0.924	0.917	0.902	0.923	0.925	0.872
San Diego	0.796	0.926	0.901	0.833	0.893	0.729	0.961	0.890	0.768	0.894	0.871	0.846	0.914	0.908	0.892	0.961	0.939	0.864
San Francisco	0.745	0.871	0.865	0.761	0.896	0.673	0.943	0.855	0.758	0.859	0.815	0.832	0.857	0.832	0.899	0.901	0.922	0.769
Seattle	0.844	0.917	0.931	0.861	0.944	0.700	0.928	0.941	0.814	0.880	0.925	0.918	0.944	0.918	0.922	0.948	0.950	0.850
St. Louis	0.824	0.945	0.942	0.861	0.934	0.727	0.924	0.933	0.874	0.900	0.901	0.932	0.941	0.892	0.920	0.945	0.963	0.850
Tampa	0.846	0.917	0.911	0.927	0.904	0.770	0.908	0.880	0.837	0.968	0.883	0.877	0.946	0.940	0.946	0.951	0.973	0.917
Washington	0.640	0.786	0.732	0.783	0.808	0.673	0.812	0.718	0.676	0.845	0.700	0.711	0.773	0.776	0.841	0.908	0.869	0.792

Correlations Transformed Variables (continued)

	PHI	PHO	PIT	POR	PRO	RAL	RIC	ROC	SAC	SLC	SAN	SDI	SFR	SEA	STL	TAM	WAS
Albany	0.961	0.850	0.957	0.898	0.925	0.926	0.934	0.905	0.872	0.850	0.934	0.902	0.867	0.933	0.911	0.937	0.845
Atlanta	0.892	0.861	0.894	0.945	0.841	0.915	0.850	0.808	0.872	0.943	0.830	0.901	0.904	0.889	0.923	0.911	0.794
Austin	0.920	0.847	0.903	0.933	0.866	0.961	0.836	0.858	0.857	0.911	0.856	0.949	0.971	0.916	0.932	0.938	0.883
Birmingham	0.930	0.938	0.928	0.932	0.900	0.937	0.949	0.841	0.954	0.959	0.929	0.900	0.845	0.932	0.943	0.933	0.791
Boston	0.990	0.854	0.949	0.932	0.920	0.937	0.929	0.928	0.853	0.875	0.908	0.900	0.904	0.911	0.943	0.933	0.791
Buffalo	0.938	0.860	0.959	0.957	0.969	0.924	0.893	0.936	0.877	0.925	0.893	0.906	0.850	0.937	0.931	0.917	0.748
Charlotte	0.898	0.889	0.881	0.911	0.849	0.863	0.917	0.799	0.879	0.928	0.858	0.849	0.797	0.857	0.889	0.858	0.685
Chicago	0.960	0.826	0.941	0.957	0.910	0.925	0.899	0.920	0.842	0.888	0.858	0.890	0.874	0.900	0.933	0.901	0.739
Cincinnati	0.920	0.868	0.946	0.972	0.970	0.922	0.877	0.924	0.877	0.953	0.898	0.908	0.852	0.937	0.932	0.917	0.733
Cleveland	0.904	0.815	0.943	0.934	0.961	0.896	0.854	0.940	0.841	0.885	0.854	0.847	0.813	0.925	0.923	0.859	0.693
Columbus	0.944	0.875	0.909	0.916	0.893	0.887	0.944	0.846	0.883	0.916	0.944	0.833	0.819	0.880	0.934	0.922	0.725
Dallas	0.893	0.884	0.877	0.943	0.839	0.913	0.871	0.811	0.889	0.947	0.871	0.900	0.904	0.886	0.904	0.929	0.791
Dayton	0.900	0.826	0.962	0.957	0.971	0.944	0.817	0.942	0.842	0.909	0.837	0.930	0.894	0.962	0.933	0.880	0.781
Denver	0.887	0.917	0.887	0.886	0.813	0.952	0.885	0.775	0.928	0.917	0.885	0.938	0.941	0.926	0.921	0.927	0.914
Detroit	0.934	0.821	0.962	0.943	0.920	0.952	0.850	0.941	0.828	0.884	0.850	0.920	0.924	0.928	0.943	0.908	0.833
Grand Rapids	0.872	0.797	0.906	0.936	0.933	0.892	0.791	0.901	0.807	0.897	0.791	0.884	0.826	0.892	0.897	0.848	0.693
Greensboro	0.863	0.812	0.894	0.929	0.949	0.839	0.832	0.889	0.825	0.912	0.832	0.828	0.748	0.886	0.865	0.817	0.610
Greenville	0.858	0.836	0.894	0.936	0.916	0.897	0.805	0.865	0.839	0.932	0.781	0.892	0.812	0.900	0.902	0.833	0.711
Hartford	0.889	0.815	0.869	0.848	0.878	0.816	0.908	0.867	0.829	0.815	0.908	0.796	0.745	0.844	0.824	0.846	0.640
Houston	0.898	0.908	0.921	0.966	0.887	0.955	0.878	0.840	0.898	0.968	0.858	0.926	0.871	0.917	0.945	0.917	0.786
Indianapolis	0.932	0.861	0.935	0.983	0.961	0.934	0.870	0.914	0.872	0.963	0.891	0.901	0.865	0.931	0.942	0.911	0.732
Jacksonville	0.846	0.939	0.844	0.827	0.792	0.853	0.948	0.708	0.949	0.896	0.948	0.833	0.761	0.861	0.861	0.927	0.783
Kansas City	0.922	0.871	0.944	0.939	0.893	0.926	0.902	0.861	0.905	0.932	0.902	0.893	0.896	0.944	0.934	0.904	0.808
Las Vegas	0.634	0.823	0.626	0.644	0.617	0.725	0.704	0.492	0.781	0.766	0.761	0.729	0.673	0.700	0.727	0.770	0.673
Los Angeles	0.914	0.842	0.941	0.962	0.920	0.952	0.830	0.920	0.828	0.905	0.830	0.961	0.943	0.928	0.924	0.908	0.812
Louisville	0.920	0.847	0.941	0.976	0.971	0.925	0.858	0.920	0.862	0.950	0.878	0.890	0.855	0.941	0.933	0.880	0.718
Memphis	0.842	0.789	0.843	0.896	0.809	0.827	0.819	0.755	0.800	0.892	0.799	0.768	0.758	0.814	0.874	0.837	0.676
Miami	0.885	0.872	0.884	0.885	0.830	0.912	0.882	0.791	0.885	0.872	0.882	0.894	0.859	0.880	0.900	0.968	0.845
Milwaukee	0.926	0.841	0.943	0.932	0.960	0.895	0.901	0.941	0.865	0.887	0.901	0.871	0.815	0.925	0.901	0.883	0.700
Minneapolis	0.939	0.843	0.939	0.938	0.949	0.905	0.896	0.917	0.859	0.906	0.896	0.846	0.832	0.918	0.932	0.877	0.711
Nashville	0.927	0.891	0.949	0.966	0.957	0.932	0.902	0.902	0.905	0.958	0.924	0.914	0.857	0.944	0.941	0.946	0.773
New Orleans	0.877	0.885	0.896	0.918	0.908	0.905	0.875	0.829	0.900	0.927	0.917	0.908	0.832	0.918	0.892	0.940	0.776
New York	0.948	0.869	0.926	0.925	0.870	0.932	0.924	0.855	0.905	0.891	0.902	0.892	0.899	0.922	0.920	0.946	0.841
Norfolk	0.904	0.932	0.919	0.891	0.892	0.961	0.900	0.819	0.931	0.932	0.923	0.961	0.901	0.948	0.945	0.951	0.908
Oklahoma City	0.948	0.891	0.945	0.951	0.917	0.977	0.904	0.877	0.911	0.934	0.925	0.939	0.922	0.950	0.963	0.973	0.869
Orlando	0.771	0.925	0.806	0.798	0.779	0.843	0.851	0.668	0.919	0.882	0.872	0.864	0.769	0.850	0.850	0.917	0.792
Philadelphia		0.843	0.961	0.938	0.928	0.944	0.938	0.917	0.859	0.885	0.917	0.908	0.892	0.918	0.951	0.940	0.819
Phoenix	0.843		0.857	0.851	0.832	0.896	0.925	0.741	0.974	0.934	0.904	0.896	0.820	0.906	0.902	0.908	0.780
Pittsburgh	0.961	0.857		0.946	0.952	0.951	0.915	0.931	0.882	0.901	0.893	0.930	0.894	0.965	0.956	0.922	0.836
Portland	0.938	0.851	0.946		0.945	0.954	0.858	0.927	0.855	0.951	0.858	0.925	0.908	0.933	0.945	0.913	0.761
Providence	0.928	0.832	0.952	0.945		0.912	0.864	0.952	0.846	0.896	0.885	0.896	0.841	0.947	0.921	0.885	0.718
Raleigh	0.944	0.896	0.951	0.954	0.912		0.884	0.888	0.903	0.936	0.884	0.972	0.953	0.962	0.972	0.942	0.891
Richmond	0.938	0.925	0.915	0.858	0.864	0.884		0.802	0.940	0.882	0.957	0.864	0.789	0.894	0.911	0.938	0.792
Rochester	0.917	0.741	0.931	0.927	0.952	0.888	0.802		0.749	0.809	0.825	0.863	0.872	0.896	0.872	0.854	0.694
Sacramento	0.859	0.974	0.882	0.855	0.846	0.903	0.940	0.749		0.932	0.919	0.887	0.813	0.937	0.912	0.917	0.819
Salt Lake City	0.885	0.934	0.901	0.951	0.896	0.936	0.882	0.809	0.932		0.882	0.917	0.861	0.928	0.943	0.908	0.780
San Antonio	0.917	0.904	0.893	0.858	0.885	0.884	0.957	0.825	0.919	0.882		0.864	0.810	0.894	0.891	0.960	0.792
San Diego	0.908	0.896	0.930	0.925	0.896	0.972	0.864	0.863	0.887	0.917	0.864		0.941	0.947	0.921	0.927	0.892
San Francisco	0.892	0.820	0.894	0.908	0.841	0.953	0.789	0.872	0.813	0.861	0.810	0.941		0.910	0.904	0.891	0.878
Seattle	0.918	0.906	0.965	0.933	0.947	0.962	0.894	0.896	0.937	0.928	0.894	0.947	0.910		0.951	0.913	0.854
St. Louis	0.951	0.902	0.956	0.945	0.921	0.972	0.911	0.872	0.912	0.943	0.891	0.921	0.904	0.951		0.931	0.836
Tampa	0.940	0.908	0.922	0.913	0.885	0.942	0.938	0.854	0.917	0.908	0.960	0.927	0.891	0.913	0.931		0.858
Washington	0.819	0.780	0.836	0.761	0.718	0.891	0.792	0.694	0.819	0.780	0.792	0.892	0.878	0.854	0.836	0.858	

