BRINGING MEN IN: AN ANALYSIS OF MALE AND FEMALE FERTILITY

A Dissertation

by

LI ZHANG

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

August 2007

Major Subject: Sociology

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Approved by:

Chair of Committee, Dudley L. Poston, Jr.
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ABSTRACT

Bringing Men In: An Analysis of Male

and Female Fertility. (August 2007)

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Chair of Advisory Committee: Dr. Dudley L. Poston, Jr.

Prior research has focused on studying female fertility, but male fertility remains overlooked. Using data from the 2001 *Demographic Yearbook*, the 1964 to 2002 *Taiwan-Fukien Demographic Yearbooks*, the 2004 *National Statistics Reports* and the 2002 *National Survey of Family Growth* (NSFG) Cycle 6, this dissertation examines male and female fertility at the aggregate and individual levels by studying men's and women's fertility differentials in rates and in determinants.

Based on examining the age-specific fertility rates (ASFRs) and the total fertility rates (TFRs) for men and women during the 1990 to 1998 period in 43 countries and places, results show that male and female age-specific fertility mainly differs in the older age groups. In those age groups, male fertility largely outnumbers female fertility. And this pattern is especially apparent in low fertility countries (TFR<2,200). With regard to total fertility, male and female TFRs tend to be similar in countries with TFR values lower than 2,200 where female fertility tends to be higher than male fertility. The opposite pattern is true for countries with male and female TFRs higher than 2,200.

In the analysis of Taiwan fertility, results reveal that male and female TFRs for most years during 1975 to 2004 are far from identical. The ASFRs for men and women also differed over time and varied by educational attainment. Although fertility determinants at the aggregate level impact men's and women's fertility similarly, models combining these factors are more powerful when explaining female than male fertility.

The individual level analyses of the U.S. samples also show significant fertility differentials by gender. Age, marriage, and Hispanic origin increase men's fertility to a greater extent compared to women's fertility. Family income increases men's fertility but decreases women's fertility. Participating in the labor force shows a much stronger positive effect on male than on female childbearing. Cohabitation experience, however, has a significantly stronger impact increasing women's than men's fertility. And an increased number of sexual partners is more likely to reduce men's children compared to women. These findings reported draw research attention to male fertility and contribute to understanding the dynamics of male fertility.

DEDICATION

I dedicate this dissertation to the memory of my father, Jianguo Zhang and to my mother, Yanqing Shi.

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There are many people that I would like to thank for supporting me to finish my dissertation and receiving my doctoral degree. The first person I would like to thank is my committee chair, Dr. Dudley L. Poston who has been both my mentor and friend at Texas A&M University. He led me to the field of demography and provided me valuable guidance and tremendous help. Without him, I would not have today's achievements. I would also like to thank the other members of my committee, including Dr. Alex McIntosh, Dr. Rogelio Saenz, and Dr. Don Albrecht, for their guidance and support throughout the course of this research.

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CHAPTER I

INTRODUCTION

Fertility is one of the major areas of study in demography. Yet, until recently, studies of fertility have been focusing almost exclusively on the roles and patterns of females and their reproductive behaviors. Males have been largely neglected in fertility studies. As Bledsoe and her associates (2000a 333) note, "men, if they appeared at all, usually did so as shadows; as partners-by-implication of those engaged in childbearing." Coleman (2000: 31) also refers to males as "a neglected minority."

In order to justify this exclusion, demographers have provided a number of reasons why fertility studies have concentrated on females. The biological characteristics of females, namely puberty, menopause, and duration of pregnancy are sometimes viewed as reasons for choosing to focus on women (Hertrich 1998). Also, compared to men, women have a more sharply defined and a narrower range (15-49) of reproductive years; and "both the spacing and number of children are less subject to variation among women: a woman can have children only at intervals of 1 or 2 years, whereas a man can have hundreds" (Keyfitz 1977: 114).

Practical and methodological issues are also contributive to demographers' concentration on females. Historically, fertility data have been gathered mostly through interviewing women instead of men for many reasons. For instance, women are easier to be interviewed because previously they were more often at home than men. Women are also assumed to be able to provide proper information about their husbands' attitudes

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This dissertation follows the style of *American Sociological Review*.

towards reproductive behavior (Shryock and Siegel 1976). Moreover, data collected from women are considered more accurate than those collected from men because women are usually more directly involved in reproductive events, such as pregnancies and births (Courgeau 1992; Hertrich 1998; Poulain, Rianey, and Firdion 1992). Even today, in most countries, data on parental age at the birth of the baby are more frequently gathered from the birth registration certificates for mothers than for fathers. This occurs because the indirect involvement of men in childbearing leads to a greater number of unreported ages for fathers, particularly for births occurring outside of marriage and among younger age groups (Poston and Chang 2005). Data of infancy death are often gathered from women as well since men are found to be more likely to omit or overlook infant deaths (Hertrich 1998; Seltzer 1973). This is especially the case in some less industrialized areas, such as Africa, where levels of infant and child mortality rates are high. As a result, more detailed questions for men are usually avoided in national surveys or censuses, making it more difficult to study the fertility of men.

In addition to these practical matters, there are some methodological difficulties that have resulted in downplaying of men in fertility. Take classical demographic models as an example. These models are constructed as one-sex models, which only include females and leave males out. The stable population model, for instance, only takes age-specific fertility rates (ASFRs) and age-specific death rates (ASDRs) of females into consideration. The reason men are not included is because bringing men in these classical models requires generalizing the demographic events to men and taking into account the male role in reproduction and population dynamics. This generalization, however, is not easy, not only technically but also conceptually since it makes the models too complicated to be constructed (Pollak 1986; Schoen 1981). Difficulties also exist in modeling fertility determinants for both sexes. It has been pointed out that demographic techniques are not sophisticated enough to “separate male and female factors affecting fertility” (Wood 1994: 475). This is because variables that impact husband’s and wife’s childbearing behaviors are usually correlated with each other. Incorporating these variables into a single quantitative model is not easy. Wood (1994: 17) has contended that the existing single-sex and female-dominated perspective of fertility studies is largely “a matter of convenience…[because] the two-sex models of population dynamics are very much more complicated mathematically than single-sex models.”

The exclusion of men does not only result from the above biological, practical and methodological realities of fertility, but also stems from the theoretical tradition and social environment. Demographic theories explaining the fertility transition rarely require an involvement of men. The most popular explanatory theory of fertility, such as the proximate determinants theory, may emphasize factors such as marriage, contraceptive use and prevalence; but it does not necessarily demand data for both men and women (Greene and Biddlecom 2000). The cost and benefit theory stresses the importance of rational calculation in reducing fertility, but it does not consider whether or not the value of children is changing for men over time. The wealth flows perspective reveals the mechanism of fertility decline when a society transforms from a traditional patriarchal system to a more modernized system. But the perspective does not acknowledge the changing role of males who are assumed to be the gatekeepers of conventional patriarchal social structure. This “lack of coherent theoretical grounding” in demography has somehow contributed to the unawareness of men in fertility (Greene and Biddlecom 2000: 84).

Sociologically, men are often considered as less involved in fertility for they are regarded principally as breadwinners and “as typically uninvolved in fertility except to impregnate women and to stand in the way of their contraceptive use” (Greene and Biddlecom 2000: 83). The traditional understanding of men’s and women’s roles is frequently described as “men work outside the home, whereas women are responsible for activities associated with the production of children and domestic services” (Watkins 1993: 561). Even today, although the terms of gender and gender equity are gaining popularity, “gender” by and large is still more often considered a biological category than a sociological classification. The assumption of “consonance between men’s and women’s interests within marriage” has further played a part to the one-sex research interest (Greene and Biddlecom 2000: 83). It is also a fact that children are more likely to be living with their mothers than with their fathers, especially in divorced families and when childbearing occurs in nonmarital unions (Shryock and Siegel 1976). This fact has strengthened the belief that women are more closely tied to childbearing and childrearing than men. All of these factors have presented a social context for not considering men and men’s role in fertility.

The one-sex tradition of fertility, however, has highlighted an important demographic concern, i.e., whether fertility variation can be entirely understood without considering males. The assumption of females' primacy in fertility remains unquestioned.

Biology and demography literature in fact has provided some proof of male specialty in reproduction, which distinguishes male fertility from that of females. From the biological point of view, the male sex as a whole has an equivalent amount of contribution to reproduction as the female counterpart. Nonetheless, the male role differentiates itself from that of female in the way that the variation of each individual male's contribution to generating offspring is significantly greater than that of the female. As it is observed that in most sexually reproducing mammalian species, "while most females reproduce, some males do not reproduce at all while others produce very large numbers of offspring" (Coleman 2000: 33). This is partly due to the sexual competition in evolutionary process.

In demography, the male specialty in fertility is demonstrated in a number of ways. Male age-specific fertility shows a later starting, and much later stopping pattern compared to female age-specific fertility (Paget and Timaeus 1994). The median age of first births for men is also found to be higher than for women. In Norwegian countries, for example, the median ages of first births were 26 years and 23 years for men and women respectively in 1972; in Denmark in 1993, the median age was 31 for males and 28 for females (Coleman 2000: 51). But the age effect on male fertility is revealed to be much weaker on female fertility. Women reach their fertility peak between the ages 25 to 35, at which time they begin to have a declining fertility until menopause. Men's reproductive aging, on the other hand, is a gradual process which continues until death (Wood 1994). Male fertility further differs from that of female in total fertility rates (TFRs). Male TFRs was first higher than female TFRs in most Western industrialized countries before the 1960s, which likely resulted from the relative shortage of men caused by World War I and II and their corresponding higher levels of marital rates. Since the 1960s, males have recovered from war time losses, and in most industrialized countries, emigration has been replaced by immigration which is largely dominated by men (Coleman 2000). This has resulted in the opposite situation to be true, i.e. female TFRs began to be higher than male TFRs. Additional evidence of male specialty in fertility comes from the progeny size distribution and childlessness pattern among men and women. Males are more likely to have less children than females; thus, there are higher percentages of childless men compared to women (Coleman 2000).

Besides demonstrating the special of men in fertility, the male and female differentiation in TFRs discussed above contains another important implication. That is, using female fertility levels to stand for those of males is inappropriate because different male and female fertility (MFF) levels not only occur in a specific year, but also across various time periods. The patterns of MFF are subject to change with the dynamics of social context. Using female fertility levels to stand for those of male is especially problematic in the social environment where divorce, remarrying and migration rates are fairly high. Even applying marital female fertility rates to represent male fertility as an alternative solution is unsuitable because men tend to have more biological children from more than one sexual union compared to women and in some societies nonmarital birth rates are comparatively high (Greene and Biddlecom 2000; Juby and Bourdais 1998; Magnani, Bertrand, Makani, and McDonald 1995). Thus, it is imperative to separate the analyses of male fertility level from that of females.

If fertility researchers are interested in taking a step further rather than merely examining the levels of fertility, involving men in fertility studies also appears to be necessary. When exploring female fertility determinants, researchers need to gather information on both men and women because childbearing is a process that includes couples' communication and negotiation. Only relying on females' responses may bias the research results since women may not be able to provide reliable reports about their partners' social and economic background, their reproduction-related attitudes and behaviors. This situation is "most common among less-educated women, young women and those with larger numbers of births (as well as unmarried women)" (Goldscheider and Kaufman 1996: 93). When it comes to male fertility determinants, they are actually largely eluded from researchers. To investigate male fertility determinants and compare them to those of women certainly requires incorporating men into fertility studies. Beyond investigating fertility determinants, examining other dimensions of fertility needs involving males as well. For example, understanding the timing of parenthood demands exploring closely the meaning of fatherhood and motherhood in various cultural institutions and how the meaning changes over the life course for men compared to for women. Looking into the link between the construction and deconstruction of a childbearing and childrearing union (such as cohabitation and marriage) also requires knowing more about men's commitment in these unions.

My above argument of bringing men into fertility studies has indeed been affirmed by recent social and academic developments. Feminist thought has encouraged studying "the sexes in contrast with each other, not just the analysis of women's characteristics as determinants of fertility" (Greene and Biddlecom 2000: 87). The women's health movement has stressed the need for men to be aware of their responsibilities in family planning and reproductive health. Some demographers have begun to criticize the failure of classic demographic theories that ignore men's fertility (Goldscheider and Kaufman 1996; Poston and Chang 2005). They have interpreted the lack of research on male fertility as "reflecting conceptual shortcomings rather than merely weaknesses of the data" and have urged demographers to take men into consideration (Greene and Biddlecom 2000: 88). The methodological development of quantitative and qualitative combined approaches has also broadened the research scope and capability. It allows researchers to gain knowledge of not only the couples, but the extended families' participation in fertility decision making and the diffusion effects of social norms and cultural concepts on both MFF (Greene and Biddlecom 2000).

Newly available male fertility data sources have provided a possibility of studying male fertility in more detail. The *United Nations Demographic Yearbook* contains birth rates by age of mothers and fathers in the issues of 1949-1950, 1954, 1959, 1965, 1969, 1975, 1981, 1986 and 1990-1998 (Coleman 2000; United Nations 2001). By 2005, Demographic and Health Surveys (DHS) have conducted surveys of males or husbands in 42 countries, particularly in sub-Saharan Africa (Demographic and Health Surveys 2005). There are also some census or survey data carried out by several nations presenting male fertility information. For example, in the United States, the 2002 National Survey of Family Growth (NSFG), Cycle 6, for the first time includes men in its survey. This dataset contains information on “fertility, marriage, cohabitation, contraception and related issues” of 7,643 women and 4,928 men (National Center for Health Statistics 2004: 5). The following U.S. surveys also included male fertility questions: the Current Population Survey (CPS) conducted by the Bureau of Census, the Panel Study of Income Dynamics (PSID) funded by the National Science Foundation, the Survey of Income and Program Participation (SIPP) conducted by the U.S. Census Bureau, the National Survey of Families and Households (NSFH) carried out by the National Center for Health Statistics, the National Longitudinal Survey, Youth Cohort (NLSY79) conveyed by the Bureau of Labor Statistics, and the National Survey of Adolescent Males (NSAM) (Thomas 1996). There are also a couple of international data sources containing male fertility information. The *Taiwan-Fukien Demographic Fact Book* published by the Ministry of the Interior of the Republic of China presents the birth data of Taiwan by mothers and by fathers from 1949 to the present (Ministry of the Interior of Republic of China 2005). The World Fertility Surveys provide survey data for men regarding for a few countries as well (Greene and Biddlecom 2000).

Since 1990, more studies of couples’ reproductive attitudes and behaviors and the role of men in fertility decision-making have appeared. Most of this existing body of research, however, is dominated by a problem-oriented approach and focuses on a few issues such as contraceptive use and men’s sexual behaviors (Greene and Biddlecom 2000). And most of the work studies male fertility in less industrialized nations, such as the sub-Saharan African countries (Goldscheider and Kaufman 1996). A more comprehensive review of existing male fertility studies is presented in Chapter II.

Although existing studies have begun to take men onto consideration in fertility studies, a couple of important demographic concerns dealing with male fertility remain untouched by previous research. The first concern is about the general pattern of MFF. The existing studies have described a MFF pattern in Western industrialized countries such that male TFRs were first higher than female TFRs before the1960s and a reverse situation became true since then. But it does not provide a threshold for this pattern for other countries over time. The other issue concerns the determinants of male fertility. Few studies have addressed the issue of male reproductive attitudes in determining female fertility. However, the determinants of MFF have rarely been compared to those of females; and not much has been done on assessing the characteristics and life experience of men in influencing male fertility. In other words, the determinants of male fertility are unclear. These concerns become the primary questions that will be examined in this dissertation.

I answer these questions through comparing MFF levels and determinants with particular attention paid to Taiwan and the United States. The analyses conducted in this dissertation help to achieve my main goal of drawing research attention to male fertility. There are eight chapters in this dissertation. Following this introductory chapter, Chapter II reviews the literature related to male fertility and evaluate the strengths and weaknesses of previous male fertility studies. Chapter III explores the general pattern of MFF rates by contrasting male and female TFRs in 43 countries and places. It reveals that for most countries and places that have male and female TFRs lower than 2.2, MFF rates are at a similar level, with ratios of male and female TFRs ($R_{TFR\_M/Fs}$) below 1.0; while for most countries and places that have male and female TFRs higher than 2.2, MFF levels are far from identical with $R_{TFR\_M/Fs}$ above 1.0. The patterns of MFF levels in Taiwan shown in Chapter IV confirmed the general model found in Chapter III. Beyond comparing MFF levels, Chapter IV also compares males and female fertility determinants at the aggregate level. The factors that have been used to explain fertility transition of Taiwanese women are found to have a weaker explanation capability on Taiwanese men. Thus, using individual data to further investigate the factors that lead to the dynamics of male fertility is needed. To do so, Chapter V to Chapter VII move on to assess MFF determinants in the United States using data from NSFG Cycle 6. These chapters show that demographic characteristics, socioeconomic status and sexual experience did impact U.S. men's and women's fertility differently. These findings emphasize the necessity of constructing separate fertility theories for men to expand the existing fertility theories. The final chapter concludes the findings, and places future research attention on taking men's roles and commitments into account when considering factors leading to decisions about bearing and rearing children.

CHAPTER II

REVIEW OF MALE FERTILITY LITERATURE

This chapter reviews the literature of male fertility; particular attention will be paid to social and demographic studies of male reproduction and its related issues. It has been suggested that the majority of studies dealing with male fertility are biological and medical in orientation (Poston and Chang 2005). These biological or medical oriented studies of male fertility have covered the following major topics: 1) biological, behavioral and natural factors influencing male reproduction and reproductive health, such as cadmium, spermatogenesis, tripterygium hypglaucum, Ramafhan fast, smoking and temperature (Abbas and Basalamah 1986; Archibong and Hills 2000; Bujan and Mieusset 1996; McLachlan, Newbold, Burow, and Li 2001; Raji, Oloyo, and Morakinyo 2006; Rispin 2002); 2) contraceptive approaches regulating male fertility, including hydroxyurea, goyssypol, testosterone, injections, hormonal methods and immunological approaches (Archibong, Powell, and Hills 2000; Frich 1994; Handelsman 2000; Talwar and Pal 1994; Yu and Chan 1998); and 3) diseases causing male infertility and sterility, for instance, Chlamydia trachomatis, Chlamydial Serology and other age-related diseases (Autoux, De Mouy, and Acar 1987; Gdoura, Keskes-Ammar, Bouzid, Eb, and Orfila 2001; Pflieger-Bruss, Schuppe, and Schill 2004; Rolf, Kenkel, and Nieschlag 2002; Sherr and Barry 2004). These studies account for about two thirds of the existing male fertility literature (Poston and Chang 2005).

Despite the tradition of female dominance in demography and sociology, since the 1990s there has been an increasing number of fertility studies involving males in their analyses. Articles and book chapters on male fertility have begun to appear in the demographic literature. In 1998 the journal *Demography* published a special issue, namely, "men in families," which focused on men's involvement in parenting in the United States and men's reproductive behavior and parenting outside of the United States. In 1996 and 2000, two major papers appeared in the journal *Population and Development Review* (Goldscheider and Kaufman 1996; Greene and Biddlecom 2000) that stressed the importance of involving men in fertility studies and suggested directions for future research on male reproductive roles. In 2000, a book based on the papers presented at a 1995 conference of the IUSSP was published, namely, *Fertility and the Male Life-Cycle in the Era of Fertility Decline* (Bledsoe, Guyer, and Lerner 2000b). Professional meetings of demography have also included male fertility studies in their sessions. The Population Association of America (PAA) 2006 Annual Meeting included papers discussing male reproduction and evaluating the quality of fertility data collected from men (Dribe and Stanfors 2006; Guzzo and Furstenberg 2006; Rendall, Joyner, Peters, Yang, Handcock, and Ryan 2006). Male fertility has thus drawn an increasing amount of research attention recently in demography and sociology. The rest of this chapter will explore the major topics covered by existing demographic studies of male fertility, followed by an evaluation of these analyses.

Data Quality and Male Fertility

Assessing the quality of fertility data gathered from men is an important topic that has been examined in many demographic studies of male fertility. Women are usually assumed to be more trustworthy than men when it comes to fertility because they are more directly involved in reproductive events, such as births and pregnancies. For some fertility parameters such as miscarriages, fecundity-impairing illnesses, and age of children, information provided by females are claimed to be more reliable than that given by males (Yaukey, Roberts, and Griffith 1965). There is a disagreement, however, as to the reliability of men's reports. The majority of studies suggest that men tend to underreport considerably the number of children born to them, especially children outside of marriage and from previous marriages. In a study assessing men's retrospective fertility histories, Rendall and associates find that among U.S. and Britain samples, one third to half of men underreport their nonmarital births and births in previous marriages (Rendall, Clarke, Peters, Ranjit, and Verropoulou 1999). Other studies show similar results. Using the 1979 and 1980 Current Population Survey (CPS), Cherlin and colleagues (1983) indicate that children from previous unions living elsewhere are substantially missed in men's reports compared to women's reports. Studies analyzing the 1987 wave of the National Survey of Families and Households (NSFH) show large shortfalls in men's reports, i.e., between one quarter and one half of the children of nonresident fathers are omitted by male respondents in the NSFH (Seltzer and Brandreth 1994; Sorensen 1997). Analyzing male data from the survey of Income and Program Participation (SIPP) conducted in 1992 by the U.S. Census Bureau, Bachu (1996) finds higher nonresponse rates for men than for women, especially among the never-married population. She suggests that "analysis of fertility data for single men requires much caution" (Bachu 1996: 31). Rendall and associates (2006) assess men's fertility reports in the 2006 National Survey of Family Growth (NSFG) and show that men tend to underreport the number of their biological children, and this is especially the case among men in younger age groups. Studies in Europe also note that women report family events and moves with greater accuracy than do men (Auriat 1991; Courgeau 1992; Poulain, Rianey, and Firdion 1992). Other fertility measurements, such as infancy deaths are found to be more likely omitted by men than by their female counterparts as well (Seltzer 1973).

Although most research suggests the inaccuracy of male fertility data, others contend that data gathered from men in certain social contexts are reliable and that information on some fertility-related items reported by men is more accurate than that collected from women. Zarate's (1967) study shows that Latin American males can provide sufficient information on number of children ever born (CEB). Fikree, Gray, and Shah (1993) compare the spouses' reports of their reproductive histories in a U.S. community and find that even though men's reporting of spontaneous or induced abortion is less reliable, their reports of timing and number of live births are accurate. Bachu (1996) evaluates the quality of data gathered from men in the SIPP and affirms the overall validity of men's responses, particularly the responses of married men. She states, "overall, extremely close agreement was found in the average number of CEB reported by all husbands (2,249 births per 1,000) and wives (2,248 births per 1,000)"(Bachu 1996: 20). For the married population, Bachu (1996: 14) notes that "asking about the number of children they had ever fathered will yield the analyst with not much more information than if a survey was taken with the traditional 'female only' universe." Analyzing data from the NSFH, Bachrach and associates (1992) reach a similar conclusion. The results of a telephone survey conducted by Coughlin, LaPorte, O'Leary and Lee (1998) also reveal that men appear to be able to recall reproductive information (such as contraceptive use, frequency of intercourse and time of spouse's conception) with acceptable accuracy, and that American men's reports can be valid sources for epidemiological studies. These statements certify the accuracy of fertility reports by American men.

In addition to the above analyses, other studies confirm the validity of men's reports in certain African populations. Hertrich (1998) design a field survey in a village of Mali to evaluate the quality of men's and women's responses to marital history among 78 marriages and reproductive history among 72 couples. The results show that women are not necessarily the best source of information on pregnancies. To illustrate, women tend to underreport pregnancies compared to their husbands even though infancy death is more likely to be omitted by men. In another field, marriage history, men actually provide more reliable and detailed information than women. In another study, Ratcliffe, Hill, Harrington and Walraven (2002) survey 1,315 men and 1,261 women in rural Gambia. They report that even in Gambia where polygyny and marital disruption yield complicated reproductive histories for both men and women, men can report their wives' pregnancy events reliably. Interestingly, the authors observe that "women's refusals and reluctance to participate were more common than men's…the women were less willing to give details about children who had died and more easily upset by the recollection of dead children" (Ratcliffe, Hill, Harrington, and Walraven 2002: 582).