Note: PCA run at the Department of Geography of Texas A&M University using SPSS 13.0 for Windows and data obtained from the CenStats database (U.S. Bureau of Census).

6.4. Most relevant correlations between city data for a PCA run with city employment by NAICS two-digit segments in the largest United States cities, 2004



Note: Based on PCA output from exhibit 6.3 of this Appendix.

7.1. Busiest airports in the world by total passengers, 2005

rank	*urban area*	*airport code*	*passengers*
1	Atlanta, GA	ATL	80,171,036
2	Chicago, IL	ORD	72,135,887
3	Los Angeles, CA	LAX	68,477,689
4	London, UK	LHR	64,607,185
5	**Dallas, TX**	**DFW**	**60,687,122**
6	Tokyo, Japan	HND	56,402,206
7	Frankfurt, Germany	FRA	49,360,620
8	Paris, France	CDG	48,240,137
9	San Francisco, CA	SFO	41,173,983
10	Amsterdam, Netherlands	AMS	39,604,589
11	Denver, CO	DEN	38,748,781
12	Las Vegas, NV	LAS	36,856,186
13	Seoul, South Korea	SEL	36,727,124
14	Minneapolis, MN	MSP	36,688,159
15	Phoenix, AZ	PHX	35,889,933
16	Detroit, MI	DTW	35,535,080
17	**Houston, TX**	**IAH**	**35,246,176**
18	New York, NY	EWR	34,194,788
19	Miami, FL	MIA	33,569,625
20	New York, NY	JFK	32,779,428
21	Madrid, Spain	MAD	32,765,820
22	Hong Kong, China	HKG	32,746,737
23	London, UK	LGW	32,056,942
24	Orlando, FL	MCO	30,822,580
25	St Louis, MO	STL	30,546,698
26	Bangkok, Thailand	BKK	29,621,898
27	Toronto, Canada	YYZ	28,820,326
28	Singapore, Singapore	SIN	28,618,200
29	Seattle, WA	SEA	28,404,312
30	Boston, MA	BOS	27,412,926
31	Tokyo, Japan	NRT	27,389,915
32	Rome, Italy	FCO	25,921,886
33	Paris, France	ORY	25,399,111
34	New York, NY	LGA	25,233,889
35	Philadelphia, PA	PHL	24,900,621
36	Sydney, Australia	SYD	23,553,878
37	Munich, Germany	MUC	23,125,872
38	Charlotte, NC	CLT	23,073,894
39	Honolulu, HI	HNL	22,660,349
40	Zurich, Switzerland	ZRH	22,649,539

Notes: Figures for Passengers refer to total passengers enplaned and deplaned, with passengers in transit counted once.

Source: Airports Council International.

7.2. Largest United States gateways for international air passenger traffic, all types of flights by urban area in 2005

rank	*urban area*	*state*	*passengers*
1	New York	NY	29,084,581
2	Los Angeles	CA	17,011,897
3	Miami	FL	16,924,213
4	Chicago	IL	11,222,764
5	San Francisco	CA	8,413,843
6	Atlanta	GA	7,294,897
7	**Houston**	**TX**	**6,571,033**
8	Washington	DC	5,699,502
9	**Dallas**	**TX**	**5,051,734**
10	Boston	MA	3,921,401
11	Detroit	MI	3,823,855
12	Philadelphia	PA	3,693,307
13	Orlando	FL	3,195,124
14	Minneapolis	MN	2,595,471
15	Seattle	WA	2,323,564
16	Charlotte	NC	1,984,825
17	Phoenix	AZ	1,768,034
18	Las Vegas	NV	1,658,438
19	Denver	CO	1,592,221
20	Cincinnati	OH	1,073,153

Notes: Figures for total passengers starting their trips at the location; in transit traffic was not considered.

Source: United States Department of Transportation.

7.3. Largest foreign destinations for international air passenger traffic from the United States, all types of flights by urban area in 2005

rank	*urban area*	*country*	*passengers*
1	London	UK	15,429,575
2	Toronto	Canada	8,484,193
3	Frankfurt	Germany	6,502,585
4	Tokyo	Japan	6,282,160
5	Paris	France	6,260,358
6	Cancun	Mexico	5,295,896
7	Mexico City	Mexico	4,685,824
8	Amsterdam	Netherlands	4,658,869
9	Vancouver	Canada	3,811,866
10	Montreal	Canada	2,946,743
11	Nassau	Bahamas	2,417,621
12	Seoul	South Korea	2,334,167
13	Guadalajara	Mexico	2,070,729
14	Taipei	Taiwan	2,022,083
15	Sao Paulo	Brazil	1,998,657
16	San Jose del Cabo	Mexico	1,946,067
17	Calgary	Canada	1,935,003
18	Montego Bay	Jamaica	1,931,586
19	Manchester	UK	1,868,821
20	San Jose	Costa Rica	1,747,448

Notes: Figures for total passengers starting their trips at the location; in transit traffic was not considered.

Source: United States Department of Transportation.

7.4. Largest United States gateways for scheduled international air passenger traffic, departures by airport in 2005

rank	*city, country*	*airport code*	*passengers*	*US share*	*foreign share*
1	New York, NY	JFK	18,242,171	38.2%	61.8%
2	Los Angeles, CA	LAX	16,823,836	20.5%	79.5%
3	Miami, FL	MIA	13,941,241	61.1%	38.9%
4	Chicago, IL	ORD	10,709,540	58.7%	41.3%
5	Newark, NJ	EWR	9,077,600	66.2%	33.8%
6	San Francisco, CA	SFO	7,835,239	43.7%	56.3%
7	Atlanta, GA	ATL	7,249,910	79.6%	20.4%
8	**Houston, TX**	**IAH**	**6,482,330**	**82.1%**	**17.9%**
9	**Dallas, TX**	**DFW**	**4,769,893**	**89.0%**	**11.0%**
10	Washington, DC	IAD	4,758,409	46.3%	53.7%
11	Honolulu, HI	HNL	4,356,250	30.7%	69.3%
12	Boston, MA	BOS	3,713,956	30.7%	69.3%
13	Philadelphia, PA	PHL	3,683,764	79.7%	20.3%
14	Detroit, MI	DTW	3,631,279	89.9%	10.1%
15	Guam, TT	GUM	2,409,298	55.0%	45.0%
16	Minneapolis, MN	MSP	2,371,062	94.9%	5.1%
17	Seattle, WA	SEA	2,284,299	58.9%	41.1%
18	Fort Lauderdale, FL	FLL	2,077,717	55.8%	44.2%
19	Orlando, FL	MCO	2,021,707	6.1%	93.9%
20	Charlotte, NC	CLT	1,964,241	92.5%	7.5%
21	San Juan, PR	SJU	1,943,139	88.8%	11.2%
22	Phoenix, AZ	PHX	1,765,570	77.2%	22.8%
23	Las Vegas, NV	LAS	1,511,583	29.2%	70.8%
24	Denver, CO	DEN	1,479,053	59.3%	40.7%
25	New York, NY	LGA	1,449,164	34.8%	65.2%
26	Cincinnati, OH	CVG	1,049,087	92.6%	7.4%
27	Saipan, TT	SPN	923,060	49.8%	50.2%
28	Anchorage, AK	ANC	650,095	4.4%	95.6%
29	Baltimore, MD	BWI	546,879	31.5%	68.5%
30	Portland, OR	PDX	474,260	45.6%	54.4%
31	Memphis, TN	MEM	376,567	100.0%	0.0%
32	Tampa, FL	TPA	351,289	10.7%	89.3%
33	Salt Lake City, UT	SLC	345,785	94.3%	5.7%
34	San Diego, CA	SAN	332,110	63.3%	36.7%
35	Washington, DC	DCA	330,858	37.5%	62.5%
36	San Jose, CA	SJC	269,903	47.5%	52.5%
37	Cleveland, OH	CLE	235,841	86.2%	13.8%
38	Oakland, CA	OAK	203,051	4.9%	95.1%
39	Chicago, IL	MDW	177,750	100.0%	0.0%
40	Raleigh, NC	RDU	177,729	60.3%	39.7%

Notes: Passengers refer to total passengers starting their trips at the location; in transit traffic was not considered.

Source: United States Department of Transportation.

7.5. Largest foreign gateways for international air passenger traffic into the United States, scheduled departures by airport in 2005

rank	*city, country*	*airport code*	*passengers*	*US share*	*foreign share*
1	London, UK	LHR	11,421,345	33.2%	66.8%
2	Tokyo, Japan	NRT	9,656,941	59.8%	40.2%
3	Toronto, Canada	YYZ	7,716,745	46.7%	53.3%
4	Frankfurt, Germany	FRA	6,194,975	37.5%	62.5%
5	Paris, France	CDG	5,801,423	41.9%	58.1%
6	Amsterdam, Netherlands	AMS	4,354,459	58.9%	41.1%
7	Vancouver, Canada	YVR	4,032,531	67.5%	32.5%
8	Mexico City, Mexico	MEX	4,015,540	52.9%	47.1%
9	London, UK	LGW	3,647,948	61.2%	38.8%
10	Cancun, Mexico	CUN	3,397,600	90.9%	9.1%
11	Montreal, Canada	YUL	2,728,572	59.7%	40.3%
12	Seoul, South Korea	ICN	2,688,376	6.0%	94.0%
13	Taipei, Taiwan	TPE	2,078,162	1.4%	98.6%
14	Nassau, Bahamas	NAS	2,047,701	81.9%	18.1%
15	Osaka, Japan	KIX	2,024,829	34.7%	65.3%
16	Sao Paulo, Brazil	GRU	1,755,804	63.2%	36.8%
17	Montego Bay, Jamaica	MBJ	1,755,517	48.5%	51.5%
18	Guadalajara, Mexico	GDL	1,747,790	38.0%	62.0%
19	Madrid, Spain	MAD	1,615,035	40.7%	59.3%
20	Sto. Domingo, Dominican Rep.	SDQ	1,597,932	95.7%	4.3%
21	San Jose, Costa Rica	SJO	1,579,868	67.2%	32.8%
22	Calgary, Canada	YYC	1,554,609	77.3%	22.7%
23	Hong Kong, China	HKG	1,463,495	39.2%	60.8%
24	Manchester, UK	MAN	1,372,782	45.7%	54.3%
25	San Jose del Cabo, Mexico	SJD	1,350,944	83.4%	16.6%
26	Rome, Italy	FCO	1,260,357	65.7%	34.3%
27	Munich, Germany	MUC	1,245,779	33.1%	66.9%
28	Zurich, Switzerland	ZRH	1,202,927	39.0%	61.0%
29	San Salvador, El Salvador	SAL	1,187,287	39.9%	60.1%
30	Sydney, Australia	SYD	1,150,799	38.0%	62.0%
31	Lima, Peru	LIM	1,050,632	60.5%	39.5%
32	Milan, Italy	MXP	1,036,610	29.7%	70.3%
33	Puerto Vallarta, Mexico	PVR	985,505	90.6%	9.4%
34	Guatemala City, Guatemala	GUA	967,277	68.8%	31.2%
35	Monterrey, Mexico	MTY	957,246	50.8%	49.2%
36	Aruba, Aruba	AUA	945,002	100.0%	0.0%
37	Tel Aviv, Israel	TLV	908,376	28.8%	71.2%
38	Auckland, New Zealand	AKL	905,028	0.0%	100.0%
39	Nagoya, Japan	NGO	867,907	59.4%	40.6%
40	Caracas, Venezuela	CCS	816,133	82.3%	17.7%

Notes: Passengers refer to total passengers starting their trips at the location; in transit traffic was not considered.

Source: United States Department of Transportation.