These findings emphasize the value and importance of surveying men in terms of fertility and its related behaviors.

Even though there are some mixed findings in this group of literature, the contribution of these studies to male fertility research is apparent. They open up new possibilities to broaden the perspectives on male fertility. The finding that men can be a valuable source of information in certain populations makes it plausible to compare levels and variations of MFF in these populations. Reliable reports provided by men also make it possible to improve the understanding of male fertility determinants. This is so because when exploring the factors that influence male fertility, the use of first hand male data avoids the biases that may be generated by merely relying on women's reports of their partners' characteristics. As Zarate (1967) indicates, "[although] women may be in a better position to provide accurate information on several aspects of childbearing, it is doubtful that they are in a position to provide better information on [men's] socioeconomic factors" (Zarate 1967: 849). Men's reliable descriptions of their own characteristics and socioeconomic status advance the analyses of factors that cause male fertility change. Moreover, men's more detailed reporting on some fertility related items, such as marital history, supplements the shortfalls of female's reports. Thus, in order to examine male fertility in a more comprehensive manner, "it would be rewarding to pay more attention to male biographies" (Hertrich 1998: 316).

The accuracy issue in studies of male fertility data, however, also brings up several concerns when analyzing and interpreting male fertility datasets. The first concern regards the generalization of existing results to various social groups.

Discrepancies of previous studies lie in the fact that their samples are chosen from a variety of societies, which makes it difficult to draw a general conclusion in terms of overall data accuracy. The impression given by previous studies is that fertility information reported by married men can be considered accurate in most societies. However, researchers still need to be cautious when making this statement. As Ratcliffe and colleagues (2002) indicate, men can provide reliable information about pregnancy events that their wives have experienced in rural Gambia, but "such complete knowledge may not be the case in other populations… especially where pregnancies outside of marriage are common" (Ratcliffe, Hill, Harrington, and Walraven 2002: 584). The great variation in diverse social circumstances requires researchers to evaluate the precision of a particular male data source before using it in empirical analyses.

Another concern raised by the above studies is how to choose the proper reference group to justify the reliability of male responses. A major approach used by prior studies is to match men's reports to those of women's. This approach is problematic because women's answers are not always true, which has been shown in previous research (Hertrich 1998; Jones and Forrest 1992). In reality, it is possible that men's reports match those of women's, but neither of them is accurate. Therefore, referring to some other sources of information besides women's announcements is essential. In Ratcliffe and associates' (2002) study, they compare both men's and women's reports to the records of demographic surveillance systems in local Gambia to judge the accuracy of male data. In future analyses, other available sources such as regional vital registrations could also be examined for the purpose of evaluating male reports.

The last concern regarding male reports is the representative capability of male samples. This issue is somehow related to the matter of generalization discussed above. Researchers correctly point out that complete knowledge of men on some fertility events found in the studied population may not be applied to other groups (Ratcliffe, Hill, Harrington, and Walraven 2002). Nevertheless, few of them make an effort to consider the extent to which their samples represent the population they are studying. In a study of the Gambian population, Ratcliffe and associates (2002) do mention a difficulty interviewing men due to their greater mobility compared to women. But, they conclude that detailed and reliable information can be collected from men in the "West African population" (Ratcliffe, Hill, Harrington, and Walraven 2002: 581). When making this statement, these researchers fail to first clarify whether the "West African population" being studied is not overrepresented by those less mobile males. These men may have a greater chance to be included in their surveys because they are more likely to be interviewed. These males may have very different reproductive attitudes and behaviors compared to those who migrate more frequently. If this is the case, generalizing the results based on studied samples to a larger population may be inappropriate. Future research needs to address the issue of sample representativeness in order to obtain more accurate results.

Men's Participation in Fertility Decision-Making and Family Planning

Men's role in childbearing and their participation in family planning are also discussed by demographic studies of male fertility. Many findings are evident in the literature on this topic. Using data from the Demographic and Health Surveys (DHS), a number of studies have been conducted revealing men's critical role in fertility reduction and family planning in less developed nations, especially in Africa. Research results show that men in these countries have an increasing knowledge of contraceptive use and are highly involved in family planning (Lamptey, Nicholas, Ofosu-Amaah, and Lourie 1978; Maharaj 2001; Petro-Nustas 1999). In African countries, such as Ghana, Kenya, Nigeria, Sudan and Zambia, where traditions of male-dominant and patrilineal family structures are strong, men are found to play a decisive role in reducing fertility rates. Men's reproductive motivations and preferences vastly influence those of their wives; and men often decide whether a couple uses family planning methods and how many children a couple should have (DeRose and Ezeh 2005; Dodoo 1998; Isiugo-Abanihe 1994; Khalifa 1988; Lamptey, Nicholas, Ofosu-Amaah, and Lourie 1978; Mbizvo and Adamchak 1991). In other words, men's motivations of contraceptive use and their fertility preferences eclipse those of their wives in the studied African populations. In these populations, men to a large extent determine the pattern of *achieved* fertility.

Taking a step further, another group of studies focuses on developing countries and examines *prospective* fertility desires and intensions of husbands and wives rather than their achieved fertility. Through interviewing couples in a village of Nigeria in 1974, Mott and Mott (1985) confirm that husband's and wife's responses on family planning and *achieved* fertility in the population studied are similar. Yet they find that husband's and wife's responses to *prospective* fertility intentions are very different. On average, monogamous husbands want more additional children compared to their wives; but polygynous husbands want slightly fewer additional children than each of their wives. The authors conclude that unlike achieved fertility, *prospective* fertility intentions in this population operate on "an individual and not a family level" (Mott and Mott 1985: 88). In a study measuring the unmet need of husbands and wives in three countries, namely, Bangladesh, the Dominican Republic and Zambia, Becker (1999) also observes substantial differences between spouses in terms of contraceptive use and fertility intentions. Such results imply that although the social tradition of male-dominance in some societies results in men playing a crucial role in determining their wives' reproductive behavior, women's reproductive intentions can be different from those of their husbands. These findings, from a unique perspective, show the differentiation of men and women in reproduction.

Given the inconsistency of men's and women's prospective fertility intentions, researchers suggest some possible approaches to progress family planning in developing nations. Becker (1999) and Odhiambo (1997) recommend fostering spousal communication to enhance family planning. They argue that the lack of communication between husbands and wives is the primary obstacle to family planning in some developing nations rather than men's opposition to contraception. Lundgren and colleagues (2005) use the case of El Salvador to emphasize the diffusion effect of informal networks for spreading family planning information in Africa. Through examining fertility decisions made by five generations of one South Indian family, Karaa and associates (1997: 24) further propose the importance of male motivation in regulating fertility. Karaa and associates (1997: 24) contend that "individual motivation rather than choice of methods is more important for positive male participation in family planning." Thus, cultivating men's interest in family planning is crucial.

Moving on from less industrialized nations to a broader social environment, a few other studies provide a quite different picture regarding men's role in family planning and childbearing in contemporary U.S. society. Although a pattern of male-dominance in determining childbearing is also found in the U.S. in the early 1970s (Marciano 1979). Later research results begin to display greater gender equality in sexual decision-making, contraceptive use and childrearing (Grady, Tanfer, Billy, and Lincoln-Hanson 1996). The effects of ethnic stereotypes in influencing men's roles in reproduction is also highlighted in a study (Sorenson 1989). Drawing samples from the Arizona, New Mexico and Texas Public Use Microdata Samples (PUMS), Sorenson (1989) finds Non-Hispanic husbands have less of an effect on their wives' fertility compared to Mexican-American couples. Interestingly, after controlling for differences in female educational attainment, the effect of ethnicity disappears. The author concludes that if the wife's educational levels are less than high school, the wife's characteristics can only be used as a proxy for the couple's characteristics when studying marital fertility. But this rule can not be applied in studies including couples with a wide range of educational levels; under this situation, men's roles need to be taken into consideration.

Examining men's role in fertility decision-making and family planning in a variety of social contexts, the above studies make a significant contribution to constructing future family planning policies, especially in less developed nations. Many previous family planning policies have largely focused on educating women and increasing women's labor force participation as means of lowering fertility (Smith-Lovin and Tickamyer 1978). This body of work, however, emphasizes that men should be the target population in family planning, particularly in societies that have a strong male-dominant tradition. In these societies, without the involvement of men in family planning, policies merely focusing on females may well be futile. Meanwhile, these studies also stress the importance of informal networks and spousal communication in facilitating fertility transition to a lower level. These factors seem to have been neglected in previous family planning policies. To improve future family planning, these factors certainly need to be taken into account, acting upon women's increasing reproductive autonomy, coupled with socioeconomic developments of the society.

The limitation of this group of studies is that much of the literature reviewed focuses mainly on less industrialized countries. This probably reflects researchers' greater concern for fertility reduction in high-fertility countries where declines in women's desired fertility does not necessarily lead to lower fertility (Goldscheider and Kaufman 1996). Limited sources of male fertility data can be another reason that much less work has been done for highly industrialized nations. To illustrate, as one of the principal data sources that contain male fertility information, the DHS dataset only concentrates on surveying populations of developing countries, such as Africa and Asia.

This may have led to the fact that majority of this body of work mainly focuses on the African continent. Although a few studies have been conducted examining men's role in reproduction and family planning in the United States, it is not clear if the pattern of equally sharing childbearing responsibilities between husbands and wives is universal in other industrialized nations. Also, under the circumstance of gender equality, the communication and negotiation between men and women in other sexual unions, such as cohabitation, has not been examined in either developed or developing countries. It is worthy of exploration in future analyses.

Comparative Analyses of MFF Patterns and Determinants

Comparing patterns and determinants of male fertility with those of females is also a major topic covered by the demographic literature of male fertility. Under this topic, prior studies a) analyze male age-specific and completed fertility patterns; b) discuss how the timing of paternity impacts male life-cycle, c) explore the manner in which male fertility differs from that of females, and d) contrast the determinants of fertility for both sexes.

Regarding the age pattern of fertility, as in other aspects of fertility studies, great attention has been paid to females. Researchers thus have proposed the following reasons to justify the concentration on maternity age: the effects of female age on fertility are strong; the age difference between spouses normally falls in a small range; and the age effect on couple's fertility rates is largely attributed to female age (Anderson 1975a). Additionally, there are more data available on maternal age than on paternal age. The lack of knowledge about the impact of biological factors on male fecundity also contributes to the tradition of focusing on female age-specific fertility patterns (Anderson 1975a; Smith 1972). Despite the focus on the female age effect on fertility, few studies have been conducted analyzing the effect of male age on fertility and the age-specific pattern of male reproduction. Anderson (1975a) finds that fertility can be considerably affected by male age of reproduction in non-contraceptive populations such as Ireland in 1911. Paget and Timaeus (1994) observe that male age-specific fertility has a pattern of starting later, having a later and lower peak, and remaining higher than that of female's with increasing age. Kiernan and Diamond (1983) study the British cohort of 1946, and show that men tend to have their first births later compared to women (a median age of 25.9 versus 23.0); and the first birth distribution of males is more dispersed than that of females. Thomas (1996) analyzes the age pattern of male fertility in the United States and finds similar results.

Beyond investigating the age pattern of male fertility, researchers also discuss the manner in which the timing of paternity affects the male life-cycle. Research results suggest that males with early first birth occurrences tend to have lower educational attainment and income trajectories. Men who are teenage fathers are less likely to pursue higher education and more likely to earn less than men who defer parenthood (Pirog-Good and Good 1995; Thomas 1996). In addition, males who experience an early age at first birth are less "able and willing" to be fathers since paternity is intimately related to the obligation of financially supporting the children (Thomas 1996: 2). In contrast, males who undergo later fatherhood are more involved and highly affective with their children (Cooney, Pedersen, Indelicato, and Palkovitz 1993).

When it comes to completed fertility patterns, previous studies compare male fertility rates to those of their female counterparts and show a changing pattern of MFF correlation. Kuczynski (1932) calculates male and female net reproduction rates (NRRs) for France during 1920-1923, and shows that male and female NRRs are not identical (1.19 and 0.98, respectively). This differentiation is considered to be produced by the shortage of men caused by World War I. Indeed, higher male than female fertility rates have been found in other European countries before the 1960s. Since the 1960s, Coleman (2000) notes, male fertility rates have been lower than those of females in most European nations. For example, the TFRs in France in 1974 were 2.05 for males and 2.11 for females; in Denmark in 1988, the TFRs were 1.37 and 1.50 for males and females respectively.

In other regions, the transition from higher male than female fertility to the reverse pattern seems to happen in a later period. Take the United States as an example. Ventura and associates (2000) find that male TFR was still higher than female TFR in 1980 (1.97 versus 1.84). According to Coleman (2000), in 1992 the TFRs for U.S. men and women were 2.05 and 2.11. Ventura and associates (2000) observe that a decade later, male TFRs continued to be lower than those of females. In 2000, male and female TFRs were 2.02 and 2.06. Male and female completed fertility in Taiwan showed a similar pattern to that of the U.S. Poston and Chang (2005) evaluate TFRs for both men and women in Taiwan from1983 to 1995 and show that male fertility rates were first higher than female fertility rates, they then had a crossover, and the female fertility rates began to be higher than those of their male counterparts. The crossover points of MFF occurred in 1988 and 1989.

As to studies of MFF determinants, previous studies consider motivation of male contraceptive use, Hispanic origin and foreign-born status of men as influential to male fertility. To illustrate, Harter (1968) examines male fertility in New Orleans in the 1960s and finds that motivation for using contraception is a better predictor of *male excess fertility* than knowledge of contraception or behavioral involvement in family planning among various racial, religious and socioeconomic groups. The average family size of the sector with high-motivation of contraceptive use tends to have a significantly smaller family size than that of one with low motivation. Bachu (1996) studies male fertility in the U.S. by investigating the number of children 16,777 men have ever fathered, and shows that Hispanic origin, socioeconomic status and nationality shape *male marital fertility*. That is, being of Hispanic origin and having lower socioeconomic status increase the reported number of male CEB. For married couples, those in which the husband and wife are both foreign born tend to have higher male fertility rates compared to families where both spouses are native born.

When it comes to comparative analyses of fertility determinants for both sexes, Poston and Chang (2005) find that in Taiwan, independent variables generated from conventional demographic theories explaining female fertility do indeed account for the variation in female fertility; but they do not work well when predicting male fertility differentials. Zhang and associates (2007) also show similar findings in their research. Bachu's (1996) research of American men's fertility demonstrates that for the never-married population, demographic factors such as nationality, race and ethnicity have different influences on fertility for men compared to their effects on women. Foreign-born men are more likely to be childless (32 percent) than foreign-born women (24 percent). Never-married Black women report having an average of 1.2 births; while never-married Black men report an average CEB of 0.5. Marital status also plays an important role in shaping MFF. The fertility rates for married men and women tend to be more similar than dissimilar; nevertheless, fertility rates of never-married men are considerably lower than reported by their female counterparts. Corijn and Klijzing (2001) also explore the manner in which socioeconomic factors affect paternity and maternity. Using European survey data in twenty-four countries for the 1980s and 1990s, the authors find that educational attainment's generally negative effect on fertility is stronger for women than for men. Also, unemployment leads to men's postponement of marriage, whereas it affects women in two distinct ways. It either accelerates or slows down women's timing of marriage. The effect of religion is stronger among women than men. Furthermore, being Catholic and attending church services affect men and women's parenthood timing in different ways in predominantly Catholic countries. Other relevant factors such as parental influence have been shown to have a different impact on males compared to females.

Investigating male fertility patterns and determinates from various perspectives, the above research has considerably advanced our understanding of male fertility. The emphasis on using male fertility measurements rather than those based on females to represent male fertility helps to better capture the variation of male childbearing patterns.

As Poston and Chang (2005: 22) argue, “demographers and sociologists should give more attention to males in their analyses of fertility variation and change than has heretofore been the case…it is no longer acceptable or appropriate to estimate fertility models that are based solely on women and on female fertility rates.” The association explored between the male age pattern of reproduction and other life events further stresses the magnitude of men’s role in reproduction, family formation and childrearing. Moreover, the finding that MFF levels and determinants are not identical calls attention to bringing men into fertility studies. Female fertility can no longer fully represent male fertility. In sum, this group of studies has extensively challenged the status quo of conventional demography that focuses on female fertility exclusively.

In spite of the strengths of these studies, there are also some limitations. The first inadequacy lies in the approach calculating male fertility rates. The idea of applying female fertility measurements to males is sound, while some of the specific methods used in prior analyses are questionable. One common technique calculating male fertility in existing studies is to apply the number of children to women in a certain year divided by the mid-year male population. This approach is appropriate when computing the general fertility rate (GFR), the crude birth rate (CBR) and other rates that do not need to consider age effects on fertility. But when age effects on fertility are taken into account, this approach can be problematic. This is because the assumption behind this technique is that men and women have an equal amount of children in a certain age group during a specific time period. This is actually not true in most populations. In reality, females tend to have more births in the younger age groups compared to males; and the opposite situation is the case for the older age groups. Thus, using the same numerators (number of births given by females) to generate male ASFRs and TFRs, is inappropriate. Male fertility rates calculated in this way could be inaccurate.

The second flaw of the above analyses regards the reasons provided by previous studies elucidating the changing patterns of MFF correlation. This may result from the methods used to compute MFF rates as discussed above. Coleman (2000) notes that the diverse pattern of MFF differentiation can be interpreted by the existence of unequal numbers of males and females in various time periods. From the 19th century to the 1950s, emigration, military services and warfare lead to a shortage of males, which generated the higher proportion of never-married females in Western societies from the early 19th century until the mid 20th century. Thus, male fertility rates tended to be higher than female fertility rates. After World War II, the recovery of the male population from wartime losses and emigration replaced by immigration dominated by males in most industrialized counties led to relatively more males in each age cohort than females. Consequently, male TFRs become slightly lower than those of females. Such an explanation is largely based on interpreting the changes of the denominators of MFF rates to evaluate MFF variation. Nevertheless, as discussed above, if the approach used to compute male fertility rates is questionable, then the explanations of MFF transformations based upon such an approach need to be re-assessed. Even if we suppose that the shortage of men caused by two world wars is part of the reason that has caused MFF dynamics in most European countries; this account may not be able to explain MFF differentiation in other societies. For instance, almost four decades following

WWII, until 1990, male TFRs were still higher than female TFRs in the United States and in Taiwan. So the relative sizes of male and female population affected by the two World Wars seems not to be the reason for non-identical patterns of MFF in non-European regions.

Another limitation lies in this group of studies is that most of the prior literature shows the variation in MFF correlation from a longitudinal point of view; the association between MFF patterns has rarely been examined cross-sectionally. Future research needs to investigate the MFF disparity from a cross-sectional viewpoint.

Lastly, although prior research calls research attention to building male fertility theories through revealing MFF differentiation in determinants, not many studies have systematically modeled the combined effects of demographic characteristics and socioeconomic variables on various indicators of MFF, such as CEB and TFR. Other important factors that have been found crucial to female fertility, such as cohabitation and age at first sexual intercourse, have not been applied to male fertility. Most importantly, most previous studies have not used statistical tests to verify whether differentials exhibited in MFF determinants are statistically significant. It is quite possible that the differences are indeed trivial; they become sizeable just because of the dissimilar sizes or standard errors of male and female samples. All these limitations suggest directions of future research.

Modeling Male Fertility and Constructing Two-Sex Models

In addition to the above three major topics discussed in the literature, modeling male fertility and constructing two-sex models is the last major concern of demographic studies of male fertility. As Pollak (1986: 400) states, the classical stable population theory is a "one-sex" theory: only the female matters. Age-specific fertility schedules and age-specific mortality schedules of females are the two building blocks of this theory. As a matter of fact, demographers have long been aware of the lack of males in demographic model construction. And efforts made to reconcile male and female rates in analyses of stable populations date back at least to the work of Karmel (1947). Following Karmel, demographers begin to introduce male paternity and mortality schedules into the classic models (Coale 1972; Kuhn 1978). They also emphasize the importance of including age composition of men and women, reflecting gender interaction in childbearing and the marriage market. The effects of gender interactions on childbearing and marriage are referred to as birth function and marriage function, respectively (Das Gupta 1973; Das Gupta 1978; McFarland 1975; Mitra 1976; Mitra 1978; Schoen 1977; Schoen 1981).

Above and beyond incorporating males in conventional demographic models, researchers have also tried to build male fertility models by applying female fertility models to their male counterparts. Using the *United Nations Demographic Yearbook*, Paget and Timaeus (1994) investigate male fertility patterns and propose a male fertility standard. They conclude that the two-step transformation of Booth's female standard can be used to represent male fertility patterns in high fertility countries. Nonetheless, the two-parameter relational Gompertz fertility model that is based on this standard can represent male fertility distributions in a variety of countries.

Aiming to solve the two-sex problem, this body of work has made several contributions to demographic modeling. As Gupta (1978) argues, the two-sex models obtain a single rate of intrinsic growth, which reconciles the male-female conflict in the stable population theory of Lotka (1911). Lotka's theory only deals with one sex, and if the theory is applied to male and female populations separately, it leads to two different intrinsic growth rates for the two sexes. The two-sex models, in contrast, remove this limitation in Lotka's stable-population theory by giving the same intrinsic growth rate for both sexes and generating intrinsic age-specific fertility rates and intrinsic net reproduction rates for males and females. These rates are consistent and can operate simultaneously on a population.

Second, the birth function and marriage function presented by these two-sex models highlight the importance of population age-sex structure and gender interaction when studying fertility. The two-sex models seek to find a mathematical expression that depicts how men and women interact with respect to their relative ages. The birth function in these models "reflects the age pattern of the male-female interaction as of the base year" (Gupta 1978: 368). And the marriage function considers male-female age pattern and timing, and in addition, male and female nuptiality-mortality life table in determining fertility (Gupta 1978; McFarland 1975; Schoen 1977). In other words, these models stress gender interactions as an essential component of demographic modeling. Further, Paget and Timaeus (1994) apply female fertility models to male fertility in different age groups. This approach provides a potential approach of modeling male fertility.

The drawback of these studies is that they mainly concentrate on reconciling the inconsistency of male and female fertility rates by incorporating males into demographic models. The birth and marriage functions of male-female interaction also only consider age and sex effects on fertility. Until now, very little work has been done on modeling the influence of other male-female combined factors on fertility. These factors include the demographic composition, such as men and women's race and ethnicity; socioeconomic factors, for instance, husbands and wives' educational attainments and income. In future analyses, modeling male-female combined characteristics beyond age and gender on fertility should broaden the focus of two-sex stable populations or two-sex marriage models.

On the whole, prior demographic studies of male fertility have focused on studying the validity of male data, men's role in fertility decision-making, the MFF differentiation and two-sex demographic modeling. The merits and shortcomings of these studies have been discussed above. In this dissertation, I will not attempt to improve all these trends and aspects of male fertility studies. I will only concentrate on expanding the understanding of MFF differentials in rates and in determinants and fill the gaps that have been discussed in these fields. Results based on the analysis will hopefully help me to achieve my main goal of highlighting the importance of bringing men into fertility studies.

Cross-sectional analyses of MFF rates at the country level in Chapter III will fill the gap of little cross sectional analyses of MFF rates. Studying MFF changes in Taiwan between the late 1940s until 2002, Chapter IV will shed light on MFF differentials in non-European countries and the efficiency of existing fertility theories when applied to male fertility. Examining the manner in which demographic and socioeconomic characteristics as well as other factors influence MFF at the individual level is the focus of Chapter V through Chapter VII. These chapters attempt to expand the understanding of male fertility determinants and test whether MFF differentials exhibited in determinants are significant.

The next chapter will proceed to an examination of fertility rates for males and females in world counties using data from the *United Nations Demographic Yearbooks*. I will show varying patterns of MFF during 1990 to 1998 among countries. Thereby, illuminate how MFF differ in rates and how such differentiation is affected by the age composition of population.