7.6. City pairs with higher number of chartered passengers in international flights originated in the United States, 2005

rank	U.S. city, state	foreign city	country	passengers	charter share
1	Orlando, FL	Manchester	UK	369,371	60.3%
2	Orlando, FL	London	UK	356,078	33.2%
3	**Dallas, TX**	**Cancun**	**Mexico**	**195,915**	**29.4%**
4	Miami, FL	Caracas	Venezuela	178,909	24.4%
5	Chicago, IL	Cancun	Mexico	175,387	44.4%
6	Detroit, MI	Cancun	Mexico	116,371	63.6%
7	Minneapolis, MN	Cancun	Mexico	115,450	51.3%
8	Saint Louis, MO	Cancun	Mexico	111,628	78.7%
9	Miami, FL	Havana	Cuba	110,860	89.1%
10	Miami, FL	Madrid	Spain	90,659	20.5%
11	Orlando, FL	Glasgow	UK	87,078	100.0%
12	New York, NY	Port of Spain	Trinidad	77,275	39.3%
13	Denver, CO	Cancun	Mexico	75,649	31.9%
14	Chicago, IL	Puerto Vallarta	Mexico	69,941	46.7%
15	Miami, FL	Maracaibo	Venezuela	69,146	37.2%
16	Miami, FL	San Jose	Costa Rica	62,897	9.6%
17	New York, NY	Cancun	Mexico	59,656	16.4%
18	Milwaukee, WI	Cancun	Mexico	53,335	95.0%
19	**Houston, TX**	**Cancun**	**Mexico**	**52,544**	**9.2%**
20	Orlando, FL	San Jose	Costa Rica	52,068	84.0%
21	Miami, FL	Toronto	Canada	51,672	7.6%
22	Orlando, FL	Toronto	Canada	49,553	12.7%
23	Cleveland, OH	Cancun	Mexico	47,701	75.6%
24	Orlando, FL	Newcastle	UK	45,720	100.0%
25	Orlando, FL	Birmingham	UK	45,070	100.0%
26	Boston, MA	Aruba	Aruba	44,241	35.9%
27	Boston, MA	Ponta Delgada	Portugal	43,811	100.0%
28	New York, NY	Tel-Aviv	Israel	41,312	3.9%
29	Miami, FL	La Romana	Dominican R.	41,239	19.8%
30	Tampa, FL	Toronto	Canada	37,103	18.5%
31	Miami, FL	Port of Spain	Trinidad	36,577	12.8%
32	New York, NY	Montego Bay	Jamaica	34,959	10.4%
33	Orlando, FL	Cancun	Mexico	34,518	99.9%
34	Las Vegas, NV	Manchester	UK	34,233	46.3%
35	**Dallas, TX**	**Montego Bay**	**Jamaica**	**33,144**	**99.7%**
36	Saint Louis, MO	Montego Bay	Jamaica	32,314	78.3%
37	Minneapolis, MN	Puerto Vallarta	Mexico	31,003	48.9%
38	San Francisco, CA	Cancun	Mexico	30,102	68.0%
39	Boston, MA	Cancun	Mexico	28,380	41.9%
40	San Francisco, CA	Puerto Vallarta	Mexico	27,904	12.2%

Notes: Passengers refer to total passengers starting their trips at the location; in transit traffic was not considered.

Source: United States Department of Transportation.

7.7. Short-haul city pairs with higher number of passengers in international flights originated in the United States, 2005

rank	*U.S. city, state*	*foreign city*	*country*	*passengers*
1	New York, NY	Toronto	Canada	1,350,006
2	Miami, FL	Nassau	Bahamas	1,112,374
3	Chicago, IL	Toronto	Canada	943,833
4	New York, NY	Santiago	Dominican Rep.	908,253
5	Los Angeles, CA	Mexico City	Mexico	863,531
6	Los Angeles, CA	Vancouver	Canada	844,611
7	Los Angeles, CA	Guadalajara	Mexico	823,102
8	New York, NY	Santo Domingo	Dominican Rep.	803,914
9	Miami, FL	Toronto	Canada	682,138
10	**Dallas, TX**	**Cancun**	**Mexico**	**667,308**
11	Miami, FL	San Jose	Costa Rica	652,072
12	**Houston, TX**	**Mexico City**	**Mexico**	**615,264**
13	New York, NY	Montreal	Canada	602,017
14	Miami, FL	Santo Domingo	Dominican Rep.	596,817
15	**Houston, TX**	**Cancun**	**Mexico**	**570,951**
16	Miami, FL	Kingston, Jamaica	Jamaica	565,838
17	San Francisco, CA	Vancouver	Canada	562,945
18	Los Angeles, CA	Toronto	Canada	552,083
19	Miami, FL	Mexico City	Mexico	514,121
20	Miami, FL	Cancun	Mexico	500,588
21	New York, NY	Mexico City	Mexico	489,481
22	Los Angeles, CA	San Jose del Cabo	Mexico	457,287
23	New York, NY	Nassau	Bahamas	444,153
24	Chicago, IL	Montreal	Canada	442,682
25	**Dallas, TX**	**Mexico City**	**Mexico**	**428,108**
26	Miami, FL	Port au Prince	Haiti	424,571
27	Chicago, IL	Mexico City	Mexico	422,143
28	Los Angeles, CA	San Salvador	Salvador	399,277
29	Washington, DC	Toronto	Canada	399,062
30	Chicago, IL	Cancun	Mexico	395,242
31	Orlando, FL	Toronto	Canada	391,698
32	Seattle, WA	Vancouver	Canada	389,435
33	Miami, FL	Montreal	Canada	385,323
34	New York, NY	Cancun	Mexico	363,988
35	Miami, FL	Montego Bay	Jamaica	363,580
36	Boston, MA	Toronto	Canada	361,674
37	Atlanta, GA	Toronto	Canada	344,068
38	Atlanta, GA	Mexico City	Mexico	337,623
39	New York, NY	Montego Bay	Jamaica	334,862
40	Miami, FL	Panama City	Panama	330,237

Notes: Passengers refer to total passengers starting their trips at the location; in transit traffic was not considered.

Source: United States Department of Transportation.

7.8. Long-haul city pairs with higher number of passengers in international flights originated in the United States, l in 2005

rank	U.S. city, state	foreign city	country	passengers
1	New York, NY	London	UK	3,995,689
2	New York, NY	Paris	France	1,913,539
3	Chicago, IL	London	UK	1,560,445
4	Los Angeles, CA	London	UK	1,522,742
5	Los Angeles, CA	Tokyo	Japan	1,455,498
6	Los Angeles, CA	Taipei	Taiwan	1,217,990
7	Washington, DC	London	UK	1,150,675
8	New York, NY	Frankfurt	Germany	1,123,151
9	Orlando, FL	London	UK	1,071,232
10	New York, NY	Tel-Aviv	Israel	1,052,910
11	New York, NY	Tokyo	Japan	1,038,382
12	San Francisco, CA	Tokyo	Japan	990,994
13	San Francisco, CA	London	UK	954,181
14	Boston, MA	London	UK	893,046
15	Chicago, IL	Frankfurt	Germany	890,046
16	Miami, FL	London	UK	844,732
17	New York, NY	Amsterdam	Netherlands	824,126
18	Los Angeles, CA	Seoul	South Korea	780,746
19	Detroit, MI	Amsterdam	Netherlands	763,044
20	Miami, FL	Caracas	Venezuela	733,197
21	Los Angeles, CA	Sydney	Australia	731,821
22	Chicago, IL	Tokyo	Japan	721,454
23	Washington, DC	Frankfurt	Germany	704,928
24	Los Angeles, CA	Auckland	New Zealand	690,317
25	Miami, FL	Sao Paulo	Brazil	682,158
26	San Francisco, CA	Hong Kong	China	671,584
27	New York, NY	Rome	Italy	666,545
28	Orlando, FL	Manchester	UK	612,606
29	Atlanta, GA	Paris	France	609,316
30	New York, NY	Madrid	Spain	597,597
31	Miami, FL	Bogota	Colombia	561,136
32	Los Angeles, CA	Paris	France	544,689
33	Washington, DC	Paris	France	536,644
34	Minneapolis, MN	Amsterdam	Netherlands	524,827
35	San Francisco, CA	Taipei	Taiwan	518,660
36	Atlanta, GA	London	UK	513,973
37	Detroit, MI	Tokyo	Japan	512,629
38	San Francisco, CA	Seoul	South Korea	493,210
39	New York, NY	Sao Paulo	Brazil	493,140
40	New York, NY	Milan	Italy	488,072

Notes: Passengers refer to total passengers starting their trips at the location; in transit traffic was not considered.