CHAPTER III

MALE AND FEMALE FERTILITY IN 43 COUNTRIES AND PLACES, 1990-98

This chapter examines male and female fertility (MFF) empirically at the country level. As discussed in previous chapters, many studies have been undertaken during the past on modeling and describing female fertility. In contrast to the attention paid to female fertility, little work has been done analyzing male fertility. Part of the reason for this downplay of men in fertility is that data on male fertility are relatively difficult to obtain. Both birth registration data and surveys are usually tabulated according to the age of mothers rather than fathers. And it is "particularly difficult to locate data of an acceptable quality, especially for high-fertility countries" (Paget and Timaeus 1994: 335).

The *United Nations Demographic Yearbooks* have compiled birth data for countries of the world since 1948. In some special editions, the *Yearbooks* have also included male fertility information. Such information is gathered by sending out a set of questionnaires by the United Nations annually and monthly to national statistical services and other appropriate government offices in world countries. "Data forwarded on these questionnaires are supplemented, to the extent possible, by data taken from official national publications and by correspondence with the national statistical services" (United Nations 2001: Genral Remarks, Pp. 3). One problem with the male fertility data collection in this process is that the age of father may not always be reported. This is especially common in most countries for illegitimate births. Even with this weakness, the *Yearbooks* provide a valuable source for evaluating male fertility. This chapter will use data representing live-birth rates specific for age of mother and father presented by the 2001 *United Nations Demographic Yearbook* to conduct the comparative analyses. Data used in this chapter are based upon records of all births, both legitimate and illegitimate.

I begin by comparing male and female total fertility rates (TFRs) during 1990 to 1998 in 43 countries and places. I next analyze the age-specific patterns of MFF in these regions by breaking down the 43 counties and places into high and low fertility nations. Doing this allows me to be able to explore the age effect on MFF in countries and places with different levels of fertility. Finally, I conclude findings according to the results of country level analyses.

Male and Female TFRs in 43 Countries and Places

The *United Nations Demographic Yearbook 2001- Special Topic: Natality Statistics* provides information on live-birth rates specific for age of mother and father from 1990 to 1998 (Tables 7 and 9). Such an age-specific fertility rate (ASFR) is generated by relying on the reports of live births by age of mother and father during 1990 to 1998 (Tables 6 and 8). The numerator for calculating the ASFR is the number of births by mothers or by fathers and the denominator is the number of females or males in the population. For the purpose of comparison, this chapter only includes 43 (out of 229) countries and places that contain both male and female ASFRs. For the countries and places with more than one year of fertility data available during the 1990 to 1998 period, fertility rates representing the most recent year are chosen.

The TFR, which is generated by ASFRs, is used as the first measurement examining MFF patterns. The calculation of the TFR for females is well-known, namely, the summing of a schedule of age-specific (5-year) fertility rates (ASFRs), and then multiplying of the sum by five, the width of the age interval of the ASFRs. For females, seven ASFRs (15-19, 20-24, … 40-44, 45-49) are used in the calculation. That is:

$$\text{TFR} = \sum_{x=15}^{49} ASFR$$

In this study, births to mothers under age 15 or over 50 are included in the ASFRs for 15-19 and 45-49, respectively. Male TFRs are calculated in the same way, but because both male fecundity and fertility extend beyond age 49, nine ASFRs (15-19, 20-24, … 50-54, 55-59) are employed. Births to fathers under age 15 or over 60 are included in the ASFRs for 15-19 and 55-59, respectively.

Table 3-1 shows the names of the 43 countries and places, along with their corresponding male and female TFRs during 1990 to 1998 and the specific years chosen for the analyses. Females have a mean TFR value across the 43 countries and places of 1,958 with a standard deviation of 723.5. It varies from a high of 3,914 in Mexico to a low of 871.5 in Hong Kong. Males have an average TFR value among the 43 countries and places of 2,008 with a standard deviation of 889.4. The highest male TFR is 4,705 in Mexico and the lowest is 867.5 in Hong Kong. The average male TFR in the 43 countries and places is only slightly higher than the average female TFR by a difference of 49 births per 1,000 persons. And the two countries and places with the highest, and the lowest, TFR values for females and males are the same, namely, Mexico and Hong Kong. The correlation between the male and female TFRs is 0.96, which is very high and statistically significant. Such a finding suggests that at the country level, MFF rates tend to be more similar than dissimilar, at least for the countries examined by this chapter. However, there is more variability in male TFRs than in female TFRs, as evidenced by their respective standard deviations and coefficients of relative variation (CRV) of 0.44 and 0.37 (CRV is the standard deviation divided by the mean). This indicates a larger variance in male fertility than in female fertility in human societies.

Table 3-1. Male and Female TFRs in 43 Selected Countries and Places, 1990-98

Country	Abbreviation	Male TFR	Female TFR	Selected Year
Australia	AUS	1835.5	1855.0	94
Bahamas	BAH	2277.0	1954.0	92
Bahrain	BRN	1953.5	2783.0	97
Bosnia and Herzegovina	BIH	1624.0	1744.5	91
Bulgaria	BUL	1064.5	1093.0	97
Canada	CAN	1458.0	1551.5	97
Chile	CHI	2163.5	2146.5	98
China-Hong Kong	HKG	867.5	871.5	98
China-Macao	MAC	1311.5	1037.0	98
Croatia	CRO	1605.5	1683.0	97
Cuba	CUB	1409.5	1439.5	96
Cyprus	CYP	1839.5	1918.5	98
Denmark	DEN	1672.0	1759.0	96
Egypt	EGY	4205.5	3742.5	95
EI Salvador	ESA	3692.5	2937.5	98
Estonia	EST	1184.0	1240.0	97
Greenland	GRN	1755.0	2369.0	98
Hungary	HUN	1318.5	1335.0	98
Iceland	ISL	2015.5	2040.0	97
Israel	ISR	3154.0	2933.0	97
Italy	ITA	1202.0	1191.5	95
Kyrgyzstan	KGZ	3023.5	2827.0	98
Latvia	LAT	1055.5	1111.0	97
Lithuania	LTU	1302.5	1363.5	98
Mauritius	MRI	2027.0	2036.0	97
Mexico	MEX	4705.0	3913.5	90

Table 3-1 Continued

Country	Abbreviation	Male TFR	Female TFR	Selected Year
Norway	NOR	1855.5	1923.0	91
Panama	PAN	3173.0	2910.5	97
Philippines	PHI	3708.0	3259.0	91
Poland	POL	1490.5	1507.0	97
Portugal	POR	1507.0	1465.0	97
Puerto Rico	PUR	2071.0	1913.0	98
Romania	ROM	1349.0	1332.0	98
Singapore	SIN	1645.0	1706.5	97
Slovenia	SLO	1061.0	1233.5	98
Spain	ESP	1191.5	1186.0	97
The Former Yougoslav Rep. of Macedonia	MKD	1896.0	1926.5	97
Trinidad and Tobago	TRI	1809.0	1718.0	97
Tunisia	TUN	3111.0	2614.0	95
United States	USA	1914.5	2032.5	97
Uruguay	URU	2332.0	2464.5	96
Venezuela	VEN	2812.5	2248.0	96
Yugoslavia	YUG	1843.0	1896.0	95

Sources: The 2001 *United Nations Demographic Yearbook*, Tables 7&9.
Note: the female TFR for Australia is adjusted according to the U.S. Census Bureau International Data Sheet due to the extremely high level of the female fertility rate reported by the *Demographic Yearbook*.

Figure 3-1 shows a scatterplot of male and female TFRs for these 43 countries and places, using the data in Table 3-1. The countries and places in this figure are identified by abbreviated versions of their names (see Table 3-1 for the abbreviations). The unity line inside the figure is not a regression line, which indeed indicates that geographic areas above this unity line have higher female than male TFRs; an the opposite occurs for countries and places below the line.

The general pattern shown by Figure 3-1 is consistent with the descriptive results discussed earlier. That is, male and female TFRs in most nations studied are comparable, considering that most of the countries are either close to or fall on the unity line. Another observation drawn from Figure 3-1, but not shown by the descriptive analyses, is that male and female TFRs are closer in value in countries and places that have both male and female TFRs lower than 2,200.

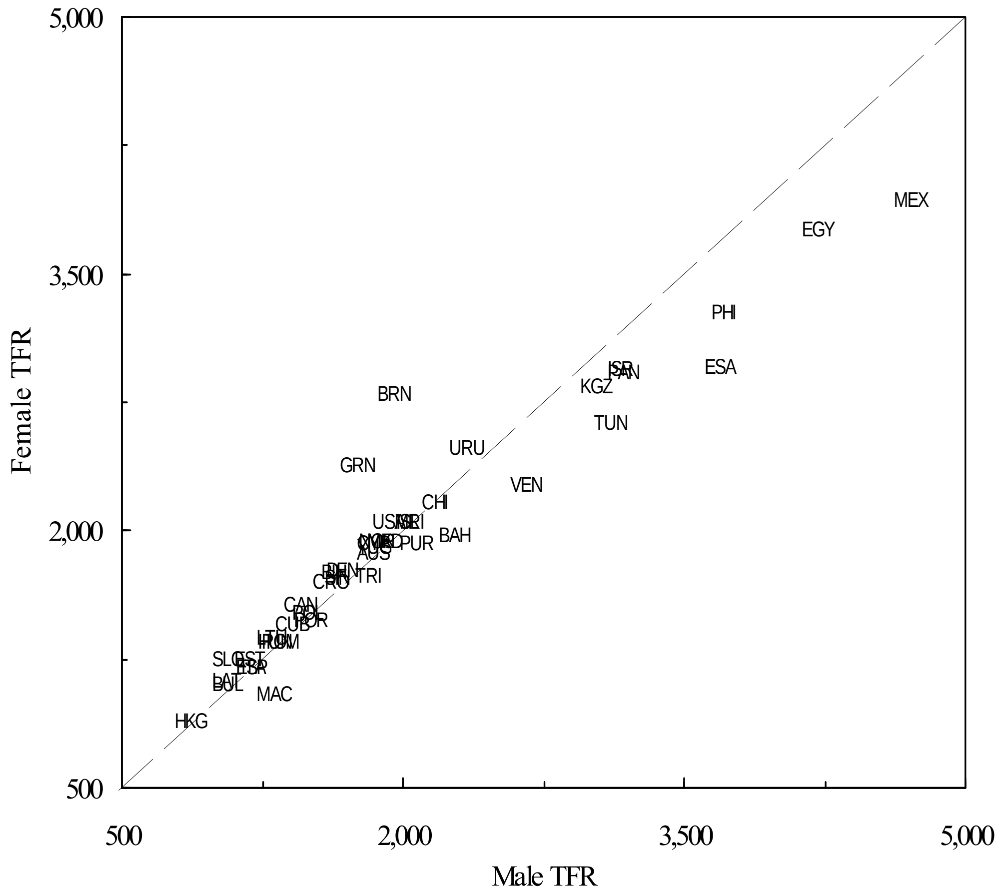


Figure 3-1. Male and Female TFRs: 43 Countries and Places, 1990-98

When the ratio of male to female TFRs (R_{TFRs}) is used to measure the relationship of MFF, the majority of R_{TFRs} values in these low fertility countries are lower than 1.0, meaning female TFRs are higher than male TFRs. The calculation of R_{TFR} follows the following formula:

$$R_{TFR} = \frac{MaleTFR}{FemaleTFR}$$

Here a R_{TFR} value of 1.0 represents male and female TFRs are identical. A R_{TFR} value above 1.0 means that male TFR is higher than female TFR, with the opposite for a R_{TFR} value below 1.0.

With male and female TFRs above 2,200, the differences between male and female TFRs also increase, given that in Figure 3-1the countries with high fertility are away from the unity line. In fact, for those high fertility countries, the majority of them have R_{TFRs} values above 1.0, indicating male fertility rates tend to be higher than those for females. Examples of these fertility countries are, Bahrain (male 1,954 and female 2,783), El Salvador (male 3,695 and female 2,938) and Mexico (male 4,705 and female 3,914). They have male and female TFR differences in rates of 829.5, 791.5 and 755.0, respectively.

To further demonstrate the dissimilar, rather than similar, patterns of male and female total fertility in high fertility countries and places (TFRs > 2,200), Figure 3-2 plots the residuals from a regression equation with the values of male TFRs that are predicted by female TFRs. In this figure, countries and places below the line have predicted values of male fertility larger than their actual values, with the opposite for the countries and places above the line. Figure 3-2 suggests that knowledge of female fertility predicts male fertility well for a majority of the countries and places. It does especially well for countries and places with low male and female TFRs (TFRs < 2,200), such as Canada (CAN), Australia (AUS) and Singapore (SIN). In these regions, errors predicting male TFRs with female TFRs are small. With the increase of the predicted male TFRs above 2,200, the errors also increase dramatically. For instance, Tunisia (TUN) has an actual male TFR of 3,111, but a predicted value of 2,779, an under-prediction of 332 births. Venezuela (VEN) has an actual male TFR of 2,654, but a predicted value of 2,348, an under-prediction of 306 births. At the other extremes, Bahrain (BRN) has an actual male TFR of 1,953, but a predicted male TFR of 2978, or an over-prediction of 1,025 births. Greenland (GRN) has an actual male TFR of 1,755, but a predicted value of 2,491, for an over-prediction of 736 births.

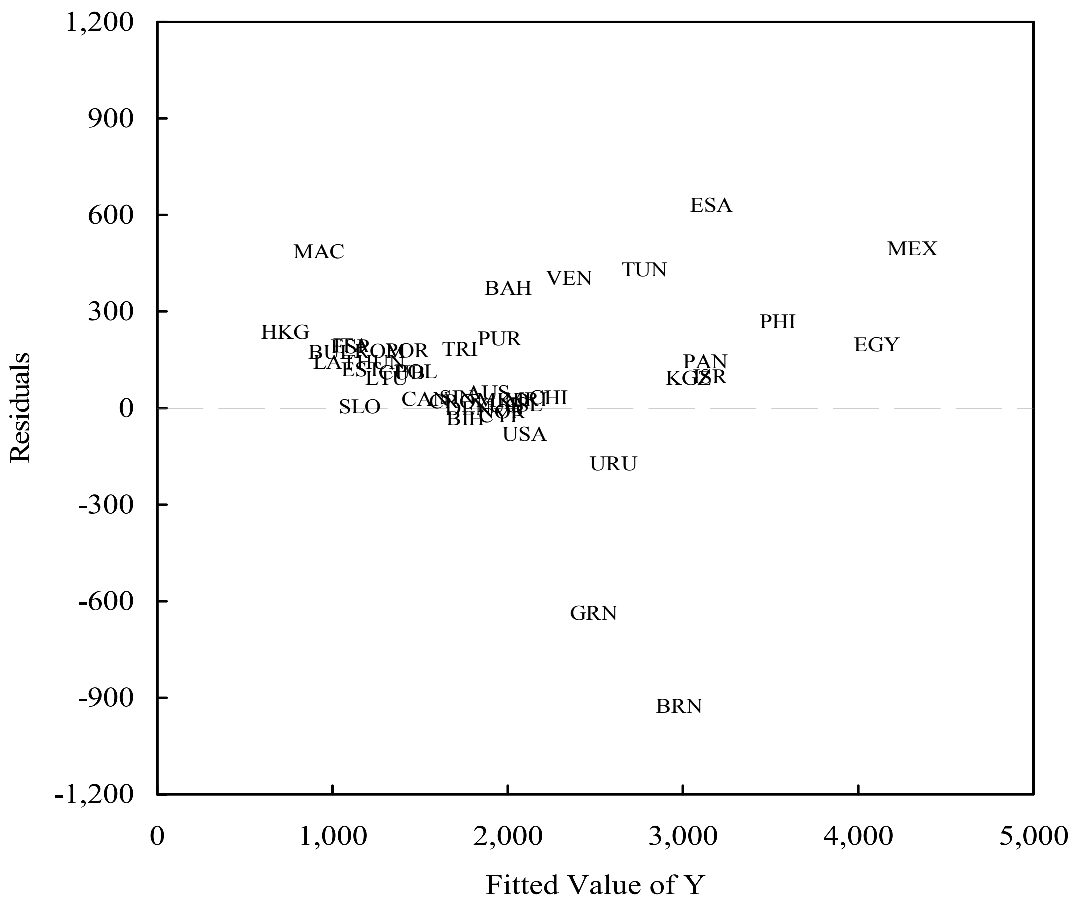


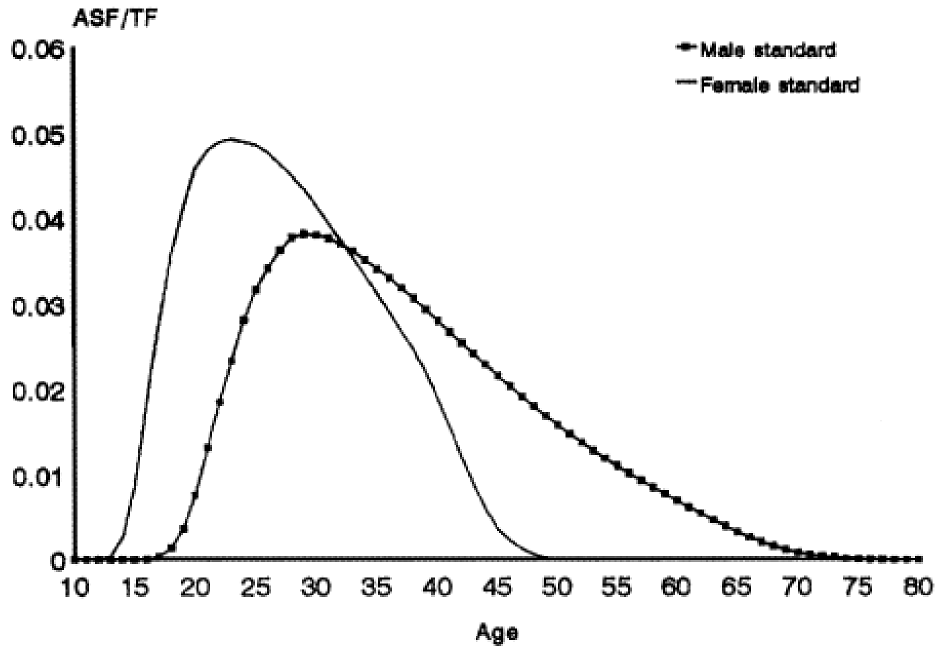
Figure 3-2. Residuals vs. Fitted Values of Y: 43 Countries and Places, 1990-98

The above findings imply that cross-sectionally, under the general pattern of similar male and female TFRs, MFF differences in rates mainly occur in higher fertility (TFRs > 2,200) regions. And those places usually have higher male than female fertility rates. For geographic areas with male and female TFR values below 2,200, MFF rates tend to be comparable, with male fertility slightly lower than female fertility ($R_{TFR} < 1.0$). Thus, a TFR value of 2,200 for the study period of 1990 to 1998 seems to be a critical value distinguishing similar or dissimilar patterns of male and female total fertility among countries. Since the TFR is generated from the ASFRs, the next section of this chapter moves to analyzing the age-specific patterns of fertility for males and females, delving more into the age effects shaping the MFF relationships.

Male and Female ASFRs in 43 Countries and Places

Among the studies of age effect on MFF, Paget and Timaeus's (1994) research is especially informative. They have used the Gompertz model to demonstrate effectively the age-specific patterns of MFF. Relying on the fertility schedules of 17 countries reported by the United Nations' *Demographic Yearbooks*, they have described male fertility as starting later, having a lower peak and stopping much later compared to female fertility. Such a pattern is demonstrated in Figure 3-3 which was constructed by Paget and Timaeus (1994).

Since Paget and Timaeus's (1994) study combines four polygynous populations, eight high fertility populations, and five medium fertility populations into the analyses, it hardly shows whether the age-specific patterns of MFF are identical in countries with dissimilar male and female total fertility rates. In addition, Paget and Timaeus's (1994)



Source: Figure 1 in Paget and Timaeus's (1994) study, Pp.337.

Figure 3-3. Male and Female Standard Fertility Distribution

study results are based on examining fertility patterns of world countries during 1959 to 1980 when fertility rates were generally high. Thus, their study is not able to capture the features of male and female age-specific fertility in low fertility nations. In order to fill this void, this part of the chapter studies age-specific patterns of fertility for males and females during 1990 to 1998. I breaks down the 43 countries and places into high and low fertility regions to contrast the manner in which age affects male and female fertility in high and low fertility contexts. Since a TFR value of 2,200 tends to be a critical point that distinguishes patterns of male and female completed fertility at the country level, a TFR value of 2,200 is used to define high and low fertility countries in this part of the analyses. Among the 43 countries and places, nine of them that have both male and female TFR values above 2,200 are considered as high fertility countries and the rest, 34 of them, are defined as low fertility regions.

For the purpose of comparison, ASFRs for seven age groups (15-19, 20-24, … 40-44, 45-49) are examined in the analyses. Tables 3-2 and 3-3 show the descriptive analyses of male and female ASFRs for the seven age groups in high and low fertility countries, respectively. According to the **mean values** of male and female ASFRs presented in column 1, it is clear that female fertility rates surpass those of males for the younger age groups (15 to 19, 20 to 24, and 25 to 29). It is especially the case for the youngest age group, namely, 15 to 19. The average value of female ASFRs for this age group is about five times that of males in both high and low fertility countries. And the fertility gap between males and females decreases as age increases. Staring from age group 30 to 34, the opposite situation is true, i.e., the average value of the male ASFRs begins to get larger than that of females. For instance, the average ASFR for age group 30 to 34 is 167.9 for men and 127.3 for women in high fertility countries; and the corresponding values are 89.6 and 71.8 in low fertility countries. In fact, the gap between the mean values of male and female ASFRs tends to increase after age 34. And such a higher male than female fertility pattern continues until age group 45 to 49. For age group 45 to 49, the mean value of male ASFR in high fertility countries is 37.9, which is almost six times the average female ASFR. In low fertility countries, the ratio of average male to female ASFR is even higher (around ten) for the same age group. After age 49, female fertility stops while male fertility continues to later ages.

Table 3-2. Descriptive Analyses of Male and Female ASFRs in High Fertility Countries, 1990-98 (N=9)

	Mean		Std. Dev.		Min		Max	
	Male	Female	Male	Female	Male	Female	Male	Female
15-19	14.7	60.5	13.4	40.5	0.0	13.4	32.5	105.7
20-24	85.9	147.3	52.4	34.2	6.0	91.2	169.9	210.8
25-29	154.2	167.9	39.7	41.6	90.5	128.5	229.7	250
30-34	167.9	127.3	42.5	30.3	114	92.1	242.6	176.6
35-39	125.3	75.4	38.5	19.9	76.4	53.9	196.5	107.6
40-44	73.5	25.8	22.8	9.1	41	15.1	108.9	40.5
45-49	37.9	6.5	14.4	4.3	16.3	1.2	57.6	14.3

Source: see Table 3-1.

Table 3-3. Descriptive Analyses of Male and Female ASFRs in Low Fertility Countries, 1990-98 (N=34)

	Mean		Std. Dev.		Min		Max	
	Male	Female	Male	Female	Male	Female	Male	Female
15-19	5.7	29.1	5.9	18.1	0.4	5.3	29	73.8
20-24	48.3	89.4	24.3	33.1	10.8	25	99.8	161.5
25-29	93.3	100.7	30.1	23.4	31.7	56.5	188.5	140.3
30-34	89.6	71.8	26.2	25.4	42.3	22.4	156.9	133.2
35-39	52.4	31.7	18.9	17.9	18	7.3	92.1	104.4
40-44	22.4	7.1	12.2	7.4	6.4	1.6	68.0	45.9
45-49	8.6	0.8	8.6	1.9	2.0	0.1	51.7	10.9

Source: see Table 3-1.