Source: United States Department of Transportation.

7.9. Major hubs of U.S. airlines, and foreign airlines with a U.S. hub

airline	***major hubs***
AirTran	Atlanta, Baltimore
Alaska	Seattle, Los Angeles, Portland
Allegiant	Las Vegas, Orlando
American	Dallas, Chicago, Miami, St.-Louis
ATA	Chicago
Atlantic Southeast	Atlanta, Salt Lake City
Continental	Houston, Newark, Cleveland
Delta	Atlanta, Cincinnati, New York, Salt Lake City
Frontier	Denver
Independence	Washington
Midwest	Kansas City, Milwaukee
Northwest	Minneapolis, Detroit, Memphis, *Amsterdam*
United	Chicago, San Francisco, Washington, Denver, Los Angeles
US Airways	Charlotte, Philadelphia, Phoenix, Las Vegas
Air New Zealand	Los Angeles
Mexicana	Los Angeles

Notes: Secondary hubs were not considered.

Source: Mutzabaugh (2005a,b).

7.10. Major airline alliances and their member components

alliance	*airline members*	
Oneworld 692 destinations 320 million passengers	Aer Lingus **American Airlines** British Airways Cathay Pacific	Finnair Iberia LAN Qantas
Sky Team 728 destinations 373 million passengers	Aeroflot Aeromexico Air France-KLM Alitalia **Continental Airlines**	CSA Czech Airlines ***Delta Air Lines*** Korean Air ***Northwest***
Star Alliance 855 destinations 413 million passengers	Air Canada Air New Zealand ANA Asiana Austrian Airlines BMI LOT Polish Airlines Lufthansa SAS Scandinavian Airlines	Singapore Airlines South African Airways Spanair SWISS TAP Air Portugal Thai Airways International ***United Airlines*** US Airways

Notes: Total passengers based on last figures available in alliance websites.

Source: OAG (2006) and alliance websites.

7.11. Largest U.S. gateways for domestic flights by number of enplaned passengers, all airports in the urban area included, 2005

rank	*urban area*	*total links*	*passengers*
1	Chicago, IL	156	38,812,136
2	Atlanta, GA	161	38,155,321
3	New York, NY	160	35,388,117
4	Los Angeles, CA	129	32,293,384
5	Washington, DC	171	28,429,039
6	**Dallas, TX**	**170**	**28,069,728**
7	San Francisco, CA	112	22,863,962
8	Las Vegas, NV	138	20,332,148
9	Miami, FL	118	20,182,398
10	Denver, CO	159	19,792,628
11	**Houston, TX**	**147**	**19,342,669**
12	Phoenix, AZ	117	19,249,665
13	Minneapolis, MN	168	16,331,063
14	Detroit, MI	157	16,198,408
15	Orlando, FL	121	15,275,538
16	Philadelphia, PA	147	13,594,875
17	Boston, MA	131	13,182,265
18	Charlotte, NC	139	12,856,566
19	Seattle, WA	115	11,967,734
20	Cincinnati, OH	137	10,652,363
21	Salt Lake City, UT	121	10,137,210
22	Tampa, FL	92	9,313,792
23	San Diego, CA	94	8,356,483
24	St. Louis, MO	144	6,742,811
25	Portland, OR	89	6,309,487
26	Cleveland, OH	136	6,090,830
27	Memphis, TN	141	5,437,932
28	Pittsburgh, PA	144	5,114,928
29	Kansas City, MO	127	5,028,715
30	Sacramento, CA	85	4,936,140
31	Raleigh, NC	113	4,629,047
32	Nashville, TN	112	4,541,851
33	Indianapolis, IN	126	4,175,320
34	New Orleans, LA	109	3,879,440
35	Ft. Myers, FL	72	3,659,671
36	**Austin, TX**	**110**	**3,636,505**
37	**San Antonio, TX**	**98**	**3,514,700**
38	Milwaukee, WI	114	3,504,006
39	Hartford, CT	81	3,499,579
40	Columbus, OH	115	3,287,221

Notes: Figures for Passengers refer to total passengers enplaned, including passengers in transit.

Source: Bureau of Transportation Statistics and author's calculations.

7.12. Largest U.S. destinations for top upward linkages, absolute and relative number of enplanements in domestic flights in 2005

rank	*urban area*	*linkages*	*passengers*	*% of total*
1	New York	20	24,372,219	68.9%
2	Chicago	25	23,689,180	61.0%
3	Atlanta	27	21,527,932	56.4%
4	Los Angeles	17	17,168,404	53.2%
5	**Dallas**	**26**	**16,575,845**	**59.1%**
6	Miami	12	15,307,301	75.8%
7	Washington	18	14,660,527	51.6%
8	Denver	21	13,196,321	66.7%
9	San Francisco	14	12,466,952	54.5%
10	Phoenix	17	9,611,696	49.9%
11	Las Vegas	16	9,171,824	45.1%
12	**Houston**	**17**	**9,109,905**	**47.1%**
13	Orlando	13	8,772,577	57.4%
14	Seattle	15	8,741,619	73.0%
15	Boston	14	7,192,585	54.6%
16	Minneapolis	13	6,918,956	42.4%
17	Detroit	14	6,647,724	41.0%
18	Philadelphia	12	6,373,171	46.9%
19	Salt Lake City	10	4,718,919	46.6%
20	Tampa	9	4,494,278	48.3%

Notes "%of total refers" to enplanements in upper linkages flights traveling to the destination as a proportion of all enplanements in the same destination; Texas major gateways are shown in bold.

Source: Bureau of Travel Statistics and author's calculations.

7.13. Texas destinations for top upward linkage, absolute and relative number of enplanements in in-state flights in 2005

rank	*urban area*	*linkages*	*passengers*	*% of total*
1	Dallas	18	4,851,514	93.7%
2	Houston	6	840,703	20.9%

Notes "%of total refers" to enplanements in upper linkage flights traveling to the destination as a proportion of all enplanements in the same destination.

Source: Bureau of Travel Statistics and author's calculations.

7.14. Top upward linkages for Texas gateways, absolute and relative number of enplanements in in-state flights in 2005

gateway	*destination*	*distance*	*passengers*	*% of total*
Abilene	Dallas	158	60,285	79.4%
Amarillo	Dallas	324	259,522	74.3%
Austin	Dallas	190	849,444	54.7%
Beaumont	Houston	79	39,720	97.5%
Brownsville	Houston	276	341,519	70.0%
Brownwood	Dallas	135	227	100.0%
College Station	Dallas	164	46,636	54.9%
Corpus Christi	Houston	201	230,975	60.1%
Dallas	-	-	-	-
Del Rio	Houston	342	11,091	100.0%
El Paso	Dallas	551	406,095	50.5%
Houston	Dallas	239	1,402,147	34.8%
Killeen	Dallas	134	107,068	67.6%
Laredo	Dallas	394	51,658	62.4%
Longview	Dallas	140	23,204	100.0%
Lubbock	Dallas	293	316,653	66.9%
Mcallen	Houston	316	206,489	62.9%
Midland	Dallas	319	191,935	52.5%
San Angelo	Dallas	228	50,404	79.1%
San Antonio	Dallas	247	902,809	56.0%
Texarkana	Dallas	181	24,367	71.8%
Tyler	Dallas	103	61,722	71.8%
Victoria	Houston	123	10,909	99.9%
Waco	Dallas	89	51,090	75.4%
Wichita Falls	Dallas	113	46,248	100.0%

Notes “%of total refers” to enplanements in upper linkage as a proportion of all enplanements in the gateway.