Regarding the **standard deviations** of the male and female ASFRs, the general pattern shown in Tables 3-2 and 3-3 emphasizes that besides the younger age groups (15 to 19 and 20 to 24), there is more variation in male ASFRs compared to female ASFRs in each older age group. Nevertheless, female ASFRs tend to vary to a larger extent than those of males for age group 15 to 19 in all countries. This pattern is also shown in low fertility countries for age group 20 to 24, which is not shown in high fertility regions. These findings in general indicate a larger variance of male than female fertility. The **minimum and maximum values** of male and female ASFRs presented in Columns 3 and 4 in Tables 3-2 and 3-3 suggest a similar MFF pattern shown by the mean values of male and female ASFRs in Column 1. Age group 30 to 34 seems to be a threshold at which male fertility begins to be higher than female fertility in all countries studied (see Figure 3-4). This finding echoes the age-specific patterns presented by Paget and Timaeus (1994) in their study of MFF in world countries from the 1960s to the 1980s. It implies that male and female age-specific fertility differentials appear to keep the same trend over time even under a declining pattern of total fertility.

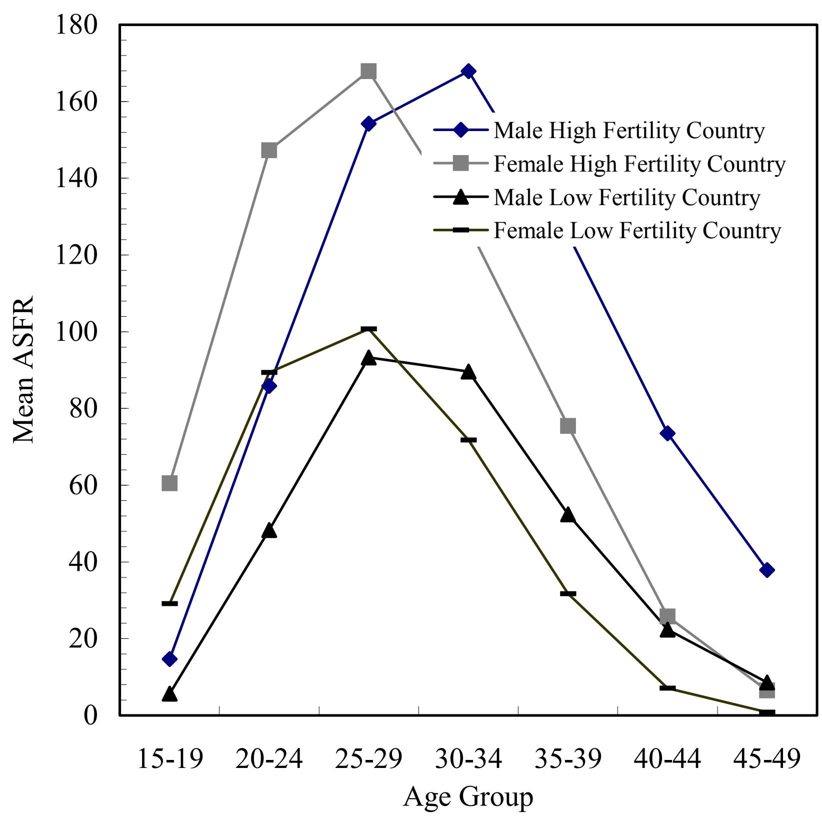


Figure 3-4. Mean Values of Male and Female ASFRs for High and Low Fertility Countries, 1990-98

Table 3-4 presents the descriptive analyses of the ratios of male and female ASFRs (R_{ASFRs}). The calculation of R_{ASFR} follows the following formula:

$$R_{TFR} = \frac{MaleASFR}{FemaleASFR}$$

It seems that the mean values of R_{ASFRs} for high and low fertility regions are similar before age group 40 to 44. Beginning at age group 40 to 44, the mean values of R_{ASFRs} in low fertility countries are significantly higher than those in high fertility countries. For age group 45 to 49, in particular, the mean value of R_{ASFR} is 24.2 in the 34 low fertility countries, which is three times that for high fertility nations. One may argue that the much higher mean value of R_{ASFR} in low fertility nations for this age group may be caused by the larger standard deviation of R_{ASFRs} which is influenced by the number of observed cases.

Table 3-4. Descriptive Analyses of Ratios of Male and Female ASFRs, 1990-98

	Mean		Std. Dev.		Min		Max	
	H	L	H	L	H	L	H	L
15-19	0.18	0.19	0.11	0.10	0.00	0.04	0.33	0.45
20-24	0.54	0.53	0.27	0.17	0.07	0.19	0.82	0.88
25-29	0.93	0.94	0.20	0.27	0.61	0.43	1.15	1.75
30-34	1.32	1.32	0.08	0.37	1.23	0.56	1.48	2.64
35-39	1.65	1.82	0.17	0.50	1.40	0.73	1.83	3.63
40-44	**2.93**	**3.65**	0.52	1.21	1.96	1.48	3.74	7.46
45-49	**8.17**	**24.19**	4.15	15.72	2.11	2.00	15.25	86.00
	N= 9	N=34						

Source: see Table 3-1.
Note: "H" indicates high fertility countries and "L" indicates low fertility countries.

To justify this argument, Figures 3-5 and 3-6 show R_{ASFRs} for seven age groups in high and low fertility regions, respectively. Apparently, the majority of R_{ASFRs} for age group 45 to 49 in low fertility regions range from 15 to 40. Whereas the values of R_{ASFRs} in high fertility regions are between 2.1 to 15.3, meaning that the R_{ASFR} for age group 45 to 49 in countries with TFR values below 2,200 is indeed higher than that in countries with TFRs above 2,200.

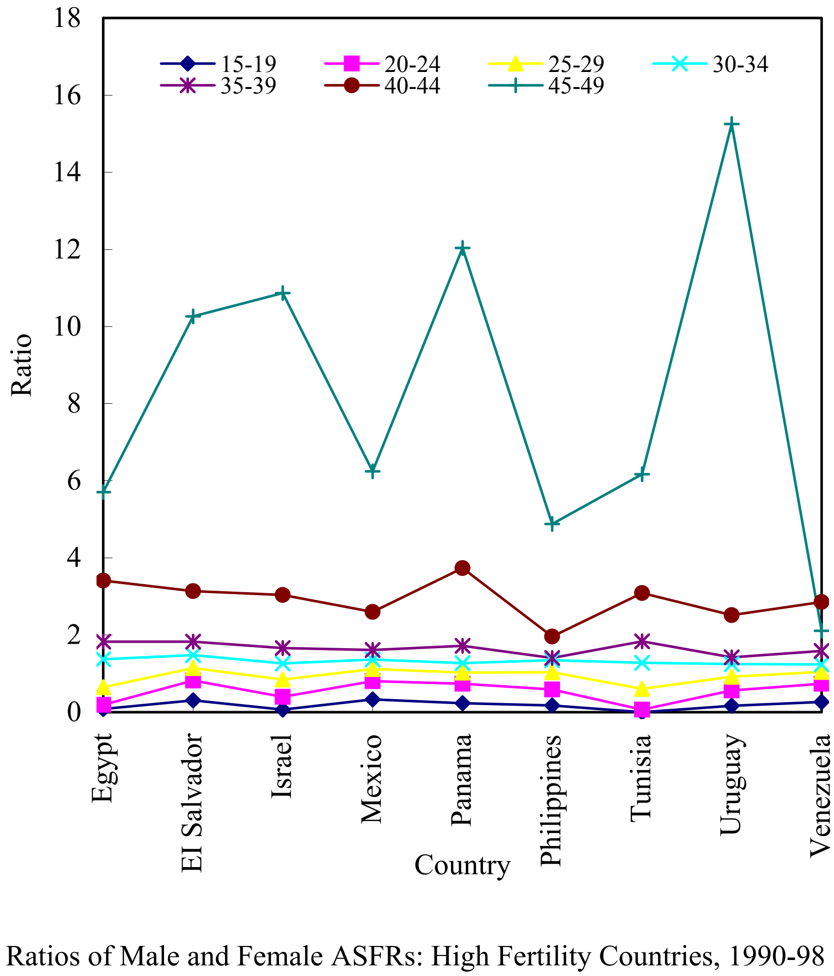


Figure 3-5. Ratios of Male and Female ASFRs: High Fertility Countries, 1990-98

This suggests that the differences between R_{ASFRs} in high and low fertility regions for older age groups (especially for age group 45 to 49) are not likely to be caused by their non-identical standard deviations. The R_{ASFRs} for age group 35 to 39 and younger show similar values, regardless of the levels of total fertility.

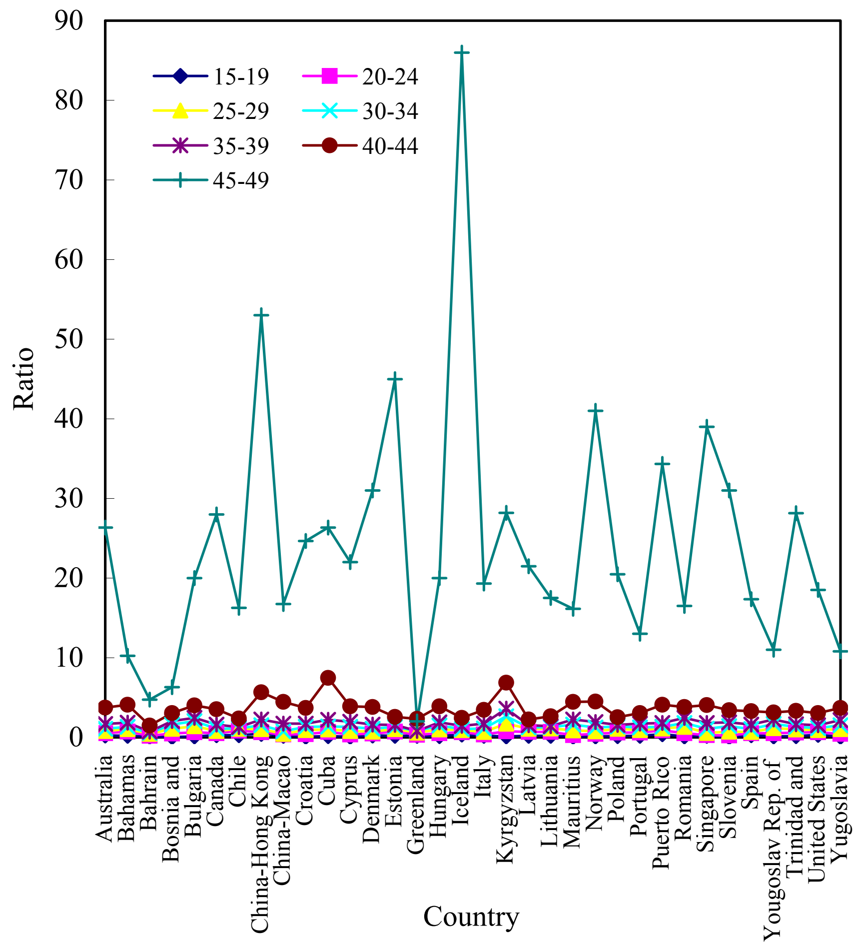


Figure 3-6. Ratios of Male and Female ASFRs: High Fertility Countries, 1990-98

In conclusion, male and female total fertility and age-specific fertility do not show identical patterns in the 43 countries and places studied in this chapter. In terms of total fertility, male and female TFRs tend to be similar in countries with TFR values lower than 2,200 where female fertility is slightly higher than male fertility. In countries and places with both male and female TFRs above 2,200, MFF tend to be more dissimilar rather than similar, and male fertility is higher than female fertility. Regarding age-specific fertility, this chapter shows that male and female age-specific fertility mainly differs among the older age groups, i.e., age groups 40 to 44 and 45 to 49. In those age groups, male fertility is higher than female fertility. And this pattern is especially apparent in low fertility countries (TFR<2,200). In the future, with the declining pattern of fertility, it is most likely that male and female total fertility will get closer. But under the low fertility regime, male fertility is able to distinguish itself from female fertility in the older age groups. The future trend of population aging in most developed nations that causes an increasing number of the population to fall into older age groups will make the study of male fertility in the older age groups far more important. It is also necessary to examine the interaction effects of age and other socioeconomic factors on MFF across age groups. The next chapter of the dissertation will study MFF in a specific region, namely, Taiwan. It will show the dynamics of MFF over time and across the 23 sub-regions of Taiwan in the year of 2002, followed by an examination of the combined effects of marriage and other socioeconomic factors on MFF.

CHAPTER IV

MALE AND FEMALE FERTILITY IN TAIWAN

The previous chapter examined the total fertility and the age-specific fertility patterns for males and females cross-sectionally among countries. In this chapter, I will analyze the dynamics of MFF in a particular region, namely, Taiwan, from both longitudinal and cross-sectional points of view. Using data from the 1964 to 2002 *Taiwan-Fukien Demographic Yearbooks* and the 2004 *National Statistics Reports* by Statistics Bureau of Republic of China, I will first examine the male and female TFRs in Taiwan from 1949 to 2004. I then move to study the age-specific patterns of fertility, followed by an analysis of male and female ASFRs by educational attainment. Finally, I will evaluate the variation of MFF in 23 sub-regions of Taiwan in 2002 and justify whether fertility theories based mainly on females can be used to explain male fertility change.

Male and Female TFRs in Taiwan, 1975 - 2004

The first part of the analysis focuses on examining the TFRs for males and females longitudinally from 1949 to 2004. The calculation of the female TFRs follows the following formula:

$$\text{TFR} = \sum_{x=15}^{49} ASFR$$

Where seven ASFRs (15-19, 20-24, … 40-44, 45-49) are used in the calculation. Since both male fecundity and fertility extend beyond age 49, the Ministry of the Interior of Taiwan applies eight ASFRs (15-19, 20-24, … 50-54) to male TFR calculation for years 1949 to 1974 and nine ASFRs (15-19, 20-24, … 55-59) for years 1975 to 2004. When generating both male and female TFRs, births to mothers under age 15 or over 50 are included in the ASFRs for 15-19 and 45-49, respectively, and births to fathers under age 15 or over 50/60 are included in the ASFRs for 15-19 and 50-54/55-59, respectively.

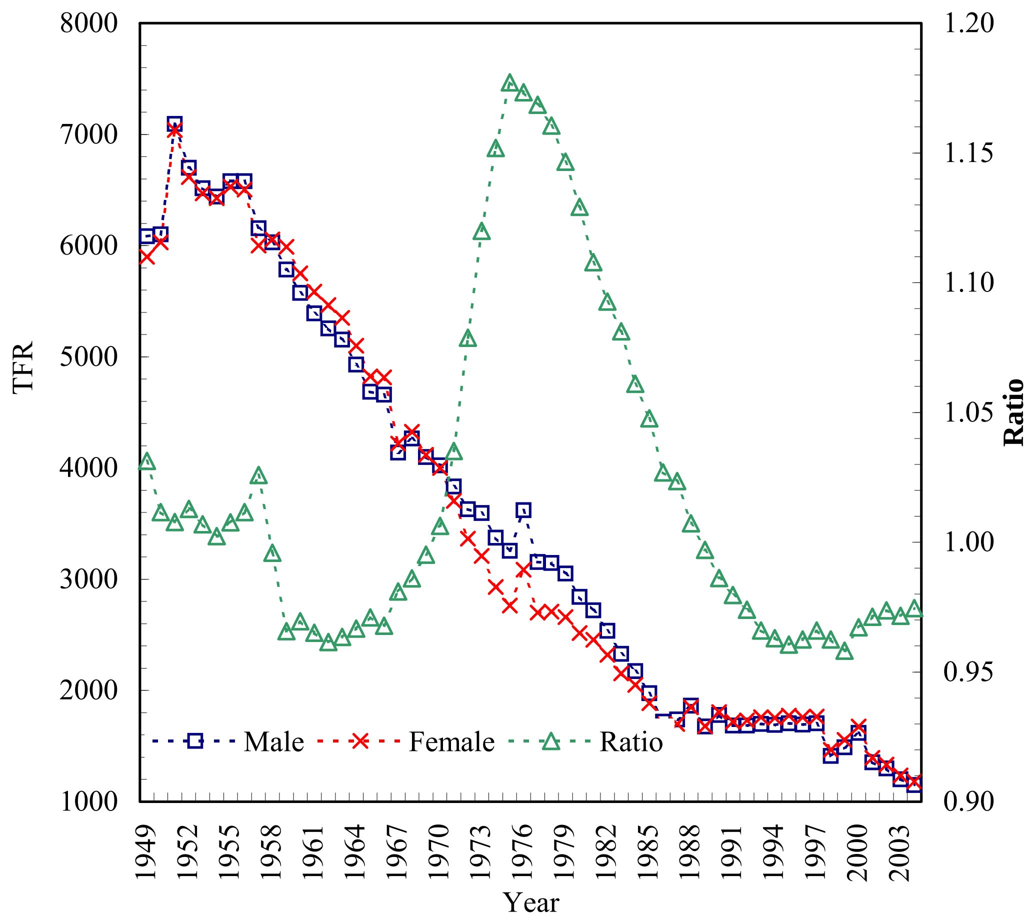


Figure 4-1. Male and Female TFRs: Taiwan, 1949-2004

Figure 4-1 charts male and female TFRs for Taiwan for each year from 1949 to 2004. In general, male and female TFRs are dropping dramatically with a little fluctuation. In year 1949, male and female TFRs were 6,085 and 5,900, respectively. They rose to 7,095 and 7,040 in 1951 and after that they began to drop with a few years showing a slightly increasing pattern of fertility. For example, in 1976, the male TFR increased from 3,255 of 1975 to 3,620; and the female TFR rose from 2,765 of the previous year to 3,085. Until year 2004, the male and female TFRs have dropped to 1,150 to 1,180, respectively. These figures may be interpreted as follows: a hypothetical (synthetic) cohort of 1,000 men ended up having 1,150 live births, as they passed through their 45 years of childbearing, they were subjected to the ASFRs of the Taiwanese men in 2004. Both female and female TFRs have dropped below the replacement level.

When male and female TFRs are compared, Figure 4-1 shows that during 1945 to 1958, male fertility was first higher than female fertility, considering the ratios of male and female TFRs, R_{TFRs}, were above 1.0. From 1959 to 1969, the R_{TFRs} began to be slightly lower than 1.0, meaning female fertility was higher than male. Years 1975 to 1988 are the years that had more births given by males compared to those given by their female counterparts. Since year 1989, the opposite situation becomes true, that is, females have been more productive than males. Also, an obvious opposite "U" shape can be observed according to Figure 4-1, suggesting a changing pattern of male and female fertility relationship. And it seems that the year 1975 is the threshold from when the R_{TFRs} dropped down.

When interpreting the changing patterns of male and female TFRs, one thing worth mentioning here is that for years 1949 to 1974, the *Demographic Yearbooks* did not include the unknown births by father or mother in the male and female TFR calculations. And since year 1975, "all the births to fathers [or mothers] whose ages are unknown are proportionately distributed among those to fathers [or mothers] of known age in calculating age-specific fertility rates" (Ministry of the Interior of Republic of China 2002: 22; Ministry of the Interior of Republic of China 2005). Thus, the TFR values for both Taiwanese men and women during years 1949 to 1974 are slightly lower than they should be in reality since the unknown births are excluded from the calculations. And this is especially the case for men. Also, the ratios of male and female TFRs (R_{TFRs}) for the same time period should be slightly lower since a larger amount of unknown births are excluded from the calculation of male TFRs compared to that of females. This is because men are more likely to underreport their live births compared to women. And this is particularly common among younger age groups and those unmarried. As Table 4-1 suggests, the maximum and minimum values of percent unknown births for men are 3.0 percent and 1.3 percent, respectively; and these corresponding values for women are only 0.37 percent and 0.01 percent, respectively. Table 4-1 also shows a declining pattern of percentage unknown births for both men and women over time. This means that male and female TFR values should be closer to the true rates since less unknown births are excluded in the TFRs for both genders. The gap between male and female TFRs could be possibly smaller due to the fact that less unknown births for males are excluded from the calculation compared to the previous years.

Table 4-1. Numbers of Total Births, Unknown Births and Percent of Unknown Births for Males and Females: Taiwan Area, 1949-74

		Male		Female	
Year	Total Births	Unknown Births	% Unknown Births	Unknown Births	% Unknown Births
1949	300,843	7,991	2.66	420	0.14
1950	323,643	8,458	2.61	487	0.15
1951	385,383	10,971	2.85	712	0.18
1952	372,905	11,138	2.99	776	0.21
1953	374,536	10,750	2.87	945	0.25
1954	383,574	10,589	2.76	889	0.23
1955	403,683	11,034	2.73	1,058	0.26
1956	414,036	12,361	2.99	1,052	0.25
1957	394,870	9,930	2.51	1,031	0.26
1958	410,885	10,364	2.52	1,246	0.30
1959	421,458	10,022	2.38	1,258	0.30
1960	421,458	8,590	2.04	1,396	0.33
1961	419,442	7,647	1.82	1,548	0.37
1962	420,254	7,301	1.74	1,458	0.35
1963	423,469	5,445	1.29	42	0.01
1964	416,926	5,649	1.35	35	0.01
1965	406,604	5,336	1.31	60	0.01
1966	415,108	6,232	1.50	92	0.02
1967	374,282	4,820	1.29	105	0.03
1968	394,260	5,151	1.31	46	0.01
1969	390,728	4,973	1.27	86	0.02
1970	394,015	5,202	1.32	84	0.02
1971	380,424	4,817	1.27	86	0.02
1972	365,749	4,860	1.33	141	0.04
1973	366,942	4,894	1.33	120	0.03
1974	367,823	4,788	1.30	100	0.03

Sources: 1976 *Taiwan-Fukien Demographic Yearbook* . Table 13.

One should also be aware that the male and female TFRs for years 1975 to 2004 may not represent the real male and female total fertility levels because the unknown births should not be proportionately distributed to each age group. For men, in particular, the younger age group may deserve to receive more of the unknown births since the unmarried young men are more likely to omit their births compared to the older married men. As a result, the ASFRs of the younger age groups tend to be smaller than their real values should be, with the opposite true for the older age groups.

Even with the flaws of the dataset, the dynamics of male and female total fertility may still be evaluated over time since the manner in which the male and female ASFRs or TFRs are generated is constant during the time periods 1949 to 1974, and 1975 to 2004. For the years of 1949 to 1957, the ratios of the male rate to the female rate, $R_{TFRs,}$ were all slightly above 1.0, meaning a higher level of male fertility. From years 1958 to 1969, female TFRs began to be higher than male TFRs. Starting from 1970 to 1988, the R_{TFRs} rose to above 1.0, indicating again a higher level of male fertility. Since 1989, the R_{TFRs} have fallen below 1.0 and fluctuated between the values of 0.96 and 0.99. Figure 4-1 charts a pattern of R_{TFRs} as first increasing till the year 1975 and then decreasing dramatically afterwards. The highest R_{TFR} value in 1975 was 1.18, meaning that in 1975 male fertility was 18 percent higher than female fertility. In 1975, there were 490 more births per 1,000 males than 1,000 females (the male and female TFRs were 3,255 and 2,765, respectively). The ratios then dropped year by year, reaching 1.0 in 1988 (both male and female TFRs were 1,885).

This means that by the late 1980s, Taiwan had joined most of the developed world with higher female fertility rates than male fertility rates. This important trend has largely gone unnoticed in the demographic literature because of the tendency of conventional demography to ignore males in fertility studies.

Male and Female ASFRs in Taiwan, 1949 – 2002

I now examine the age-specific fertility patterns for Taiwanese men and women. Figures 4-2 and 4-3 describe the ASFRs for males and females for each age group from 1949 to 2002, respectively. Some similarities are found in these two figures. Firstly and most apparently, both male and female age-specific fertility in Taiwan has been declining during the past 50 or so years.

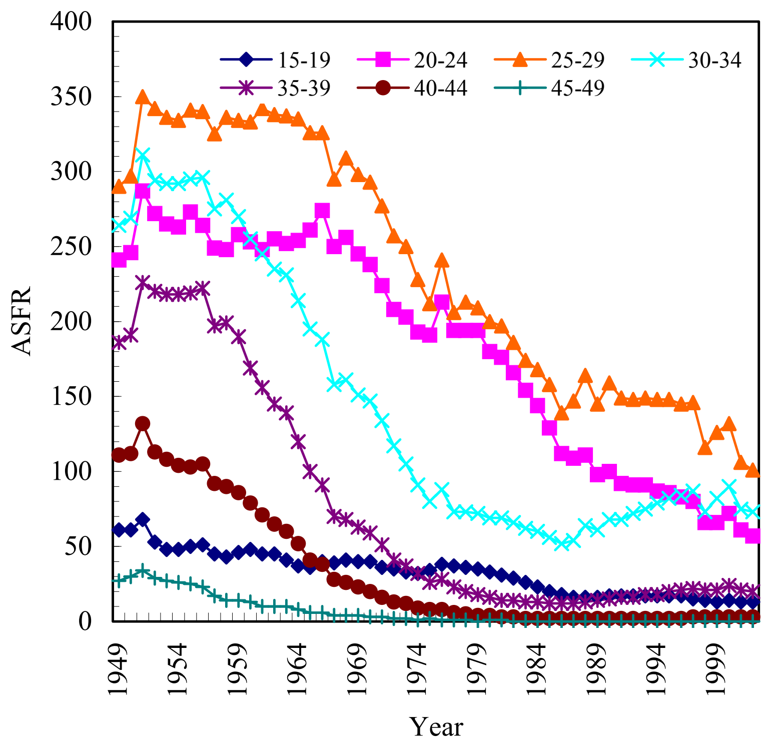


Figure 4-2. Female ASFRs: Taiwan, 1949-2002

Secondly, the age group 25 to 29 seems to be the one that has the highest level of fertility for both genders. For this age group, the highest ASFR for males was 306 in year 1951 and the lowest ASFR was 71 in 2002, with a mean value of 221.3. For females, the corresponding values ranged from 350 in 1951 and 101 in 2002, with an average value of 235.2.

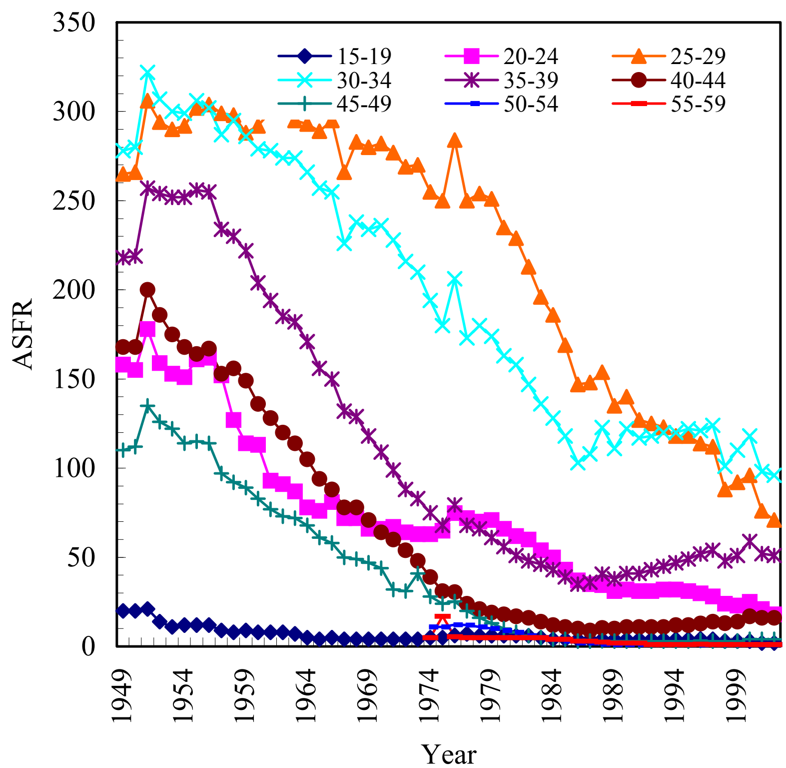


Figure 4-3. Male ASFRs: Taiwan, 1949-2002

Even with these similarities, the differences of male and female age-specific fertility are also striking. To illustrate, for males, the second highest ASFRs occur in age group 30 to 34 for most years, followed by age groups 35 to 39, 20 to 24, 45 to 49, 50 to

54 and 55 to 59. For females, age group 20 to 24 has the second highest ASFR values for most years, followed by age groups 30 to 34, 35 to 39, 15 to 19 and 45 to 49. However, male ASFRs for age group 30 to 34 and 25 to 29 had a crossover in 1994, and since then male ASFRs for age group 30 to 34 are the highest among all the age groups. For females, there was a crossover in year 1996 between ASFRs for 30 to 34 and 20 to 24. It indicates age group 30 to 34 is replacing that of 25 to 29 and becoming the age group with the fertility peak. The male and female age-specific fertility patterns described here suggest a picture of male fertility starting later, stopping much later, and remaining higher in the older ages compared to their female counterparts.

As far as the relationship of male and female ASFRs are concerned, ratios of male and female ASFRs, R_{ASFRs}, are presented in Figure 4-4. It is seen that the R_{ASFRs} for age group 45 to 49 is not a continuous line because the female ASFRs for certain years were zero. The R_{ASFRs} for age groups 15 to 19, 20 to 24, and 25 to 29 seem to maintain relatively constant levels during the years studied. The R_{ASFRs} for age groups 30 to 34 and 35 to 39 show more fluctuation compared to the younger age groups, with year 1978 and 1982 having the highest R_{ASFR} values of 2.47 and 3.64 for age groups 30 to 34 and 35 to 39, respectively. The male and female ASFR differentials are more obvious for age group 40 to 44, especially after year 1964. In year 1981, the male ASFR was seven times the female ASFR for the 40 to 44 age group. For age group 45 to 49, an even more dramatic increasing pattern of male and female age-specific fertility differentials is observed over time, with a maximum R_{ASFR} value of 28.0 in 1974. Thus, over time, the male and female age-specific fertility distinction is getting larger, particularly among the older age groups.

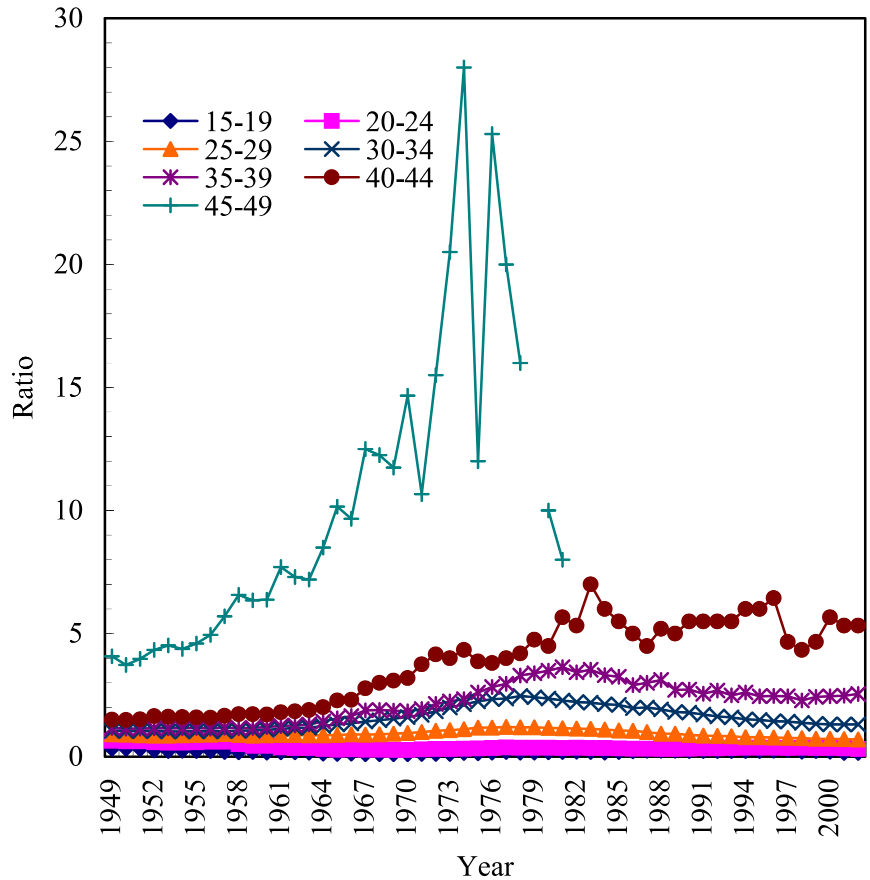


Figure 4-4. Ratios of Male and Female ASFRs: Taiwan, 1949-2002

Male and Female ASFRs by Educational Attainment, 1974-2002

This part of the analysis concentrates on examining the combined effects of age and educational attainment on MFF during 1974 to 2002 in Taiwan. Figures 4-5 through

4-11 describe the ratios of male and female ASFRs by educational attainment for seven age groups. The trend line representing university or college degree group in Figure 4-5 stops after the year 1997. This is because since that year the female ASFRs have were zero for this educational group. The trend line for the illiterate population stops at the same time as well due to the fact that the illiterate population began to disappear in Taiwan after 1997. Figure 4-5 shows that for age group 15 to 19, R_{ASFRs} for all educational groups are clustered based on the order of educational attainment. That is, the higher the educational attainment, the higher the values of R_{ASFRs} and the higher the male than female age-specific fertility. In fact, the mean values of R_{ASFRs} for the six groups with educational attainment from the highest, university or college graduates, to the lowest, illiterate, are 0.06, 0.19, 0.20, 0.25, 0.32 and 1.03, respectively. This means that on average, the illiterate males' ASFRs for age group 15 to 19 during the past 50 or so years is only 6 percent that of their female counterparts; however, the university or college graduates males have an average of ASFR 1.03 times of that of university or college graduates females. As indicated in the previous section, female age-specific fertility should be higher than that of males for age group 15 to 19 (see Figures 4-2 and 4-3). But after incorporating the effect of education into the picture of male and female age-specific fertility, there appears to be a stronger inhibitive effect of education on female fertility compared to on male fertility. It is also true that the R_{ASFRs} for university or college graduates group fluctuate more compared to those of the other educational groups over time, which reflects relatively unstable male and female fertility correlations among young and well educated Taiwanese population.

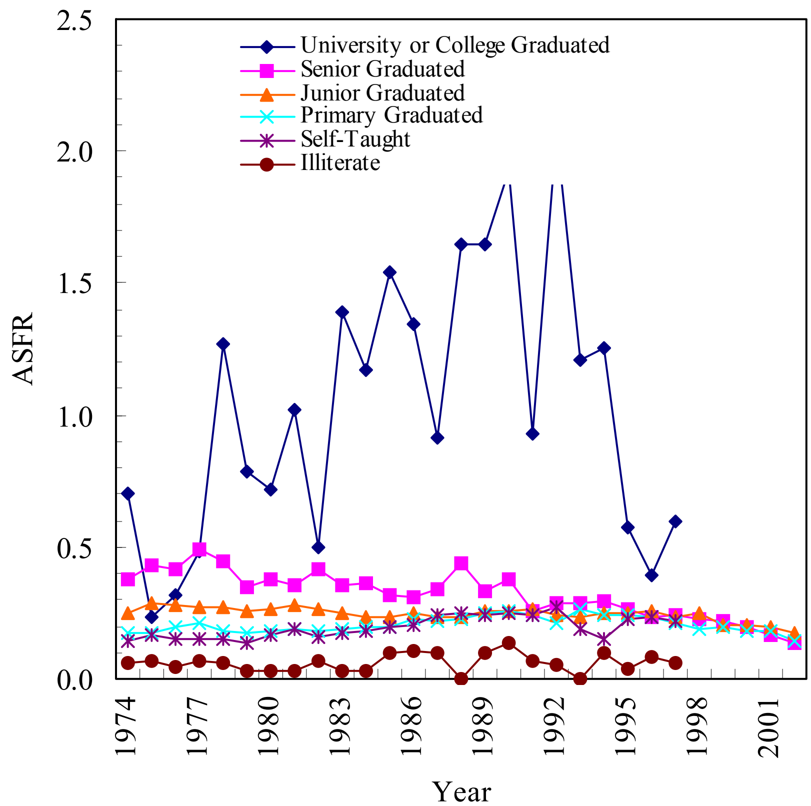


Figure 4-5. Ratios of Male and Female ASFRs by Educational Attainment for Age Group 15 to 19: Taiwan, 1974-2002

Regarding the fertility patterns for age group 20 to 24, male and female fertility ratios for the educational groups besides the illiterate group show a mixed pattern in Figure 4-6. The trend line connecting R_{ASFRs} of the illiterate group is different from those of the other educational groups. This means that for Taiwanese aged 20 to 24, education mainly plays a role in differentiating male and female fertility between the illiterate and literate groups. There does not seem to be a significant effect distinguishing male and female fertility patterns among the various groups of the literate population. In other words, compared to the educated population, illiterate females tend to have a much higher fertility rate than their male counterparts. By receiving education brings down the values of R_{ASFRs} and makes female fertility closer to that of males.

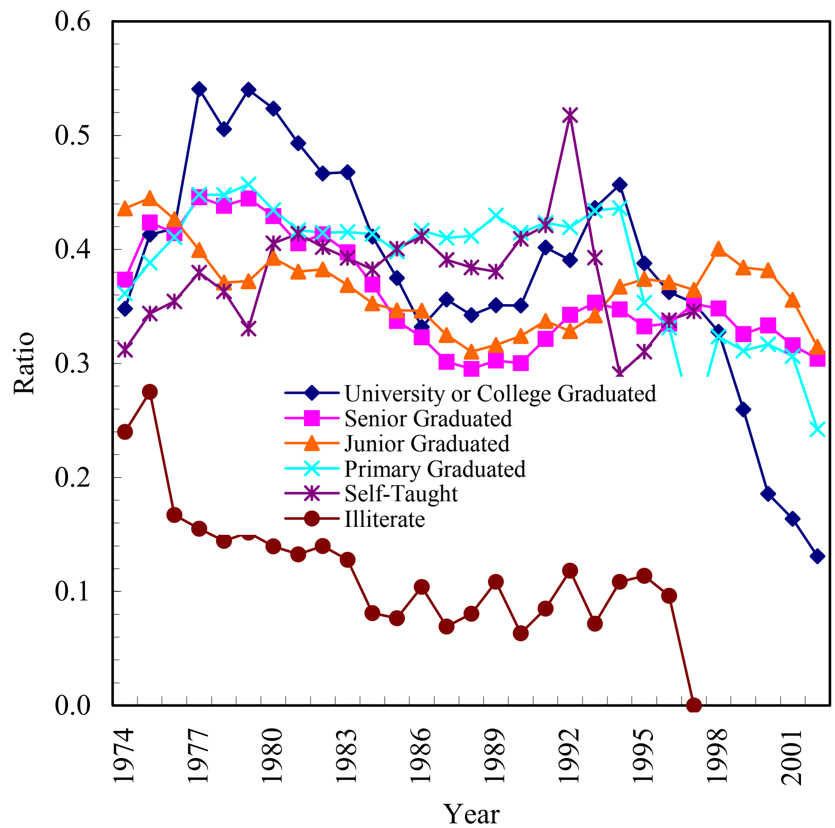


Figure 4-6. Ratios of Male and Female ASFRs by Educational Attainment for Age Group 20 to 24: Taiwan, 1974-2002

Figure 4-7 charts R_{ASFRs} changes of the six educational groups for age group 25 to 29. For this age group, the trend line connecting the R_{ASFRs} for illiterate population reaches the trend lines representing the R_{ASFRs} of the other educational groups.

Meanwhile, the trend lines representing the other educational groups become more spread out, compared to those shown in Figure 4-6. These results more clearly present the manner in which educational attainment impacts male and female ASFRs. That is, the distinction between illiterate and literate groups still exists because the R_{ASFRs} for the illiterate population continue to be lower than those of the literate groups. Once again, this represents a stronger negative effect of education on female than on male fertility among uneducated people compared to their educated counterparts. Most importantly, one is able to see the differentiation of male and female age-specific fertility patterns by education among the literate population. For the majority of the years, the R_{ASFRs} values for the self-taught group rank the highest among all the literate educational groups, followed by those of the primary graduates, junior graduates, senior graduates and university or college graduates. Such a pattern is opposite to that presented in Figure 4-5 for age group 15 to 19. It means that for literate Taiwanese aged 25 to 29, the lower the educational attainment, the higher the R_{ASFRs} values, and thus the higher male than female fertility. For instance, the average R_{ASFRs} values for university or college graduates is 0.79 while the mean R_{ASFRs} values for the self-taught group is 1.2. One possible explanation is that educational attainment is more likely to be a preventive factor for literate males than for females in terms of childbearing for this age group.

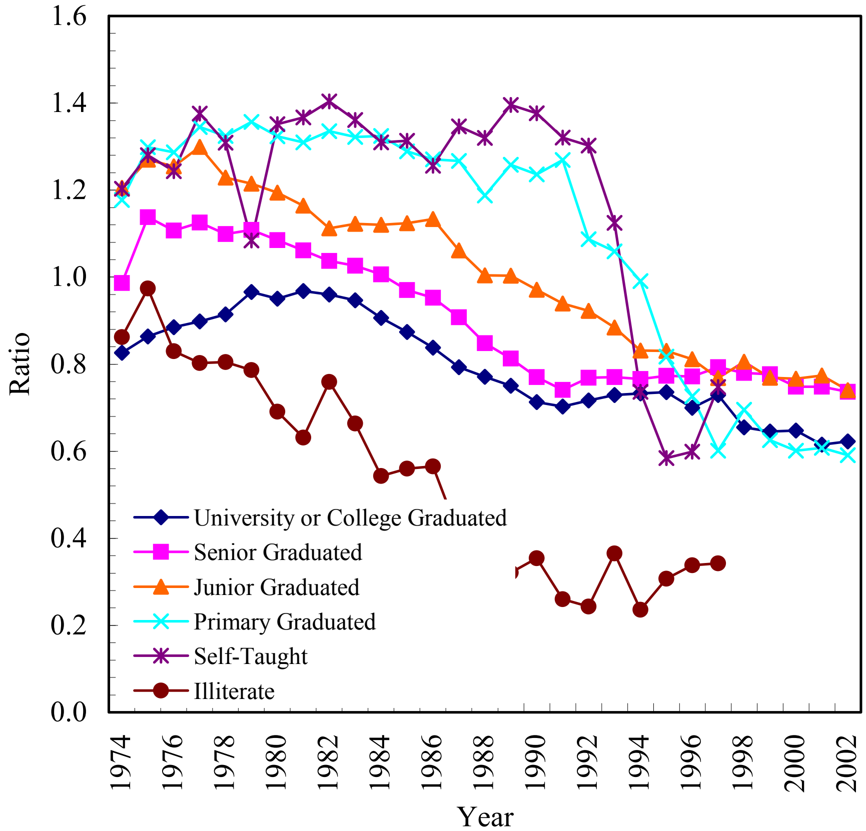


Figure 4-7. Ratios of Male and Female ASFRs by Educational Attainments for Age Group 25 to 29: Taiwan, 1974-2002

Recall the findings from the second part of this chapter: during 1971 to 1987, the male ASFRs for age group 25 to 29 were higher than the female ASFRs in Taiwan. This may due to the higher male than female fertility in four of six educational groups. Since the year 1998, the illiterate and self-taught population has diminished in Taiwan. The differential ASFRs among the educational groups have become less apparent, and R_{ASFRs}

values for all existing educational groups have dropped below 1.0. Since then, Taiwan has become a low fertility country and begun to have male ASFRs lower than female ASFRs for 25 to 29 age group.

In general, MFF for age group 30 to 34 shown in Figure 4-8 demonstrates a similar pattern as that for age group 25 to 29, except for the trend line for the illiterate group. It is closer to that for the other educational groups. Before the year 1987, the R_{ASFRs} for the illiterate population rank above those for the junior graduates, senior graduates and university or college graduates. This means that the distinction that education has between the illiterate and literate groups for age group 25 to 29 is not present for age group 30 to 34. It is indeed more likely that the R_{ASFRs} for the less educated groups (self-taught, primary graduates and illiterate) are higher than those for the better educated groups. Thus, the less educated groups tend to have much higher male than female fertility. After the year 1987, the differentials between the literate and illiterate groups are apparent again in terms of the effect of education on differentiating MFF, with the R_{ASFRs} for illiterate group below 1.0. After the late 1990s, the effect of education on MFF fertility patterns seems to be unclear.

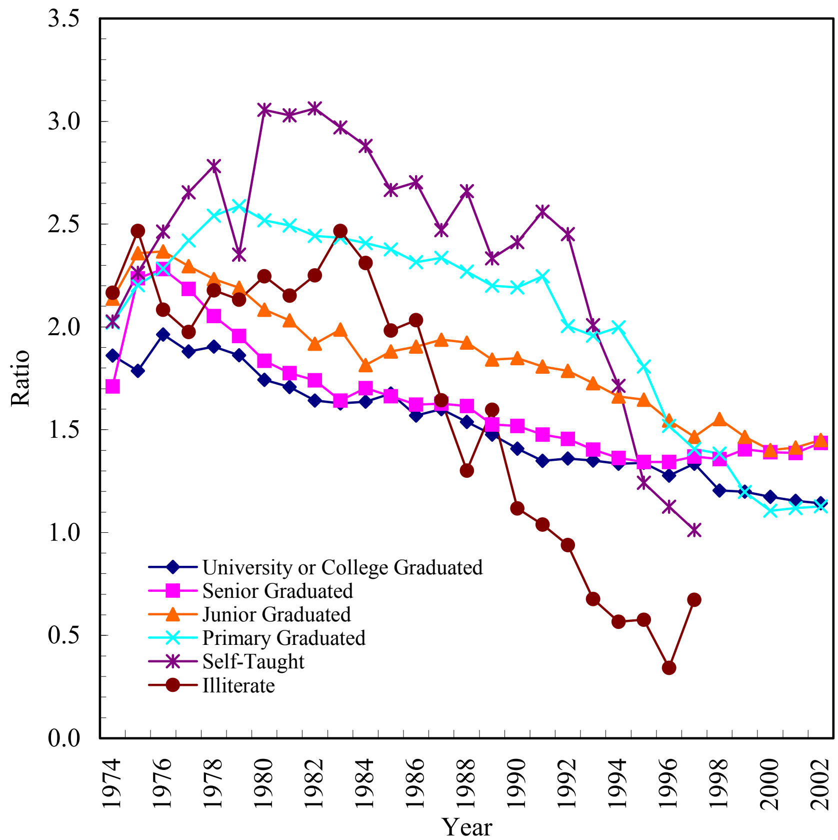


Figure 4-8. Ratios of Male and Female ASFRs by Educational Attainment for Age Group 30 to 34: Taiwan, 1974-2002

The age-specific fertility for age group 35 to 39 is presented in Figure 4-9. Basically, before the early 1990s, male fertility tends to be much higher than female fertility among the less educated groups compared to the better educated groups. An opposite "U" shape for self-taught and illiterate groups is observed with a peak of R_{ASFRs} occurring in the 1980s. Even after the year 1998 when the self-taught and illiterate

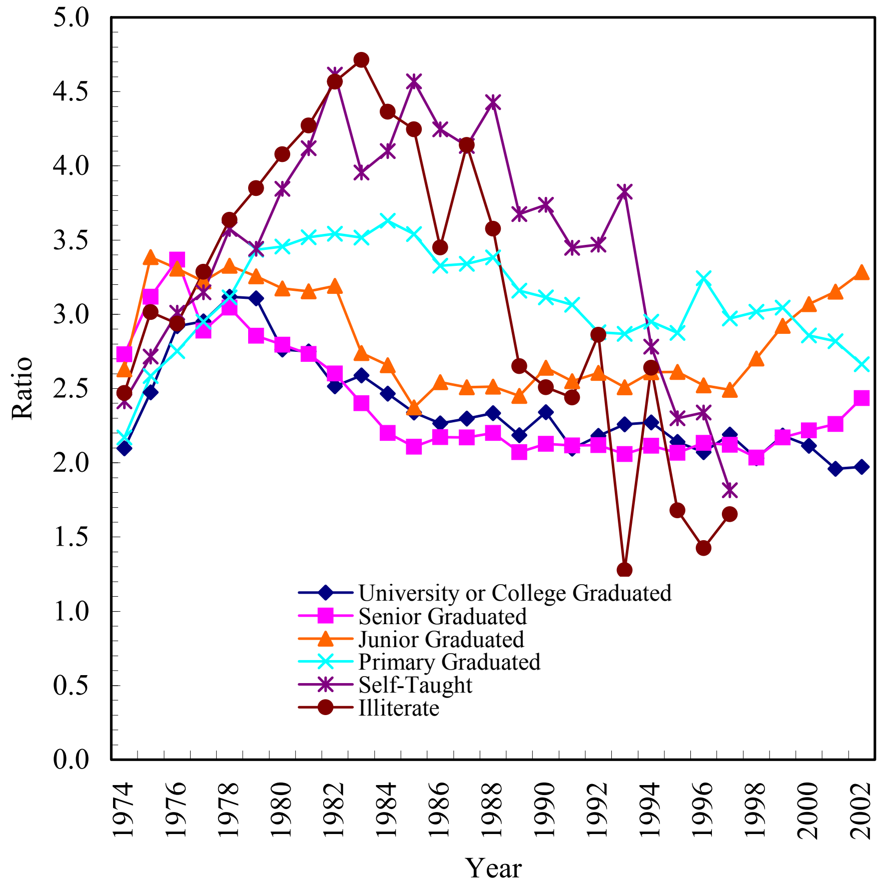


Figure 4-9. Ratios of Male and Female ASFRs by Educational Attainment for Age Group 35 to 39: Taiwan, 1974-2002

population disappeared in Taiwan, a higher male than female fertility pattern can still be observed, meaning that higher education has a stronger negative effect on male than on female fertility.