Source: Bureau of Travel Statistics and author’s calculations.

7.15. Air travel time between Texas cities served by scheduled flights in the week of April 24-30, 2005

airport	*code*	*abi*	*ama*	*aus*	*bpt*	*bro*	*cll*	*crp*	*dal*	*dfw*	*drt*	*elp*	*hrl*	*hou*
Abilene	ABI	-	4.13	3.49	12.16	7.21	4.26	4.24	5.03	2.05	9.75	4.87	7.39	3.98
Amarillo	AMA	4.07	-	6.21	5.38	6.30	4.20	4.18	2.14	2.00	9.59	4.82	8.38	4.74
Austin	AUS	3.64	10.33	-	3.66	4.58	3.78	3.62	1.54	1.57	7.88	3.28	9.00	1.64
Beaumont	BPT	6.40	5.32	3.59	-	58.42	11.75	3.78	3.66	3.44	12.32	5.31	4.69	4.92
Brownsville	BRO	7.40	6.32	4.59	4.83	-	5.17	4.78	58.93	4.44	9.04	6.30	5.69	5.92
College Station	CLL	4.26	4.27	3.63	58.13	5.01	-	4.06	3.93	2.19	8.31	5.01	4.96	4.13
Corpus Christi	CRP	4.29	6.49	3.58	58.65	4.73	4.16	-	3.64	2.22	8.02	5.04	4.17	2.28
Dallas-dal	DAL	6.34	2.23	1.52	3.77	59.32	4.11	3.76	-	3.09	7.98	3.18	3.01	1.26
Dallas-dfw	DFW	2.07	2.07	1.44	3.49	4.40	2.21	2.18	2.98	-	7.70	2.82	3.83	1.93
Del Rio	DRT	10.48	9.40	7.67	7.90	8.82	59.33	7.86	7.74	7.52	-	9.38	10.53	9.00
El Paso	ELP	4.90	4.91	3.32	5.27	6.18	5.04	5.02	2.96	2.83	9.48	-	5.39	3.50
Harlingen	HRL	7.38	13.22	9.00	4.80	5.72	5.15	4.23	2.99	3.87	9.01	5.80	-	1.95
Houston-hou	HOU	3.99	4.28	1.61	4.99	5.90	5.33	2.28	1.22	1.92	9.20	3.85	1.89	-
Houston-iah	IAH	4.50	3.42	1.70	1.93	2.84	2.28	1.89	1.76	1.55	6.14	3.41	2.79	3.02
Killeen	GRK	3.63	3.63	3.00	4.15	5.07	3.76	3.74	3.99	1.56	8.36	4.38	5.01	3.49
Laredo	LRD	5.03	5.03	4.40	5.44	6.36	5.16	5.14	5.28	2.96	9.65	5.78	6.30	4.89
Longview	GGG	5.74	5.74	5.11	7.16	8.07	5.88	5.85	6.65	3.67	11.37	6.49	7.49	5.60
Lubbock	LBB	3.98	3.99	5.08	5.20	6.11	4.12	12.92	2.05	1.91	9.41	9.00	11.67	5.28
McAllen	MFE	5.64	5.64	4.25	4.49	5.40	4.83	4.44	4.32	3.57	8.70	5.96	5.35	5.50
Midland	MAF	4.58	4.58	4.38	5.12	6.03	4.72	13.08	2.49	2.51	9.33	8.83	5.29	3.40
San Angelo	SJT	4.61	4.62	3.98	6.52	7.43	12.05	4.73	5.52	2.54	10.73	5.36	6.37	4.48
San Antonio	SAT	3.72	3.72	3.09	3.69	4.61	3.86	3.65	1.53	1.65	7.91	3.72	4.83	1.64
Texarcana	TXK	5.71	5.71	5.08	6.53	7.44	5.85	5.82	6.36	3.64	10.74	6.46	7.39	5.57
Tyler	TYR	13.22	4.04	3.40	4.54	5.45	4.17	4.15	4.37	1.96	8.75	4.78	5.40	3.90
Waco	ACT	4.04	4.04	3.41	5.20	6.12	4.18	4.15	5.03	1.97	9.41	4.79	6.06	3.90
WichitaFalls	SPS	4.00	4.01	3.37	5.42	6.34	4.14	4.12	4.91	1.93	9.63	4.75	5.76	3.87

Note: Travel time expressed in hours.

Source: OAG Flight Guide, April 2005 and author's calculations.

airport	*code*	*iah*	*grk*	*lrd*	*ggg*	*lbb*	*mfe*	*maf*	*sjt*	*sat*	*txk*	*tyr*	*act*	*sps*
Abilene	ABI	4.37	3.59	5.03	5.64	3.98	5.54	4.59	4.65	4.65	5.69	4.00	3.98	4.02
Amarillo	AMA	3.45	3.54	4.97	5.58	3.92	5.48	4.53	4.60	4.60	5.63	3.94	3.92	3.96
Austin	AUS	1.74	3.11	4.55	5.16	5.08	4.36	4.53	4.17	4.17	5.21	3.52	3.50	3.54
Beaumont	BPT	1.90	4.19	5.47	7.03	5.20	4.53	5.07	6.04	3.68	6.48	5.17	5.24	5.41
Brownsville	BRO	2.90	5.18	6.47	8.03	6.20	5.52	6.06	7.04	4.68	7.48	6.17	6.24	6.41
College Station	CLL	2.17	3.73	5.17	5.78	4.12	4.80	4.73	12.62	3.79	5.83	4.14	4.12	4.16
Corpus Christi	CRP	1.88	3.76	5.20	5.81	4.15	4.51	59.27	4.82	3.67	5.86	4.17	4.15	4.19
Dallas-dal	DAL	1.84	4.12	5.41	6.68	2.11	4.46	2.52	5.69	1.56	6.42	5.03	5.01	5.06
Dallas-dfw	DFW	1.56	1.54	2.98	3.59	1.93	3.49	2.54	2.60	1.60	3.63	1.94	1.92	1.97
Del Rio	DRT	5.97	8.26	9.55	11.11	9.28	8.60	9.14	10.12	7.76	10.56	9.25	9.31	9.49
El Paso	ELP	3.34	60.33	5.81	6.42	8.92	5.97	8.83	5.43	3.63	6.47	4.78	4.76	4.80
Harlingen	HRL	2.87	5.16	6.44	7.46	5.51	5.50	13.00	6.47	4.92	7.46	5.81	5.79	5.84
Houston-hou	HOU	3.06	3.46	4.90	5.51	3.80	5.41	3.54	4.52	1.69	5.55	3.86	3.84	3.89
Houston-iah	IAH	-	2.29	3.57	5.13	3.30	2.63	3.17	4.83	1.79	4.59	3.28	3.34	3.51
Killeen	GRK	2.22	-	4.53	5.14	3.48	4.85	4.09	4.16	3.15	5.19	12.63	3.48	3.52
Laredo	LRD	3.51	4.50	-	4.88	4.88	6.14	5.49	5.56	4.55	6.59	4.90	4.88	4.92
Longview	GGG	5.23	5.21	6.64	-	5.59	7.15	6.20	6.27	5.26	7.30	5.61	5.59	5.63
Lubbock	LBB	3.27	3.45	4.89	3.84	-	5.40	4.45	4.51	4.31	5.55	3.86	3.84	3.88
McAllen	MFE	2.56	4.84	6.13	7.16	5.49	-	5.72	6.17	4.34	7.14	5.51	5.49	5.53
Midland	MAF	3.19	4.05	5.48	6.10	4.43	5.82	-	5.11	11.58	6.14	4.45	4.43	4.47
San Angelo	SJT	4.59	4.08	5.52	6.13	4.47	6.03	5.08	-	4.14	6.18	4.49	4.47	4.51
San Antonio	SAT	1.77	3.19	4.63	5.24	7.51	4.39	10.42	4.25	-	5.28	3.59	3.57	3.62
Texarcana	TXK	4.60	5.18	6.62	7.23	5.56	7.13	6.17	6.24	5.24	-	5.58	5.56	5.61
Tyler	TYR	2.61	3.50	4.94	5.55	3.89	5.23	4.50	4.56	3.56	5.60	-	3.89	3.93
Waco	ACT	3.27	3.51	4.94	5.56	3.89	5.45	4.50	4.57	3.56	5.60	3.91	-	3.93
WichitaFalls	SPS	3.49	3.47	4.91	5.52	3.86	5.42	4.47	4.53	3.53	5.57	3.88	3.86	-