Figures 4-10 and 4-11 describe the R_{ASFRs} by educational attainment for age groups 40 to 44 and 45 to 49, respectively. Compared to the previous age groups, the R_{ASFRs} for each educational group show a dramatic increase. There are outliers of the R_{ASFRs} for university or college graduates in year 1978 because males had low ASFRs for this educational group. In these two charts, the R_{ASFRs} for the various educational groups show a mixed pattern compared to the younger age groups. Education does not seem to play an important role in shaping MFF for these two age groups.

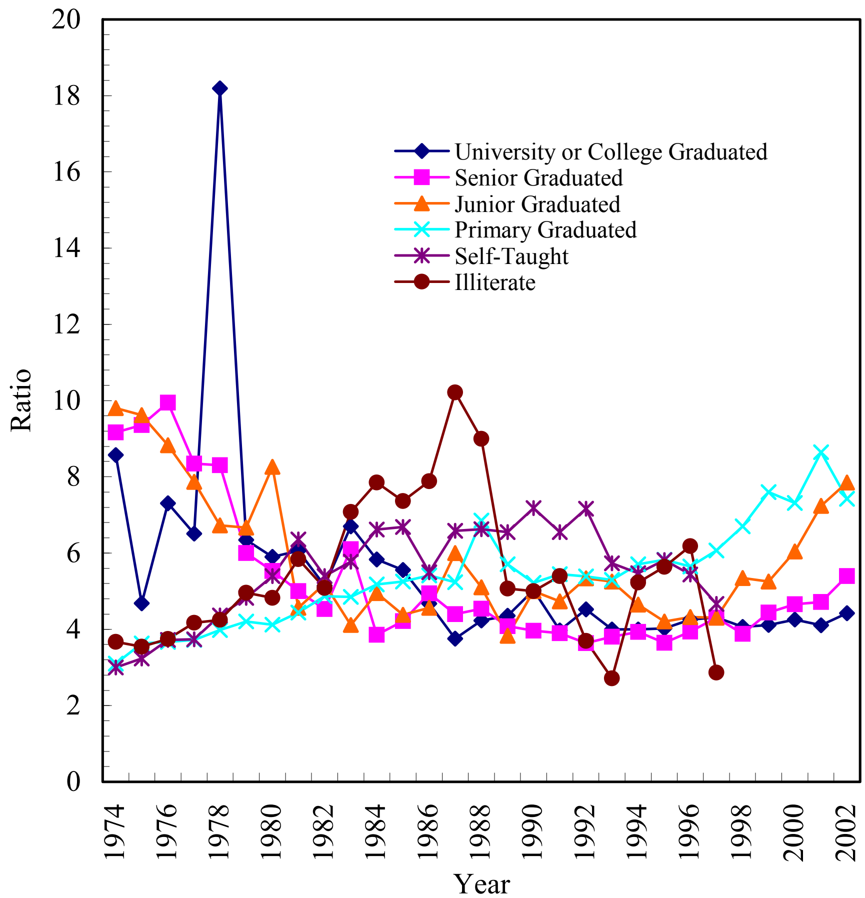


Figure 4-10. Ratios of Male and Female ASFRs by Educational Attainment for Age Group 40 to 44: Taiwan, 1974-2002

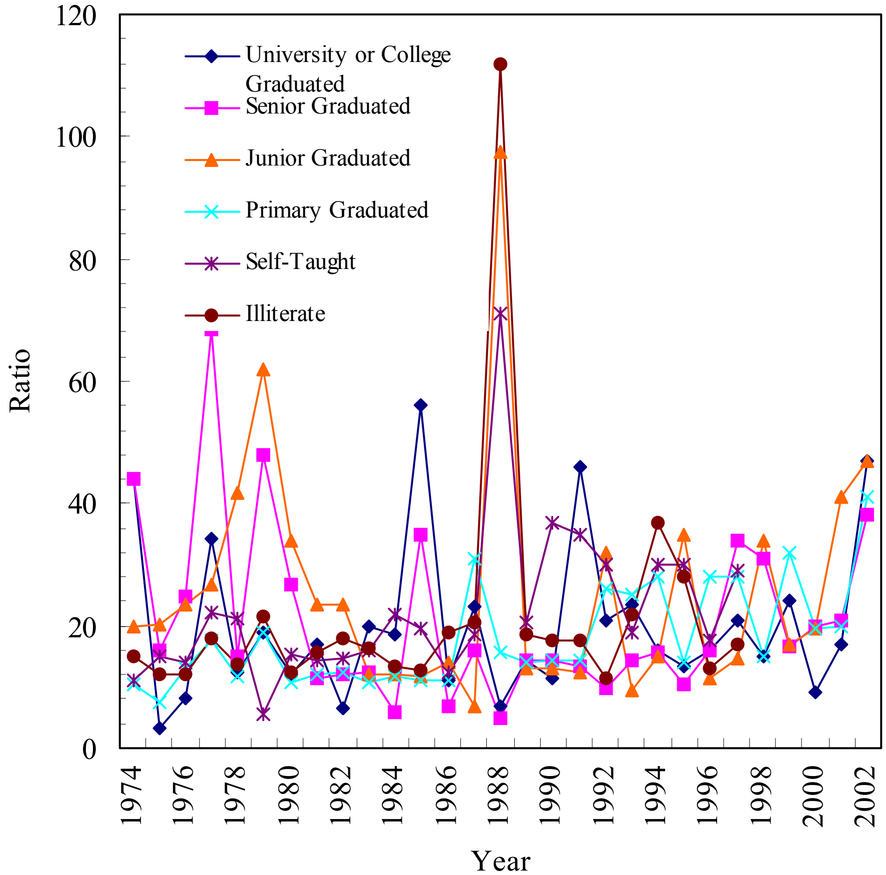


Figure 4-11. Ratios of Male and Female ASFRs by Educational Attainment for Age Group 45 to 49: Taiwan, 1974-2002

Since the year 1998, the illiterate and self-taught populations are almost non-existent in Taiwan. But there is a clearer pattern of male and female age-specific fertility for age group 40 to 44. Primary school graduates have the highest R_{ASFRs}, followed by junior graduates, senior graduates and university or college graduates. It again indicates that education plays a role regulating female fertility to a larger extent compared to male fertility. The R_{ASFRs} of the educational groups for people aged 45 to 49 show a large variation over the years. Education does not seem to have a strong effect distinguishing male and female age-specific fertility over time.

In conclusion, educational attainment can be considered to be a determinant of male and female age-specific fertility. For the youngest age group, 15 to19, educational attainment clearly shows a stronger negative effect on female than on male fertility. When moving to age group 20 to 24, such an effect becomes distinct only between the literate and illiterate groups. For age group 25 to 29, the stronger effect of education preventing female than male fertility in the illiterate population is still clear. But in the meantime, education begins to play a more effective role regulating male than female fertility among the educated population groups. For the 30 to 34 and 35 to 39 years old population, education does not seem to be a factor distinguishing MFF patterns between the literate and illiterate groups. However, it still shows stronger inhibitive effect on male than on female fertility. Such an effect continues until age group 40 to 44 even though it becomes less apparent. And it finally disappears among people who are aged 45 and older. Conventional demography has focused a great deal on the importance of educational attainment on deterring female fertility. This part of my analyses, however, shows that education indeed has a stronger discouraging effect on male than on female fertility for people 30 to 40 aged. Educational attainment only prevents female fertility more than male fertility in the youngest age group, 15 to 19, and among illiterate people in their age 20s. This finding has been overlooked in the demographic literature because men had not been included in fertility studies.

Male and Female Fertility in Counties and Cities of Taiwan, 2002

I now examine MFF cross-sectionally, and I apply fertility theories largely based on females in Taiwan to male fertility and see how effective those theories are when accounting for male fertility variation. The analysis will be a based on examining MFF in 23 counties and cities of Taiwan in year 2002.

I first describe male and female TFRs in these 23 sub-regions in 2002, with detailed information shown in Table 4-2. As may be seen, cross-sectionally, most of Taiwan's 23 counties and cities have female fertility rates larger than their corresponding male fertility rates. Across the 23 subregions, females have a mean TFR value of 1,406 with a standard deviation of 211. They vary from a high of 1,845 in Hsinchu County to a low of 1,070 in Tainan City. Males have an average TFR value among the subregions of 1,330 with a standard deviation of 153. The highest male TFR is 1,705 in Hsinchu County and the lowest is 1,090 in Tainan City. The female mean TFR is higher than the male mean TFR by a difference of 76 births per 1,000 persons. Taipei County has male and female TFRs that are the same. A few subregions have higher male than female TFRs, namely, Taichung City, Chiayi City, Tainan City, the Taipei Municipality and the Kaohsiung Municipality.

Table 4-2. Male and Female TFRs: 23 Sub-Regions of Taiwan, 2002

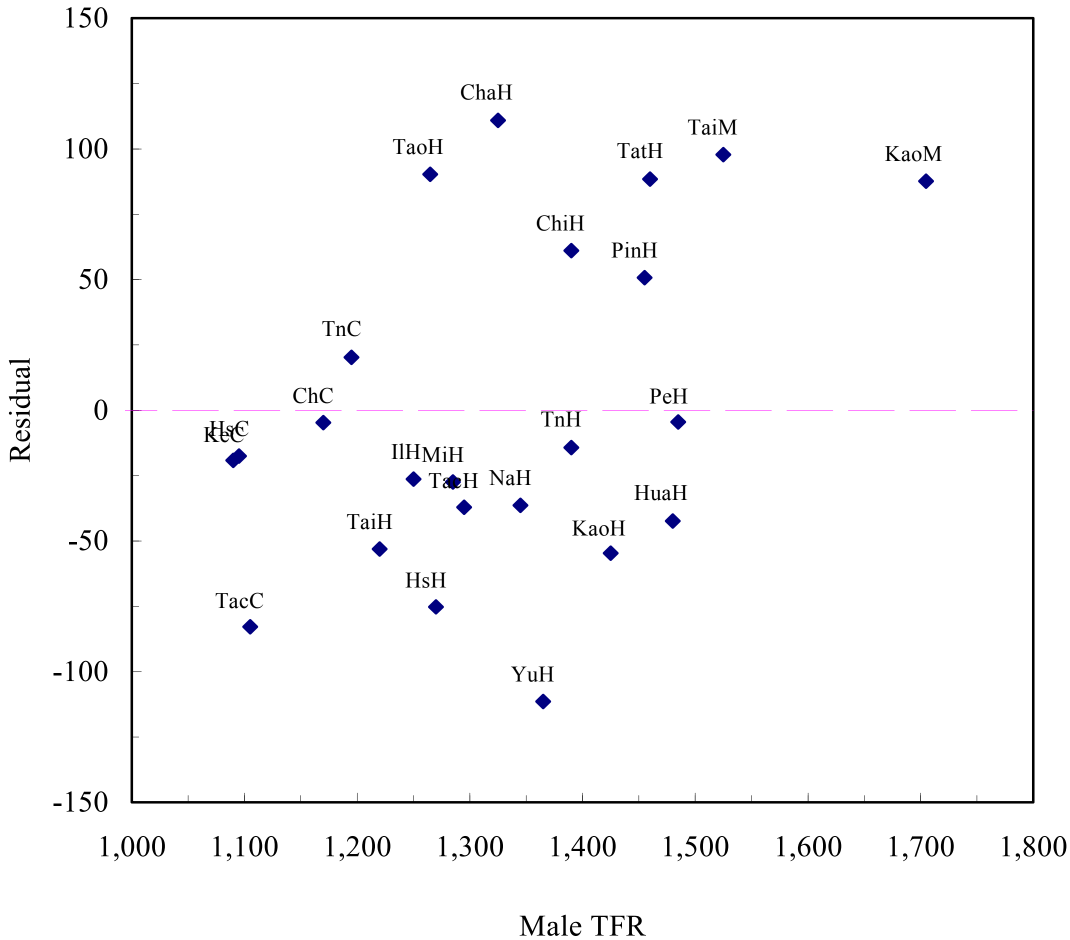
Sub-region	Abbreviation	Male	Female
Tainan City	KeC	1,610	1,710

Kaohsiung Municipality	HsC	1,835	1,880
Taipei County	TacC	1,775	1,675
Chiayi City	ChC	1,605	1,640
Taipei Municipality	TnC	1,545	1,550
Keelung City	TaiH	1,680	1,670
Taichung City	IlH	1,810	1,940
Kaohsiung County	TaoH	1,915	1,925
Tainan County	HsH	1,985	2,235
Ilan County	MiH	1,795	2,035
Taichung County	TacH	1,860	1,905
Pingtung County	ChaH	1,805	1,950
Hualien County	NaH	1,775	1,985
Taoyuan County	YuH	1,750	2,080
Penghu County	ChiH	1,690	2,035
Chaghwa County	TnH	1,605	1,785
Nantou County	KaoH	1,640	1,785
Hsinchu City	PinH	1,710	1,895
Taitung County	That	1,655	1,975
Yunlin County	HuaH	1,755	1,960
Mioali County	PeH	1,505	1,750
Chiayi County	TaiM	1,495	1,415
Hsinchu County	KaoM	1,515	1,515

Sources: The 2002 *Taiwan-Fukien Demographic Yearbook.*

Ordinary least squares (OLS) regression may be used to predict the male TFRs for the 23 subregions using the female TFRs as the independent variable. The adjusted R^2 is 0.82 indicating that more than 80 percent of the variance in male fertility may be explained by female fertility. Figure 4-12 plots the residuals from the above regression equation (vertical axis) by the values of the male TFRs (horizontal axis). Subregions below the line have predicted values of male fertility larger than their actual values, and subregions above the line have predicted values smaller than their actual values. The results show that the error using female TFRs to predict male TFRs increases with increasing values of male fertility. The two rates are more similar for subregions with low male rates.

Figure 4-12. Residuals vs. Male TFRs in 23 Counties and Cities: Taiwan, 2002



Given that male and female TFRs in 23 sub-regions are not identical, in this section of the chapter, I examine several theoretical models to compare determinants of MFF among the subregions of Taiwan in 2002, which will allow me to test the efficacy of the fertility theories on males. Some of the main theories of fertility in Taiwan are first reviewed below.

Educational Attainment and Fertility Decline Perspective

A consistently negative relationship between education and fertility has been found in Taiwan by many scholars (Chang, Freedman, and Sun 1987; Hermalin 1974; Li 1973). When age-specific fertility rates are examined, educational attainment is shown to be especially important for women under age 30 (Anderson 1975b). Moreover, fertility differentials by educational attainment are larger than fertility differentials by other factors, e.g., rural-urban differences (Chang, Freedman, and Sun 1987). Also, the educational differentials in fertility apply not only to females in general, but also to married Taiwanese females (Freedman, Fan, Wei, and Weinberger 1977). It has been reported that "while structural changes in educational level have had a significant effect in producing lower fertility in Taiwan, the major effects come from changes in fertility within educational strata; fertility has declined especially rapidly among the more poorly educated strata" (Freedman, Fan, Wei, and Weinberger 1977: 18). Education therefore is claimed to be "the most important factor affecting fertility attitudes and behavior" in Taiwan (Speare, Speare, and Lin 1973: 333).

Socioeconomic Change and Fertility Reduction Approach

Researchers also view social and economic development as an aggregate setting that has influenced female fertility decline in Taiwan. Economic welfare, such as family income, along with general health conditions, particularly as reflected in the infant mortality rate, are observed to be directly related negatively with fertility (Li 1973;

Muller and Cohn 1977). Some other socioeconomic factors are shown to reduce birth rates indirectly as mediating causes through family planning programs and other variables more proximate to fertility. These socioeconomic factors include modernization and urbanization, age at first marriage, and the extent to which people are exposed to modern ideas and concepts. Urbanization, a rising age at marriage, and the diffusion effects of mass media are shown to be related to Taiwanese' fertility reduction (Chang, Freedman and Sun 1987, Freedman, Hermalin and Sun 1987, Hermalin 1974, Li 1973). As Poston (Poston 2000: 57) writes, "[in Taiwan], there were strong influences of social and economic development factors on fertility."

Other Explanations

Previous studies also provide empirical support for the effects of preferred family size and family planning programs on fertility change (Chang, Freedman, and Sun 1987; Hermalin 1974; Jejeebhoy 1981). It is noted that even though female labor force participation has long been used as a predictor of fertility decline (Smith-Lovin and Tickamyer 1978). In Taiwan, this variable has been found to be only weakly related to reproductive behavior. Even given the increased participation of women in the modern market sector, unpaid family workers do not seem to display higher fertility than those in the market sector (Stokes and Hsieh 1983).

Since data for contraceptive use and labor force participation are not typically available in Taiwan statistical sourcebooks for the country's sub-regions, models will be presented here will mainly analyze the effects of education and other socioeconomic factors on MFF. The measures used as independent variables in the analysis are (1) percent of males and females who were receiving or have received college degrees in 1997; (2) combined average family income in 1998; (3) infant mortality rate in 1997; (4) percentages of married males and females in age group 20-24 in 1997; and (5) population density (per square kilometer) in 1997. Table 4-3 presents the descriptive statistics for these independent variables.

Table 4-3. Descriptive Statistics for Fertility Rates and Independent Variables: 23 Counties and Cities of Taiwan

Variable	Mean	S. D.	Minimum Value	Maximum Value
Dependent variables				
Male TFR	1,330.0	152.6	1090.0, Tainan City	1705.0, Hsinchu County
Female TFR	1,406.7	211.3	1070.0, Tainan City	1845.0, Hsinchu County
Independent variables				
Percent male received/receiving college degree	9.4	3.9	3.2, Taoyuan County	18.8, Taipei Municipality
Percent female received/receiving college degree	9.2	3.0	5.2, Taitung County	17.5, Taipei Municipality
Average combined family income (NT$)	1,017,699.0	203,255.8	660,563.0, Penghu County	1,531,961.0, Taipei Municipality
Infant mortality rate	7.5	1.2	6.1, Taitung County	10.8, Hualien County
Percent married males in age group 20-24	21.0	5.2	2.6, Taipei Municipality	8.9, Yunlin County
Percent married females in age group 20-24	6.3	1.7	9.4, Taipei Municipality	28.0, Taitung County
Population density per sq. km. of cultivated area	15,392.4	30,959.3	532.0, Taitung County	131,635.0, Kaohsiung Municipality
N = 23				

1 US dollar = NT$ 34.58 in July 2002, and NT$ 31.6 in 1998. The World Fact Book.
Sources: *1997 Taiwan- Fuchiun Demographic Factor Book*, Tables 6, 7, 8, 10 and 39; 1998 Republic of China National Statistics.

The variation in each of these five independent variables is as striking as the variation in male and female fertility. Average combined family income, for instance, ranges from NT$ 660,563 to NT$ 1,531,961, and population density ranges from 532 people per square kilometer to 131, 635 people per square kilometer. Because of high collinearity of some of the independent variables with each other, three ordinary least squares (OLS) regression models are estimated predicting male and female TFRs. The OLS regression results predicting male fertility are presented in Table 4-4, and the results predicting female fertility are shown in Table 4-5.

For all regression models, unstandardized and standardized regression coefficients are reported for each of the independent variables. In Table 4-4 and Table 4-5 the columns for Model 1 show the multiple regression results for male TFR and female TFR for the three socioeconomic variables of combined family income, infant mortality and education. The results show that education has a significant effect on both male and female fertility, net of the effects of the other independent variables. Together the three variables account for 10 percent of the variation in male fertility, and 23 percent of the variation in female fertility. Model 1 works much better predicting female fertility than male fertility.

In the middle columns of the two tables, the education variable is replaced with a variable measuring the percentage of male (or females) in the age group 20-24 who are married. In Model 2 the marriage variable has the most sizable effect on both male and

Table 4-4. Multiple Regression Coefficients for Male TFRs: 23 Counties and Cities of Taiwan, 2002

	Model 1		**Model 2**		**Model 3**	
Independent variable	**Unstan-dardized**	**Stan-dardized**	**Unstan-dardized**	**Stan-dardized**	**Unstan-dardized**	**Stan-dardized**
Average combined family income	0.00	0.20	0.00**	0.58**	0.00	0.21
Infant mortality rate	-1.87	-0.01	-25.44	-0.19	-1.43	-0.01
Percent males received/receiving college degree	-21.50*	-0.56*	-	-	-	-
Percent married males in age group 20-24	-		94.50***	1.05***	-	-
Pop. density per sq. km. of cultivated area	-		-	-	-0.00*	-0.60*
Constant	1394.25		482.21		1225.53	
R^2 (Adjusted)	0.10		0.51		0.16	
df	19		19		19	
N = 23						

* p < 0.05, ** p < 0.01, *** p < 0.001 (two-tailed test).

Table 4-5. Multiple Regression Coefficients for Female TFRs: 23 Counties and Cities of Taiwan, 2002

	Model 1		**Model 2**		**Model 3**	
Independent variable	**Undtan-dardized**	**Stan-dardized**	**Undtan-dardized**	**Stan-dardized**	**Undtan-dardized**	**Stan-dardized**
Average combined family income	-0.00	-0.18	0.00*	0.34*	-0.00	-0.20
Infant mortality rate	8.37	0.05	-34.15	-0.19	12.12	0.07
Percent females received/receiving college degree	-31.48*	-0.44*	-	-	-	-
Percent married females in age group 20-24	-		46.71***	1.15***	-	-
Pop. density per sq. km. of cultivated area	-		-	-	-0.00*	-0.47*
Constant	1826.84		316.10		1580.50	
R^2 (Adjusted)	0.23		0.74		0.28	
df	19		19		19	
N = 23						

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed test).

female fertility. The three variables in Model 2 together account for 75 percent of the variation in female fertility, compared to 51 percent of the variation in male fertility. The last columns of Table 4-4 and 4-5 show the results of multiple regression equations in which a population density variable is substituted for the percent married variable. This variable has a negative effect on both fertility rates, as expected. Moreover, its influence on fertility is also stronger than that of the other two variables in the model, namely, family income and infant mortality. Again, the combined effect of the three variables in Model 3 is stronger for female fertility than for male fertility.

Overall, the results of the three models predicting male and female fertility show as many similarities as differences. The infant mortality predictor is never significant, whereas the education and marriage variables are significant and influential. The economic development indicator of "combined family income" and the urbanization indicator of "population density" are both negatively associated with male and with female fertility. All three regression models account for significantly more variance in female fertility than in male fertility.

Conclusion and Discussion

In this chapter, I examine male and female fertility rates, specifically, the TFRs and ASFRs, and compare their determinants at the aggregate level in Taiwan. The chapter begins by examining male and female TFRs for Taiwan for the individual years of 1975 to 2004. It is revealed that male and female fertility rates for most years are far from being identical. In the early years, the male TFRs were higher than the female TFRs, and the opposite situation was true since the late 1980s. Cross-sectionally, male and female fertility were shown to differ significantly among most of the 23 subregions of Taiwan in 2002.

The chapter then investigates the age-specific fertility patterns for men and for women, followed by an analysis of how educational attainment differentiates MFF age-specific fertility. Male and female age-specific fertility patterns in Taiwan echo those found in other industrialized countries (see chapter III), with MFF showing major differences among the older age groups. Assuming that education has a negative effect on fertility, the ratios of male and female ASFRs for various ages reveal that the effect of educational attainment on MFF does vary across age. For younger age groups, such a negative effect is stronger on male fertility than on female fertility, with the opposite pattern to for age groups 30-34 and older. These results are informative. But since the research has not controlled for other factors in the relation of education and age-specific fertility, future analyses controlling for other possible determinants of fertility to further test the association between education and MFF are warranted.

In the results of the regression models, education generally shows a stronger negative effect on female than on male fertility. To explore the mechanism of how education impacts men's and women's fertility differently probably requires more individual level investigations. In terms of other fertility determinants, some similarities are found in the regression equations as well as differences. The same independent variables have significant effects on male fertility as on female fertility. But the models which combine several independent variables perform better when predicting female fertility than when predicting male fertility. This suggests that there are likely other factors that need to be introduced into the equations, which influence male fertility but have heretofore not been considered. The marriage variable is found to be the most significant factor influencing both male and female fertility. I need to point out that the marriage variable itself in fact shows a stronger positive effect on male than on female fertility. The positive relationship between family income and male and female fertility may require comment since previous studies found a reverse relationship between these two factors.

In sum, the results presented in this chapter indicate that levels of male fertility and female fertility do indeed differ for Taiwan over time and among the main subregions at one point in time. The results also indicate that variables that impact female fertility also have significant influence on male fertility. But fertility models seem to be better able to explain female fertility change than male fertility variation. There is considerable work to be done to improve the models of male fertility. In the next three chapters, I will explore male fertility determinants at the individual level and compare them to those of the females. Hopefully, findings from these chapters will enhance our understanding of factors that have shaped male fertility.

CHAPTER V

RELIGION, RELIGIOSITY, AND MALE AND FEMALE FERTILITY

Following the discussions in the previous chapters comparing men and women's fertility rates at the aggregate level, the discussion now shifts to an exploration of male and female fertility at the individual level. I examine how fertility determinants, such as socialization factors, particularly religion and religiosity, demographic and socioeconomic characteristics, cohabitation and sexual experience, shape men's and women's fertility outcomes differently. I will begin this chapter by outlining previous research on the relationship between religion and fertility. I then introduce my research hypotheses, data and variables, as well as statistical methods for the analyses. Finally, I conclude the chapter with a discussion of the Poisson and the zero-truncated Poisson regression results.

Linking Religion to Fertility

Before I move to empirical analyses of the effects of religion and religiosity on male and female fertility, I will first review previous literature linking religion to fertility. Most religious and demographic studies of religion and fertility in the United States elaborate female fertility differentials among people who are affiliated with various religious denominations (Janssen and Hauser 1981; Lehrer 1996; Lehrer 2004; Marcum 1988; Mosher, Johnson, and Horn 1986; Poston 1990). Catholics are often reported to have a particularly high level of fertility. Protestants' fertility is shown to be lower than that of Catholics and is located in the middle of the continuum. Non-Orthodox Jews are at the end of the continuum and have consistently tallied the lowest fertility rate among all religious groups in the U.S. (Lehrer 2004; Sander 1993). In recent years, however, demographers have reported that fertility differences among Catholics and other religious groups have been shrinking, and that Protestants' fertility tends to be higher than that of Catholics and other religious groups (Mosher, Johnson, and Horn 1986; National Center for Health Statistics 2005; Westoff and Jone 1979).

Four principle hypotheses have been proposed in the literature to explain these fertility differentials, namely, (1) the particularized theology hypothesis, (2) the characteristics hypothesis, (3) the minority status hypothesis, and (4) the social interaction hypothesis (Chamie 1981; McQuillan 2004). The particularized theology hypothesis views fertility differentials as a result of specific doctrinal differences among religions. According to this perspective, religious groups whose doctrines are against contraception and abortion and favor a large family size should have a higher fertility rate, with the opposite being the case for the religious groups who do not have such doctrines. Examples of religious groups with these doctrines include Roman Catholics, fundamentalist Protestants, Latter-Day Saints (Mormons) and Amish. Religious groups who have no proscriptions on birth control are, for example, mainstream Protestants and Jews (Jurecki-Tiller 2004). Empirical research has provided some evidence for the particularized theology hypothesis by demonstrating that mainstream Protestants and Jews have higher levels of contraceptive use and lower fertility rates compared to Catholics and fundamentalist Protestants (De Jong 1965; Freedman, Wehelpton, and Campbell 1961; Mosher and Hendershot 1984; Mosher, Williams, and Johnson 1992).

The characteristics hypothesis argues that fertility differentials among religious groups are not caused by religious doctrines. Rather, demographic and socioeconomic differentials of the members of religious groups result in their fertility differences. Once demographic and socioeconomic statuses of religious groups are controlled, fertility differentials among religious groups should disappear. The characteristics hypothesis is also supported by previous findings. The U.S. Catholic and non-Catholic fertility differentials disappear after controlling for their members' socioeconomic status (Westoff and Jone 1979); and Muslim fertility is found to be largely impacted by differences in socioeconomic conditions as well (Johnson-Hanks 2006).

Even though these theories explain fertility differences from different perspectives, the characteristics hypothesis and the particularized theology hypothesis are considered to support one another instead of being mutually exclusive (Chamie 1981; Goldscheider 1971). As Goldscheider (1971: 273) explains, if two religious groups "do not have explicit or identifiable religious ideologies about birth control or ideal family size," then fertility differences among religious groups could be due to variation in their demographic and socioeconomic statuses; if fertility differentials persist after controlling demographic and socioeconomic characteristics, then "the explanation of residual fertility differentiation must rest with a particular religious ideology on birth control and family size."

The third perspective, the minority group status hypothesis, contends that the insecurity of minority group status plays a role in depressing fertility of minority religious groups below that of the majority. The prerequisites for the minority status mechanism to operate are: (1) acculturation; (2) socioeconomic mobility; and (3) no pronatalist ideology or norms (Goldscheider 1971: 297). This hypothesis not only highlights fertility differentials among religious groups, but also among racial and ethnic groups (Poston, Chang, and Dan 2006). The definition of minority group status is based on the numerical size of the group and whether a racial and ethnic group is psychologically considered a minority. Examples of such groups are South African blacks and Latinos. In some places of the U.S., these two groups may be a numerical majority but are still psychological treated as minorities (Bouvier and Rao 1975; Chamie 1981). Part of the empirical support of this perspective comes from the low fertility level of Jews, which is often believed to be associated with their minority status (Goldscheider and Uhlenberg 1969; Lehrer 2004).

The last hypothesis, the interaction hypothesis, is also referred to as the socialization hypothesis. This hypothesis examines the role of social interaction in shaping reproductive behavior (Bongaarts and Watkins 1996; Montgomery and Casterline 1996; Watkins 1992). It believes that religious institutions are a major source of social exposure through which members of a certain religious group adopt their religious doctrines and are impacted by other members' fertility behavior. Such an approach is in line with the social networks theory and the "diffusion theory" of fertility, which emphasize the role of people's interaction in shaping people's behavior and the diffusion effect of family planning ideology in influencing people's fertility (Coale and Watkins 1986; Watkins 1992). Such a perspective also echoes the idea that "fertility is an aggregate property, a characteristic of the groups to which the couple belong and not directly of the couple themselves" (Norman 1974: 76). Recent research shows more and more support for this hypothesis (Knodel, Gray, Sriwatchrin, and Peracca 1999; Marchena and Waite 2001; Ongaro 2001; Yeatman and Trinitapoli 2007).

Previous studies of religion and fertility along with the four theoretical approaches have considerably increased our understanding of the relationship between religion and fertility. However, these studies and approaches have mainly focused on female fertility. The ways in which male fertility is impacted by religion has been largely neglected. Meanwhile, these studies have emphasized primarily fertility differentials among people who belong to various religious denominations. The effect of religiosity on fertility appears to have eluded researchers. Whether people who are more engaged in religion tend to have a greater number of children regardless their religious denominations and whether the level of religiosity could be a determinant of fertility are unclear. For instance, fundamentalist Protestant religious doctrines are pronatalist, which forbids artificial forms of contraception, resists abortion and favors relatively larger families (Lehrer 1996; Marcum 1981). On average, fundamentalist Protestants also have stronger religiosity compared to other religious groups: they attend religious services more frequently than people of other religious denominations (Lehrer 2004). Previous literature rarely examines whether their higher fertility rate is caused by their greater level of religiosity by attending church services more often or is caused by the religious teaching of their denomination regarding favoring more children. In order to fill these voids, in this chapter, I try to bring gender and religiosity into religious studies of fertility, and I empirically examine: (1) whether religiosity affects people's fertility; (2)

whether fertility differentials also occur among men who belong to different religious denominations; and (3) whether men's and women's fertility outcomes are impacted by religion in a significantly different manner. Specifically, I intend to study how men's and women's fertility patterns differ in various religious groups and among members with various levels of religiosity. I will set forth a series of hypotheses to examine these issues in the next section, followed by empirical tests of the hypotheses.

Hypotheses on Religion, Religiosity, Gender and Fertility

I now present my hypotheses regarding the above three major issues. Religiosity is an important aspect of religion which is often viewed as the intensity of religious beliefs and participation (Myers 1996). Religious beliefs are, notably, beliefs in hell, heaven and an afterlife. Religious participation includes such behaviors as church attendance, participating in church-related activities, viewing/listening to religious broadcasts, and reading the holy books of their religion (Barro and McCleary 2003; Corijn 2001; Myers 1996). Strong religiosity is usually indicated by strong daily influence of religious beliefs on individual decisions and frequent participation in religious activities.

Although previous religious studies mainly focus on examining fertility differences among religious groups, empirical analyses have shown some evidence that religiosity impacts demographic behavior. In terms of the effect of religious participation on fertility and fertility-related behavior, researchers observe that religious participation among young people is strongly linked to more positive attitudes towards marriage and having children (Marchena and Waite 2001). Also, individuals who seldom participate in church activities tend to significantly delay their timing of first parenthood, controlling for all other factors (Ongaro 2001).

Then why does religious participation influence people's demographic behavior? As stated earlier, the social networks approach and the "diffusion theory" of fertility provide explanations for this mechanism. According to the social networks perspective, religious people build their social networks through attending church activities. Regular churchgoers are more strongly connected to their religious group, i.e. their social networks. As a consequence, they are more likely to accept the religious doctrines of their churches. In terms of their reproductive behavior, they are thus more likely to be influenced by their church teachings of childbearing as well as the patterns of other church members' fertility behavior. In a similar vein, the "diffusion theory," initiated by Princeton demographers, explains the effect of religious participation by looking at the role of cultural diffusion and social interaction in spreading new cultural models of reproduction, i.e. birth control and family planning (Coale and Watkins 1986; Watkins 1992). Based on the empirical findings and these explanations, I expect church participation to be highly influential in the U.S. My first hypothesis is as follows:

Hypothesis 1: The more frequently people attend religious services, the more children they will have, controlling for religious affiliation and other factors.

Besides religious participation, religious beliefs are also important. In Austria, researchers observe that non-religious persons have a lower marital rate than religious persons. Non-religious women also have a lower rate of first childbearing than religious ones (Preiffer and Nowak 2001). A similar pattern is also found in other European countries, such as Britain and Italy (Berrington 2001b; Ongaro 2001). If "no religion" is considered as one extreme on the religiosity scale, then empirical findings seem to suggest that being more religious or having stronger religious beliefs is positively related to the marital rate and the likelihood of giving first birth. Such a positive effect can be explained by the fact that most religions encourage marriage and highly value the family. Since the majority of fertility behavior does occur within the context of marital unions in most countries (Bongaarts 1982; Hervitz 1985; Mosher, Johnson, and Horn 1986), having stronger religious beliefs is expected to have a positive effect on fertility. Based on this rationale, I predict the following:

Hypothesis 2: People who have strong religious beliefs are more likely to have more children than people without such beliefs, controlling for religious affiliation and other factors.

Because I hypothesize that religiosity has a positive effect on fertility, I predict that fertility differentials among various religious groups may be partly due to the level of religiosity among members of religious groups. Thus, I hypothesize the following:

Hypothesis 3: Fertility differentials among various religious groups will decrease once religiosity is taken into consideration, controlling for other factors.

Regarding the effect of religion on male fertility compared to that on female fertility, researchers have found mixed results. The majority of them have suggested that, in general, women's behavior is more likely to be impacted by religious values and beliefs compared to men (Corijn and Klijzing 2001; Goldscheider and Goldscheider 1993). An opposite finding is shown in Preiffer and Nowak's (2001) work. They observe that in Austria, men are more likely to be influenced by religion in terms of marriage and childbearing. Other researchers, however, have argued that there are not significant gender differences with regard to the relationship between religion and fertility. Janssen and Hauser (1981) examine the effects of religious and secular socialization on Wisconsin men's and women's fertility. Their findings confirm a positive relationship between Catholic religion and the preference of having more children without showing significant gender differentials. In Britain, Berrington (2001b) shows that people with stronger levels of religiosity are more likely to marry early and give birth to children. But such a pattern does not differ among men and women.

The above findings seem to suggest that religion does have a certain effect on both men's and women's fertility and their fertility-related behavior. The discrepancy mainly occurs in terms of whether religion has a stronger effect on women than on men, with the majority of these studies showing women being influenced to a greater extent compared to men. Based on these results, I predict the following:

Hypothesis 4: There are no significant gender differences regarding fertility differentials among religious groups, controlling for other factors. But,

Hypothesis 5: Religious participation promotes women's fertility to a greater extent than men's fertility, controlling for other factors. And,

Hypothesis 6: Religious beliefs have a stronger push effect on women's than on men's fertility, controlling for other factors.

Data and Variables

So far, I have formulated hypotheses on the impact of religion and gender on fertility. Next, I move to the empirical analyses that test these hypotheses. For the tests of my hypotheses, I use data from the 2002 National Survey of Family Growth (NSFG) Cycle 6 to conduct the individual level analyses. This dataset contains information on "fertility, marriage, cohabitation, contraception and related issues" of 7,643 women 15 to 44 years old and 4,928 men 15 to 45 years old in the United States in year 2002 (2004: 5). It is worth mentioning that 2002 was the first time the NSFG included men in its surveys. The original NSFG datasets present male and female reports in two separate files. In my analyses, I combine the female and male datasets together for the purpose of generating gender interaction terms to test whether the impacts of religion and religiosity on fertility vary across gender.

As stated in an earlier chapter, when studying male fertility, the validity of male reports is always the concern of researchers. The problem of underreporting in the NSFG dataset is indeed pointed out by Rendall and associates (Rendall et al. 2006) who assess fatherhood at ages 18 to 27 years old in the period 1991 to 2000, i.e., men who were 25 years old when the survey was conducted in 2002. The reason they choose this group of male respondents is because data problems are normally greatest at younger ages. Their evaluation results reveal that underreporting of fatherhood for this group of men does exist in the NSFG dataset, meaning applying this dataset to examine fertility outcomes could be problematic. Considering this matter, my analyses of the NSFG datasets are broken into two parts for comparison purposes. The first part contains all male respondents and the second part only includes those men who are 26 years of age and older. Correspondingly, it yields 10,451 (3,938 men and 6,513 women) and 8,735 (2,222 men and 6,513 women) respondents, respectively. These respondents provided information regarding their religious denominations. Respondents who did not provide such information are eliminated from the analyses.

The dependent variable used in the research is fertility, which is measured by the number of children ever born (CEB) to a male or female respondent. For a male respondent, the survey question for CEB is "how many biological children have you ever had?" And for a female respondent, the equivalent question is "how many live births have you ever had?" These two questions are considered as measuring the same thing for men and women, i.e. the CEB.

Independent Variables

The independent variables are the religious variables, namely, religious affiliation and religiosity. The religious affiliation variable is operationalized as the respondent's current religious domination, which is classified as a set of four dummy variables: Catholic, fundamentalist Protestant, other Protestant, and other non-Christian religion. This classification follows that of the 2002 NSFG reports (National Center for Health Statistics 2005). Among those, fundamentalist Protestants include Baptists/Southern Baptists; other Protestants are such as Methodists, Lutherans, Presbyterians and Episcopalians.

Religiosity is measured by two indictors, which are "frequency the respondent attends religious services" and "the importance of religion in the respondent's daily life".

These measurements capture the behavior and belief dimensions of religiosity, respectively. Since in the NSFG questionnaire, there is no question directly asking the strength of religious belief, "the importance of religion in the respondent's daily life" is used as the question measuring the strength of religious belief. For people who are affiliated with certain religious dominations, possible responses for the religious participation variable are: more than once a week, once a week, 1-3 times per month, and less than once a month. People's responses for the religious beliefs item are: very important, somewhat important and not important. Note the religious belief measurement is inapplicable for those respondents who claim themselves having no religious affiliation. Due to this restriction, in this study, I only include respondents who claimed themselves being affiliated with denominations.

The NSFG questionnaire does contain questions associated with the respondent's religious denomination and religiosity during their upbringing, which measure religious affiliation and the frequency of religious service attendance at age 14. But my preliminary analyses do not show significant effects of these variables on CEB. Thus, I decided not to use those variables in the analyses.

Control Variables

My analyses also statistically control for some established covariates that influence fertility. These include demographic factors such as age, race and ethnicity, nativity and marital status (Coale and Trussell 1974; Jaffe and Cullen 1975; Saenz and Morales 2005; Singley and Landale 1998; Xie and Pimentel 1992); and socioeconomic factors, for example, educational attainment, employment status and income (Ballard

2004; Ellison, Echevarria, and Smith 2005; Lehrer 1996; Sander 1992). These variables are used as control variables in the equations predicting both male and female fertility. Gender is also controlled considering gender may play a role on fertility in the combined dataset.

In terms of the measurement of these control variables, age is measured in years. Respondent's race and ethnicity is measured via categorizing the respondent into one of the following four racial and ethnic groups: Hispanic origin, non-Hispanic White, Black, and other. Marital status is set as a dummy variable coded as 1 if ever married and 0 otherwise. Nativity is a dummy variable coded as 1 if the respondent is foreign born and 0 otherwise. The variable gender is coded as 1 if male and 0 if female. I use the highest degree received to represent the respondent's educational attainment. For employment status, I code it as 1 if the respondent ever worked and 0 otherwise. Income is measured by total combined gross family income in 2001, which is coded into 14 categories, ranging from under $5,000 to $75,000 or more.

Basic descriptive statistics of variables are displayed in Table 5-1. Note all the information presented in Table 5-1 is only for people who claimed themselves affiliated with certain religions. Information for nonreligious respondents is not included. Sample weights are applied to the descriptive analyses of each variable. The average CEB for women is 1.3, with a standard error of 0.03. Results show that the mean CEB for females 26 and over is 1.8 with a standard error of 0.04. The corresponding values for all males and male respondents 26 and over are 1.2 with a standard deviation of 0.05 and 1.5 with a standard error of 0.05, respectively. These figures indicate more variation in male than in female fertility, and a relatively higher level of female than male fertility. They again suggest male and female fertility differentials at the individual level. The higher level of female than male fertility echoes the findings based on the aggregate level analyses that female fertility tends to be higher than that of males in most industrialized countries since the 1960s (see chapter II). At the individual level, a higher female than male CEB could be due to underreporting of births by men and the age-specific patterns of male and female fertility (MFF). Age matters because male fertility has a pattern of starting later and having a peak in much older ages (Paget and Timaeus 1994) compared to female fertility, the male respondents who are 15 to 45 years of age have not yet completed their fertility. But for their female counterparts who are 15 to 44 years of age, they are more likely to have reached their fertility peak. Thus, male CEB is relatively lower than female CEB.

Table 5-1. Descriptive Statistics for Dependent, Independent and Control Variables: U.S., 2002

	Male (All Respondents)			Male (26 and Over)			Female(All Respondents)		
Variables	Mean (or %)	SD	N	Mean (or %)	SD	N	Mean (or %)	SD	N
Dependent variable									
CEB	1.2	0.05	3,247	1.5	0.05	2,126	1.3*	0.03	6,512
Independent variables									
Religious Affiliation			3,938			2,222			6,513
Catholic	35.4			24.1			26.8		
Fundamentalist Protestant	24.1			31.2			33.0		
Other Protestant	31.0			34.9			33.4		
Other non-Christian	9.5			9.8			6.9		
Frequency of attending religious services			3,938			2,219			6,507
More than once a week	10.7			10.0			14.1		
Once a week	23.0			23.1			25.3		

Table 5-1 Continued

Variables	Male (All Respondents) Mean (or %)	SD	N	Male (26 and Over) Mean (or %)	SD	N	Female(All Respondents) Mean (or %)	SD	N
1-3 times per month	19.0			18.9			19.2		
Less than once a month	29.0			30.2			28.0		
Never	18.4			17.8			13.4		
Importance of Religious Beliefs			3,920			2,215			6,495
Very important	47.5			49.5			57.9		
Some important	40.3			38.3			36.1		
Not important	12.2			12.2			6.0		
Control variables									
Demographic factors									
Age (mean)	29.9	0.24	3,938	35.3	0.19	2,222	30.1	0.19	6,513
Race			3,938			2,222			6,513
Hispanic	17.8			17.5			15.3		
Non-Hispanic white	63.4			64.6			64.5		
Non-Hispanic black	12.5			11.5			14.7		
Non-Hispanic other	6.3			6.5			5.5		
Nativity-if foreign born			3,938			2,222			6,499
Native born	96.1			84.0			85.5		
Foreign born	4.0			16.0			14.5		
If R ever married			3,938			2,222			6,513
Yes	46.7			75.6			59.5		
No	53.3			24.4			40.5		
Socioeconomic factors									
Education			3,938			2,222			6,513
No diploma	22.6			22.7			21.1		
High school or less	31.6			31.6			27.6		
Some college/college	26.9			26.8			29.2		
University and above	18.9			19.0			22.2		
If R ever worked			3,938			2,222			6,513
Yes	95.0			99.0			90.1		
No	5.0			1.0			9.9		
Combined family income	$35,000-$39,999		3,938	$35,000-$39,999		2,222	$30,000-$34,999		6,513

Sources: derived from NSFG Cycle6 male ad female datasets, 2002.
Note: some sub-categories may not add up to 100% due to rounding. * The CEB value for women who are 26 and over is 1.8 with a standard error of 0.04.

In terms of the independent variables, Catholicism seems to be the most popular religion for all male respondents who claim a religion (35.4%), followed by other Protestant religions (31%), fundamentalist Protestant religions (24.1%), and other non-

Christian religions (9.5%). But when only males who are 26 and over are considered, respondents who are affiliated with other Protestant religions (34.9%) and fundamentalist Protestant (31.2%) surpass Catholicism (24.1%). A similar pattern is shown among all religious females. So it seems that compared to all male respondents, the distribution of older male respondents who are 26 and over to various religious denominations are more similar to that of the female respondents. As far as religious participation is concerned, all male respondents and those who are 26 and older do not show significantly different patterns. The majority (around 30%) of the two sets of men reported attending religious services less than once a month, whereas female respondents show a pattern of attending religious services more frequently than males. Female respondents also show a tendency to consider religious beliefs to be more important compared to their male counterparts. For instance, 57.9% of female respondents report religious beliefs are “very important” in their daily lives, compared to 49.5% of male respondents 26 and over, and 47.5% of all males. A reverse pattern is shown when percentages of respondents claiming religious beliefs are “some important” and “not important” in daily life. These results somehow indicate that women are more likely to have a higher level of religiosity compared to men, and older men tend to be more engaged in religion compared to younger men. Religious denomination wise, more women and older men self-reported as being Protestant, whereas there is a higher percentage of younger men claiming themselves as Catholic.