Note: Travel time expressed in hours.

Source: OAG Flight Guide, April 2005 and author's calculations.

7.16. Air travel between Texas cities served by scheduled flights in the week of April 24-30, 2005

origin	*destination*	*distance (km)*	*minimum time*	*average time*	*total flights*	*average waiting*	*combined time*
Abilene	Beaumont	588	168	169.7	6	560.0	729.7
Abilene	Dallas (dfw)	273	44	53.1	48	70.0	123.1
Abilene	Houston (iah)	518	80	85.4	19	176.8	262.2
Amarillo	Austin	658	130	132.5	14	240.0	372.5
Amarillo	Dallas (dal)	527	60	62.5	51	65.9	128.4
Amarillo	Dallas (dfw)	527	63	64.7	61	55.1	119.8
Amarillo	Harlingen	1071	220	222.9	12	280.0	502.9
Amarillo	Houston (hou)	862	135	144.2	24	140.0	284.2
Amarillo	Houston (iah)	862	93	98.8	31	108.4	207.2
Austin	Amarillo	658	140	140.0	7	480.0	620.0
Austin	Dallas (dal)	289	50	51.9	83	40.5	92.3
Austin	Dallas (dfw)	289	59	62.1	104	32.3	94.4
Austin	El Paso	835	90	92.0	32	105.0	197.0
Austin	Harlingen	455	60	60.0	7	480.0	540.0
Austin	Houston (hou)	249	45	46.2	64	52.5	98.7
Austin	Houston (iah)	249	52	56.8	71	47.3	104.2
Austin	Lubbock	534	65	65.0	14	240.0	305.0
Austin	Midland	456	60	85.0	18	186.7	271.7
Beaumont	Brownsville	564	145	145.0	1	3,360.0	3,505.0
Beaumont	College Station	223	145	145.0	6	560.0	705.0
Beaumont	Del Rio	661	179	179.0	6	560.0	739.0
Beaumont	Houston (iah)	123	37	39.2	45	74.7	113.9
Brownsville	Dallas (dal)	762	176	176.0	1	3,360.0	3,536.0
Brownsville	Houston (iah)	463	70	75.0	34	98.8	173.8
College Station	Beaumont	223	128	128.0	1	3,360.0	3,488.0
College Station	Dallas (dfw)	244	49	61.5	48	70.0	131.5
College Station	Houston (iah)	144	35	39.3	37	90.8	130.1
College Station	San Angelo	402	197	197.0	6	560.0	757.0
Corpus Christi	Amarillo	918	210	221.3	20	168.0	389.3
Corpus Christi	Beaumont	418	159	159.0	1	3,360.0	3,519.0
Corpus Christi	Dallas (dal)	558	120	127.6	37	90.8	218.4
Corpus Christi	Dallas (dfw)	558	77	78.3	61	55.1	133.3
Corpus Christi	Houston (hou)	299	45	48.4	38	88.4	136.8
Corpus Christi	Houston (iah)	299	55	60.5	64	52.5	113.0
Corpus Christi	Midland	646	196	196.0	1	3,360.0	3,556.0
Dallas (dal)	Amarillo	527	65	68.0	51	65.9	133.9
Dallas (dal)	Austin	289	50	50.0	82	41.0	91.0
Dallas (dal)	Brownsville	762	199	199.0	1	3,360.0	3,559.0
Dallas (dal)	Corpus Christi	558	120	132.1	36	93.3	225.4
Dallas (dal)	El Paso	907	95	99.9	37	90.8	190.7
Dallas (dal)	Harlingen	735	135	136.1	76	44.2	180.3
Dallas (dal)	Houston (hou)	373	55	57.3	184	18.3	75.6
Dallas (dal)	Houston (iah)	373	60	64.8	74	45.4	110.2
Dallas (dal)	Lubbock	479	60	63.2	53	63.4	126.6
Dallas (dal)	Midland	516	65	65.0	39	86.2	151.2
Dallas (dal)	San Antonio	392	55	58.0	95	35.4	93.4
Dallas (dfw)	Abilene	273	48	54.2	48	70.0	124.2
Dallas (dfw)	Amarillo	527	66	69.4	61	55.1	124.5
Dallas (dfw)	Austin	289	52	54.1	104	32.3	86.5
Dallas (dfw)	College Station	244	52	62.5	48	70.0	132.5
Dallas (dfw)	Corpus Christi	558	73	76.0	61	55.1	131.1
Dallas (dfw)	El Paso	907	98	99.2	48	70.0	169.2

Dallas (dfw)	Houston (hou)	373	63	67.3	69	48.7	116.0
Dallas (dfw)	Houston (iah)	373	61	68.1	132	25.5	93.6
Dallas (dfw)	Killeen	199	45	51.4	82	41.0	92.4
Dallas (dfw)	Laredo	635	76	79.8	34	98.8	178.6
Dallas (dfw)	Longview	197	55	55.3	21	160.0	215.3
Dallas (dfw)	Lubbock	479	62	64.7	66	50.9	115.6
Dallas (dfw)	McAllen	743	89	89.3	28	120.0	209.3
Dallas (dfw)	Midland	516	65	68.1	40	84.0	152.1
Dallas (dfw)	San Angelo	382	58	60.0	35	96.0	156.0
Dallas (dfw)	San Antonio	392	61	63.5	104	32.3	95.8
Dallas (dfw)	Texarcana	270	53	58.0	21	160.0	218.0
Dallas (dfw)	Tyler	136	42	46.6	48	70.0	116.6
Dallas (dfw)	Waco	133	46	46.9	49	68.6	115.4
Dallas (dfw)	Wichita Falls	209	52	55.8	54	62.2	118.0
Del Rio	College Station	456	200	200.0	1	3,360.0	3,560.0
Del Rio	Houston (iah)	543	100	100.0	13	258.5	358.5
El Paso	Austin	835	85	111.1	38	88.4	199.5
El Paso	Dallas (dal)	907	85	89.2	38	88.4	177.6
El Paso	Dallas (dfw)	907	98	99.9	48	70.0	169.9
El Paso	Houston (hou)	1084	105	125.9	40	84.0	209.9
El Paso	Houston (iah)	1084	110	114.3	39	86.2	200.4
El Paso	Killeen	823	260	260.0	1	3,360.0	3,620.0
El Paso	Lubbock	473	55	55.0	7	480.0	535.0
El Paso	Midland	394	50	50.0	7	480.0	530.0
El Paso	San Antonio	796	80	129.3	38	88.4	217.7
Harlingen	Amarillo	1071	225	233.3	6	560.0	793.3
Harlingen	Austin	455	60	60.0	7	480.0	540.0
Harlingen	Dallas (dal)	735	130	135.8	77	43.6	179.5
Harlingen	Houston (hou)	452	60	60.0	59	56.9	116.9
Harlingen	Houston (iah)	452	69	73.4	34	98.8	172.3
Harlingen	Lubbock	917	215	225.3	32	105.0	330.3
Harlingen	Midland	769	220	220.0	6	560.0	780.0
Harlingen	San Antonio	376	55	55.0	14	240.0	295.0
Houston (hou)	Amarillo	862	145	148.7	31	108.4	257.1
Houston (hou)	Austin	249	40	44.7	65	51.7	96.4
Houston (hou)	Corpus Christi	299	45	48.3	38	88.4	136.7
Houston (hou)	Dallas (dal)	373	50	54.8	183	18.4	73.2
Houston (hou)	Dallas (dfw)	373	62	66.5	69	48.7	115.2
Houston (hou)	El Paso	1084	115	142.5	38	88.4	230.9
Houston (hou)	Harlingen	452	55	56.6	59	56.9	113.6
Houston (hou)	Lubbock	1292	135	141.9	39	86.2	228.1
Houston (hou)	Midland	704	80	118.9	36	93.3	212.2
Houston (hou)	San Antonio	305	50	50.0	65	51.7	101.7
Houston (iah)	Abilene	518	88	93.4	19	176.8	270.3
Houston (iah)	Amarillo	862	93	97.0	31	108.4	205.4
Houston (iah)	Austin	249	50	53.8	70	48.0	101.8
Houston (iah)	Beaumont	123	37	39.4	44	76.4	115.7
Houston (iah)	Brownsville	463	69	71.9	34	98.8	170.7
Houston (iah)	College Station	144	36	43.3	36	93.3	136.6
Houston (iah)	Corpus Christi	299	55	60.7	64	52.5	113.2
Houston (iah)	Dallas (dal)	373	55	61.6	76	44.2	105.8
Houston (iah)	Dallas (dfw)	373	61	68.4	138	24.3	92.7
Houston (iah)	Del Rio	543	110	110.0	13	258.5	368.5
Houston (iah)	El Paso	1084	114	118.3	39	86.2	204.4
Houston (iah)	Harlingen	452	66	68.6	34	98.8	167.5
Houston (iah)	Killeen	284	55	57.2	42	80.0	137.2
Houston (iah)	Laredo	468	71	74.3	24	140.0	214.3
Houston (iah)	Lubbock	1292	84	89.9	31	108.4	198.3
Houston (iah)	McAllen	479	74	75.7	41	82.0	157.6

Houston (iah)	Midland	704	80	85.1	32	105.0	190.1
Houston (iah)	San Angelo	532	90	92.3	17	197.6	289.9
Houston (iah)	San Antonio	305	50	59.2	70	48.0	107.2
Houston (iah)	Texarcana	439	75	77.5	17	197.6	275.1
Houston (iah)	Tyler	299	53	56.5	24	140.0	196.5
Houston (iah)	Waco	284	56	60.3	24	140.0	200.3
Killeen	Dallas (dfw)	199	44	52.4	82	41.0	93.4
Killeen	Houston (iah)	284	50	55.3	43	78.1	133.4
Killeen	Tyler	255	198	198.0	6	560.0	758.0
Laredo	Dallas (dfw)	635	76	78.5	34	98.8	177.4
Laredo	Houston (iah)	468	67	70.8	24	140.0	210.8
Longview	Dallas (dfw)	197	59	60.0	21	160.0	220.0
Lubbock	Austin	534	65	65.0	14	240.0	305.0
Lubbock	Corpus Christi	773	215	215.0	6	560.0	775.0
Lubbock	Dallas (dal)	479	55	59.4	53	63.4	122.8
Lubbock	Dallas (dfw)	479	61	63.0	65	51.7	114.7
Lubbock	El Paso	473	60	60.0	7	480.0	540.0
Lubbock	Harlingen	917	220	220.0	7	480.0	700.0
Lubbock	Houston (hou)	761	140	140.0	19	176.8	316.8
Lubbock	Houston (iah)	761	85	91.1	32	105.0	196.1
Lubbock	San Antonio	558	135	138.8	28	120.0	258.8
McAllen	Dallas (dfw)	743	93	94.0	28	120.0	214.0
McAllen	Houston (iah)	479	66	71.4	41	82.0	153.4
Midland	Austin	456	55	86.1	19	176.8	262.9
Midland	Corpus Christi	646	225	225.0	6	560.0	785.0
Midland	Dallas (dal)	516	60	63.5	39	86.2	149.6
Midland	Dallas (dfw)	516	64	66.4	40	84.0	150.4
Midland	El Paso	394	50	50.0	7	480.0	530.0
Midland	Houston (hou)	704	75	115.5	38	88.4	203.9
Midland	Houston (iah)	704	83	86.3	32	105.0	191.3
Midland	San Antonio	444	135	135.0	6	560.0	695.0
San Angelo	College Station	402	163	163.0	6	560.0	723.0
San Angelo	Dallas (dfw)	382	55	56.6	35	96.0	152.6
San Angelo	Houston (iah)	532	88	88.7	18	186.7	275.3
San Antonio	Dallas (dal)	392	55	56.4	95	35.4	91.7
San Antonio	Dallas (dfw)	392	64	66.6	104	32.3	98.9
San Antonio	El Paso	796	85	88.8	25	134.4	223.2
San Antonio	Harlingen	376	50	50.0	14	240.0	290.0
San Antonio	Houston (hou)	305	45	46.5	65	51.7	98.2
San Antonio	Houston (iah)	305	55	57.9	70	48.0	105.9
San Antonio	Lubbock	558	145	145.0	11	305.5	450.5
San Antonio	Midland	444	145	145.0	7	480.0	625.0
Texarcana	Dallas (dfw)	270	51	58.3	21	160.0	218.3
Texarcana	Houston (iah)	439	77	78.4	17	197.6	276.0
Tyler	Abilene	400	233	233.0	6	560.0	793.0
Tyler	Dallas (dfw)	136	40	47.7	48	70.0	117.7
Tyler	Houston (iah)	299	62	63.1	36	93.3	156.5
Waco	Dallas (dfw)	133	48	49.4	49	68.6	118.0
Waco	Houston (iah)	284	54	56.3	24	140.0	196.3
Wichita Falls	Dallas (dfw)	209	50	53.7	54	62.2	116.0

Notes: distances measured between city centers; times expressed in minutes; combined time refers the average time (of flight) plus average waiting time (between flights). No delays were considered.

Sources: OAG Worldwide Flight Guide, April 2005, and author's calculations

VITA

Name José António dos Reis Gavinha

Birth Place Caminha, Portugal

Education

High-School Diploma, Liceu Nacional de Viana do Castelo, Portugal

B.A. (Licenciatura), Geography, University of Porto, Portugal, 1983

M.Sc., Planning, University of Toronto, Canada, 1994

Ph.D., Texas A&M University, College Station, Texas, USA, 2007

Teaching and Industry Experience

1983-87 – Assistant Lecturer, University of Porto, Portugal

1993-94 - Graduate Teaching Assistant, U. of Toronto, Canada

1994-98 – Research Manager, Tourism Toronto, Canada

1998-2002 – Consultant, State of Ceará, Brazil

2002-07 – Graduate Teaching Assistant and Lecturer, Texas A&M University, College Station, Texas, USA

Permanent Address

PH9 – 40 Homewood Avenue, Toronto, ON M4Y 2K2 (Canada)