Demographically speaking, there is a higher percentage of Hispanic males than females and a lower percentage of black males than females in the dataset. Also, the percentage of married females is higher than that of males, which could be another reason for a higher female than male fertility rate. In terms of socioeconomic characteristics, the average combined family income reported by men is higher than that reported by women, $35,000 to 39,999 and $30,000 to 34,999, respectively. The percentage of men who ever participated in the labor force is higher than that of women (99.0% versus 90.1%). Interestingly, however, female respondents have a higher level of education compared to their male counterparts.

Statistical Methods and Results

Given that CEB is a count variable, Poisson regression is the statistical procedure used to conduct these analyses. The Poisson model is superior to ordinary least squares (OLS) or other linear models in this instance because the distribution of a count variable, such as CEB, is one that is heavily skewed with a long right tail, especially in the cases of low fertility populations. The skewed distribution of the CEB is due to the observed distribution of data having a very low mean, which reflects many women desiring few children and few women wanting many children in low fertility countries. Poisson regression is the suitable procedure to estimate CEB is also because CEB is a positive integer. Applying the linear regression model to count outcomes is not appropriate since it could result in "inefficient, inconsistent, and biased estimates" (Long and Freese 2006: 349).

The Poisson regression model can be written as:

$$\mu_i = \exp\,(a + X_{1i}\, b_1 + X_{2i}\, b_2 + \ldots + X_{ki}\, b_k)$$

Where μ_i is the mean of the distribution, which is estimated from observed characteristics of the independent variables; b_i represents deviation from the mean of the omitted category, which is the reference group. The X variables are related to μ nonlinearly. In this case, μ_i is the expected number of children born to a respondent based on the respondent's religious affiliation, level of religiosity and so forth. All cases are weighted based on the final weights of each sample given by the NSFG.

Since 46 percent of females and 42 percent of male respondents reported themselves having no babies, there might be a problem of over-dispersion and too many zeroes in the dataset. To avoid these problems, I also estimate negative binomial Poisson (NBP) regression models. Additionally, I drop the cases with a CEB value of 0, and I use the zero-truncated Poisson (ZTP) models to compare the results with the Poisson regression outcomes.

Table 5-2a presents the Poisson regression results analyzing the combined dataset with all male and female respondents. In model 1, I include the religious affiliation variable and socioeconomic characteristics as the control variables. Compared to Catholics, being members of other non-Christian religions multiplies the expected number of CEB by a factor of 0.86, that is, it decreases by 14% ($e^{-0.15}$), other things being equal. Fundamentalist Protestants and other Protestants do not seem to have significantly different levels of CEB compared to Catholics.

In models 2 and 3, I replace the current religious denomination variable with the variables of frequency attending religious services and importance of religious beliefs in people's daily lives, respectively. Apparently, people who reported that religious beliefs play an important role in their daily lives tend to have a higher level of CEB, whereas religious participation does not show a significant impact on fertility. A similar pattern is also found in models 4 and 5, after controlling the effect of religious denomination on fertility. That is, with every one scale increase in importance of people's religious beliefs, the expected CEB is multiplied by a factor of 1.1 ($e^{0.08}$), holding the other variables constant (see model 5). This means that the strength of religious beliefs does have a significantly positive impact on people's fertility, regardless of which religious denomination they belong to. However, frequent churchgoers do not really show a significantly higher level of CEB. These findings corroborate hypothesis 2 but reject hypothesis 1. Hypothesis 3 is tested through comparing the results of model 1 with models 4 and 5. Results show that fertility differentials among various groups do not change significantly, nor do the other variables after taking religiosity into consideration. This finding does not support hypothesis 3, meaning fertility differentiation among people who belong to different religious groups keeps a similar pattern after controlling for the levels of people's religiosity.

In addition to the clear effect of religious denomination and religious beliefs on fertility, most of the covariates are very influential as well. According to model 5, with every one year increase in age, the level of expected CEB increases by around six percent ($e^{0.06}$). Being a man decreases the level of expected CEB by 12 percent ($e^{-0.14}$) compared to being a woman, which emphasizes the significant gender effect on fertility. Being ever married increases the respondent's CEB by a factor of 2.8 ($e^{1.01}$), indicating the imperative role of marriage in determining fertility. In terms of racial and ethnic background, being of Hispanic background multiplies the number of children born to a respondent by a factor of 1.2 ($e^{0.21}$), holding the other independent variables constant. That is, Hispanics tend to have a CEB that is 20 percent higher compared to whites. Blacks and other racial groups also have a greater expected number of children than whites. Education and income have a negative and significant influence on fertility.

Table 5-2a. Poisson Regression Coefficients for Religious Affiliation, Participation, Beliefs and CEB: All Male and Female Respondents in the U.S., 2002

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Religious variables					
Current religious affiliation (ref. = Catholic)					
Fundamentalist Protestant	0.06			0.06	0.04
Other Protestant	0.04			0.05	0.03
Other non-Christian religion	-0.15*			-0.14*	-0.14*
Religiosity					
Frequency attending religious services		0.02		0.01	
Importance of religious beliefs			0.09***		0.08***
Demographic factors					
Age	0.05***	0.06***	0.05***	0.05***	0.06***
Gender (ref. = male)	-0.14***	-0.15***	-0.13***	-0.14***	-0.13***
Race (ref. group = Hispanic)					
Hispanic	0.23***	0.21***	0.19***	0.23***	0.21***
Non-Hispanic black	0.25***	0.26***	0.23***	0.25***	0.22***
Non-Hispanic other	0.21*	0.16	0.15	0.21*	0.18
If R has ever been married	1.02***	1.02***	1.01***	1.01***	1.01***
Socioeconomic factors					
Highest degree R ever earned	-0.07***	-0.07***	-0.07***	-0.07***	-0.07***
Total combined family income	-0.02***	-0.03***	-0.02***	-0.03***	-0.02***
Constant	-1.55***	-1.54***	-1.70***	-1.58***	-1.72***
N	9,759	9,750	9,729	9,750	9,729
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000

Sources: derived from NSFG Cycle 6 male and female datasets, 2002.

Note: R refers to respondent. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed tests). Regression results for *nativity* and *ever work* are not reported due to non-significant regression coefficients.

In Table 5-2b, I exclude those male respondents who are 25 and younger. In general, religious denomination, religious participation and religious beliefs show similar effects on fertility to those shown in Table 1, which again supports hypotheses 2 and rejects hypotheses 1 and 3. However, two demographic covariates, namely, *gender* and *ever married*, show weaker effects when younger male respondents are dropped from the analyses. The negative effect of being a man compared to being a woman on fertility changes from 12 percent ($e^{-0.13}$) to eight percent ($e^{-0.08}$). And the positive effect of being ever married compared to never married alters from multiplying a factor of 2.8 ($e^{1.01}$) to 2.6 ($e^{0.95}$). These findings suggest being a man and ever married tend to have weaker effects on population which is composed by older men. The weaker effect of being a male on fertility can be explained by the later fertility peak of men and the problem of underreporting which may happen more frequently among younger than among older males. The weaker effect of marriage on fertility in Table 5-2b again shows the importance of marriage on childbearing behavior, especially among younger men.

Table 5-2b. Poisson Regression Coefficients for Religious Affiliation, Participation, Beliefs and CEB: Males 26 and Over and Females in the U.S., 2002

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Religious variables					
Current religious affiliation (ref. = Catholic)					
Fundamentalist Protestant	0.05			0.05	0.03
Other Protestant	0.03			0.03	0.02
Other non-Christian religion	-0.16*			-0.15*	-0.16*
Religiosity					
Frequency attending religious services		0.02		0.01	
Importance of religious beliefs			0.09***		0.08***
Demographic factors					
Age	0.05***	0.05***	0.05***	0.05***	0.05***
Gender (ref. = male)	-0.10***	-0.10***	-0.09***	-0.10***	-0.08***
Race (ref. group = Hispanic)					
Hispanic	0.20***	0.18***	0.17***	0.20***	0.18***
Non-Hispanic black	0.24***	0.24***	0.22***	0.23***	0.21***
Non-Hispanic other	0.18*	0.13	0.11	0.17	0.15
If R has ever been married	0.96***	0.96***	0.96***	0.96***	0.95***
Socioeconomic factors					
Highest degree R ever earned	-0.07***	-0.07***	-0.07***	-0.07***	-0.07***
Total combined family income	-0.02***	-0.02***	-0.02***	-0.03***	-0.02***
Constant	-1.31***	-1.32***	-1.48***	-1.35***	-1.48***
N	8,638	8,629	8,613	8,629	8,613
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000

Sources: derived from NSFG Cycle 6 male and female datasets, 2002.
Note: R refers to respondent. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed tests). Regression results for *nativity* and *ever work* are not reported due to non-significant regression coefficients.

Up to now, I have tested hypotheses on impacts of religious denominations and religiosity on fertility. Next, I elaborate the model testing whether the effects of the religion and religiosity on fertility vary across gender. Models 1 to 3 in Table 5-3 display Poisson regression results when analyzing all male and female respondents after generating gender interaction terms. In model 1, I include variables of *religious denomination*, gender interaction terms, and socioeconomic variables to test hypothesis 4. That is, whether fertility differentials among religious groups vary with gender. As can be seen, the gender interaction terms generated by religious denominations and gender are not significant, indicating fertility differentials among religious groups do not vary substantially between men and women. This supports hypothesis 4, meaning there are no significant gender differences regarding fertility differentials among religious groups, controlling for other factors. In models 2 and 3 of Table 5-3, I test whether the effect of religious participation and religious beliefs on fertility varies with gender after controlling religious denominations, respectively. Neither of the gender interaction terms is observed as significant. This opposes hypotheses 5 and 6, and it implies that stronger religiosity does not appear to increase women's fertility to a greater extent than men's, controlling other factors.

Models 4 through 6 replicate the Poisson estimates of CEB in Models 1 to 3, excluding male respondents who are 25 and younger. There is no strong evidence showing gender differences in terms of religious denominations and religiosity shaping fertility, which is consistent with the findings analyzing all male and female respondents. Comparing the results with and without analyzing younger male respondents, the major differences again lie in the effects of gender and ever married on fertility. It suggests including fertility reports of younger men won't extensively change the estimated relationship between religious variables and fertility.

Table 5-3. Poisson Regression Coefficients for Religious Variables, Gender Interaction Terms and CEB: U.S., 2002

	All Male and Female Respondents			Males 26 + and All Females		
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Religious variables						
Current religious affiliation (ref. = Catholic)						
Fundamentalist Protestant	0.08	0.07	0.06	0.07	0.06	0.05
Other Protestant	0.02	0.01	0.01	0.01	0.00	-0.01
Other non-Christian religion	-0.12	-0.12	-0.11	-0.14	-0.13	-0.12
Religiosity						
Frequency attending religious services		0.02			0.02	
Importance of religious beliefs			0.09***			0.10***
Interaction terms						
Current religious affiliation (ref. = Catholic)						
Fundamentalist Protestant * gender	-0.04	-0.02	-0.04	-0.05	-0.03	-0.04
Other Protestant * gender	0.06	0.08	0.06	0.07	0.08	0.07
Other non-Christian religion * gender	-0.05	-0.04	-0.06	-0.05	-0.04	-0.06
Religiosity						
Frequency attending religious services * gender		-0.02			-0.02	
Importance of religious beliefs * gender			-0.01			-0.04
Demographic factors						
Age	0.06***	0.06***	0.06***	0.05***	0.05***	0.05***
Gender (ref. = male)	-0.15***	-0.12	-0.10	-0.10*	-0.06	0.00
Race (ref. group = Hispanic)						
Hispanic	0.23***	0.23***	0.21***	0.20***	0.20***	0.18***
Non-Hispanic black	0.25***	0.25***	0.23***	0.24***	0.23***	0.21***
Non-Hispanic other	0.21*	0.21*	0.19	0.18	0.18	0.16
If R has ever been married	1.02***	1.02***	1.01***	0.96***	0.96***	0.95***
Socioeconomic factors						
Highest degree R ever earned	-0.07***	-0.07***	-0.07***	-0.07***	-0.07***	-0.07***
Total combined family income	-0.02***	-0.03***	-0.02***	-0.02***	-0.02***	-0.02***
Constant	-1.55***	-1.60***	-1.73***	-1.31***	-1.37***	-1.52***
N	9,759	9,750	9,729	8,638	8,629	8,629
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Sources: derived from NSFG Cycle 6 male and female datasets, 2002.
Note: R refers to respondent. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed tests). Regression results for *nativity* and *ever work* are not reported due to non-significant regression coefficients.

As mentioned earlier, 46 percent of men and 42 percent of women reported having no kids, which may result in a problem of overdispersion, i.e. the variance of CEB is greater than the mean. So I estimate the negative binomial Poisson (NBP) regression models to compare the results with those of the Poisson regression analyses. Comparison results do not show any evidence of overdispersion (findings are not presented here) because the *alpha*s are zero, indicating the NBP regressions reduce to the Poisson regression models. The zero-inflated Poisson regression (ZIP) results without considering sample weights show that religion and religiosity have similar impacts on people who voluntarily choose not to have kids (i.e. the expected CEBs are not always 0) and people who are physically infertile (i.e. the expected CEB are always 0). But, I do find a few distinctions comparing the Poisson and the zero-truncated Poisson (ZTP) regression results (see Appendices A-1 through A-3). First, fertility differences among Catholics and other non-Christian religious groups become not significant in the ZTP models, after controlling for other factors. This echoes the finding that fertility differentials among religious groups are shrinking. This is especially the case when only people who have children are considered. Second, the magnitude of demographic factors, especially marriage, in influencing fertility reduces in the ZTP models compared to that in the Poisson regression models. This finding suggests that marriage is crucial in terms of childbearing. But once childbearing behavior occurs, its significance decreases. A finding from the ZTP models that is worth highlighting is that the results of datasets with and without younger male respondents are almost identical, with the effect of gender being slightly reduced. Such a finding could be due to less variation in fertility behavior among men and women who have already become parents compared to populations that contain unparented population.

The similar finding drawn from the two types of analyses, however, is that the impacts of religious denominations and religiosity on fertility do not vary between men and women. And the importance a respondent places on religious beliefs in his or her daily life has a significant and positive effect on childbearing behavior, regardless whether younger male respondents are excluded from the models. Indeed, the Poisson and ZTP regression results either support or oppose all of my research hypotheses in the same manner.

Conclusion

In this chapter, I shed light on the effects of religious denomination and religiosity on male and female fertility. Mosher and associates (Mosher, Johnson, and Horn 1986; National Center for Health Statistics 2005; Westoff and Jone 1979) have reported a shrinking pattern of fertility differentials among religious groups. My findings reflect this idea by showing no significant fertility differences between fundamentalist Protestants, other Protestants and Catholics. Catholics only show significantly higher level of fertility compared to other non-Christian religious people. And such a fertility differential disappears when childless respondents are dropped from the analyses.

Compared to studies of religious denomination and fertility, religiosity has received far less attention in the literature. The findings demonstrated in this research, however, help to address this shortcoming. I find even after controlling religious denomination and demographic and socioeconomic factors, the importance of religious beliefs still exhibits a graded association with U.S. fertility. This substantially positive effect of religious beliefs on fertility must have something to do with the role of religion in guiding human behavior in terms of the issues of sexuality, cohabitation, marriage and the function of the family. In general, most religious doctrines are linked to delayed sexual debut and entry into cohabitation, and more positive attitudes toward entering marital unions and having children (Bearman and Bruckner 2001; Lehrer 2004; Marchena and Waite 2001). As stated earlier in this chapter, Catholicism encourages large family size and is strongly against abortion. The Mormon theology emphasizes the central role of the family in the religious community. Both Protestants and Mormons have incentives to marry early and are oriented to home-based activities. As a result, deeming such religious beliefs important in daily life makes people more likely to internalize their church teachings and thus to favor a large family size. This perhaps explains why religiosity is influential in terms of both male and female fertility.

I do not find significant effects of religious participation on fertility. In fact, frequent church goers only display a higher level of fertility when demographic and socioeconomic factors are not controlled (findings are not presented here). So it is likely that fertility differences are caused by variation in demographic and socioeconomic factors among religious members rather than their frequency of religious participation. Such a finding echoes the characteristics hypothesis. It suggests that religious beliefs might be a better predictor of fertility than the behavioral dimension.

Compared to women's fertility, men's fertility is impacted by religious denomination, participation and beliefs in a similar manner. It is easy to understand why religious denominations determine men's and women's fertility in a similar way. But it is hard to interpret why religiosity does not show a stronger effect on female than on male fertility, which is the general pattern found in previous studies. One possible explanation for this inconsistency is that previous studies seldom use significance tests to justify whether the effects of religious variables on male and female fertility are different from each other. Different regression coefficients in separate male and female datasets could be caused by non-identical male and female sample sizes and standard errors. Thus, results based on statistical tests which take sample size and standard error into consideration should be more reliable than those not based on such tests. Such statistical methods include generating gender interaction terms and Z statistical tests (Paternoster, Brame, Mazerolle, and Piquero 1998). The stronger effect of religiosity on female fertility observed in previous literature is probably due to the larger regression coefficients estimated in the female models, which indeed have not been statistically compared with those of males. The other possible explanation is that most of the literature cited in the current research is drawn from European societies. The American social context may lead to dissimilar findings with regard to the effect of religiosity on fertility.

Additional research is warranted in this area to contrast religious influences on fertility especially at the national level. I recognize that the measurement of religious denominations and religiosity is very limited in the NSFG dataset. Some important dimensions of religious participation and beliefs are not available in the NSFG dataset and are thus not considered in this research. For example, dimensions of frequency of prayer or meditation, frequency of reading holy books, or beliefs in a God or an afterlife. Future research that includes these variables would improve the religious studies of male and female fertility.

The influence of religion on men's and women's fertility also depends on the social contexts to which religious people belong. Future research could consider community or country level religious variables along with individual level variables to estimate religious influences on men's and women's fertility. In addition, future research could consider examining the interaction effects between religious denominations and religiosity in determining fertility, which has been illustrated by some researchers (Lehrer 2004; Marcum 1988). The interaction effects shown in my preliminary analyses are not significant, which could be due to the limited measurement of religiosity applied in the analyses. Including more sound measurements of religiosity when such data become available would allow us to explore this matter in more detail.

The comparison of the results of Poisson and ZTP regressions of all respondents and respondents excluding younger men do not vary from each other in a notable manner. This suggests that serious underreporting of births among younger men that may exist in the NSFG dataset does not significantly change the results of my religious studies of fertility.

In sum, religion is a very important institution spreading behavioral norms and providing social support for people. My analyses reveal that the fertility gap among religious groups is decreasing, whereas religiosity, especially religious beliefs, demonstrates a significantly positive effect on fertility. Women do not exhibit a substantially greater likelihood of being influenced by either religious denomination or by religiosity than men. Thus, religion does not seem to be a factor that differentiates male and female fertility among the U.S. religious population.

CHAPTER VI

DEMOGRAPHIC, SOCIOECONOMIC CHARACTERISTICS, AND MALE AND FEMALE FERTILTIY

Demographers for many decades have documented that female fertility differentials result from demographic and socioeconomic differentiation. The significant effects of demographic and socioeconomic characteristics on fertility have also been revealed in the previous literature on religion and fertility when these characteristics are treated as control variables. In this chapter, I will present models that compare the impacts of age, racial and ethnic composition, nativity, metropolitan residence, marriage, education, income and employment - central measures in the construction of demographic and socioeconomic factors – on male and female fertility.

Theories and Hypotheses

Demographic Characteristics and Fertility

Among demographic factors, age has been consistently shown in the literature to be correlated with women's overall fertility in a positive manner. It is suggested that this relationship is due to older women having been in childbearing status for a longer period of time than younger women (Coale and Trussell 1974; Wood and Weinstein 1988; Xie and Pimentel 1992). As for men, the age effect on overall fertility has not been empirically tested. Studies have mainly presented a picture of male fertility being less restricted by age than female fertility. For instance, Mineaus and Trussell (1982) examine the age patterns of the 19^{th} century Mormons' fertility and find that age affects the husband's fertility less than the wife's fertility. The analysis of Goldman and

Montgomery (1989) also reveals that before age 35, male aging has little influence on childbearing.

These findings do not necessarily suggest that age does not have an effect on male overall fertility. Instead, I expect that age has a stronger effect on men's overall fertility than on that of women. I believe this to be the case because women start their childbearing earlier and they have a shorter reproductive span compared to men. Ages 15 to 49 are typically the women's childbearing ages (Coale and Tye 1961; Lavely 1986), whereas the reproductive ages of men continue all the way to their 70s (Keyfitz 1977). Men's longer reproductive span and later fertility peak should eventually lead to a stronger cumulative effect of age on male fertility than on female fertility. On the basis of this rationale, my hypotheses predict the age effects on male and female fertility are as follows:

Hypothesis 1: Age has a positive effect on both men's and women's fertility, controlling for other factors. But,

Hypothesis 2: The effect of age on male fertility is stronger than on females.

Besides age, demographers have also documented fertility differentials across U.S. racial and ethnic groups. Most often investigated are Caucasian Americans and Latinos and African Americans. Women of Hispanic origin have been found to exhibit a distinctively higher fertility level than women of any other ethnic group, followed by African American women. Caucasian women are observed to have the lowest fertility rate in the nation (Aneshensel, Fielder, and Becerra 1989; Forste and Tienda 1996; Johnson 1979; Saenz and Morales 2005). These fertility differentials are explained by demographers from a variety of perspectives. For instance, some demographers use the pronatalist cultural norms of Latin countries, and the recent increased number of Latino immigrant population to explain the high fertility rates of Latino women. Others contend that the white-black community environment differences result in the white-black fertility differentials. Additionally, different views about early childbearing and marriage among various racial groups are believed to be the key to understand fertility variation among women with various racial and ethnic background (Forste and Tienda 1996; Saenz 2004; South and Baumer 2000).

Limited research has been done regarding male fertility differentials across racial groups. Bachu's (1996) study of American men's fertility does show that Hispanic origin has a positive effect on American men's fertility. She also finds that differences in fertility between men and women by race among married couples are minimal. But for the never-married population, male and female fertility differences by race have been shown. Black women tend to have a significantly higher level of CEB compared to black men. In other words, being black has a stronger positive effect on female than on male fertility. Based on Bachu's findings, my next two hypotheses are set forth as follows:

Hypothesis 3: Racial differences in fertility are present among both men and women, controlling for other factors. But,

Hypothesis 4: The degree of fertility by racial composition does vary by gender.

In addition to fertility differences among racial groups, the U.S. foreign-born population has been shown to exhibit a higher level of fertility than their U.S.-born counterparts (Bean, Swicegood, and Berg 2000; Hervitz 1985; Jaffe and Cullen 1975;

Kahn 1994; Singley and Landale 1998). This is because the foreign-born population is more likely to come from societies that are less economically-advanced and are high-fertility oriented (Stephen and Bean 1992). The positive influence of nativity on fertility is also shown among American men. Bachu (1996) points out that foreign-born husbands have a fertility higher than that of native-born husbands. Foreign-born husbands' fertility is especially high when they are married to foreign-born wives. But prior literature has not documented fertility differences between men and women in the association of nativity and fertility. So I propose the following hypotheses for testing:

Hypothesis 5: Being foreign-born has a positive effect on both male and female fertility, controlling for other factors. And,

Hypothesis 6: The impact of nativity on fertility does not vary by gender.

In the literature of fertility, residence is also shown to influence people's childbearing behavior. Generally, urban residents display a relatively lower level of fertility than their rural counterparts; people living in central cities tend to have fewer children than people on the fringes of metropolitan areas (Burnight, Whetten, and Waxman 1956; Goldstein and Mayer 1965; Okore 1980). This residential effect on fertility is considered a consequence of delayed childbearing and the preference shown for a smaller family in the process of urbanization and modernization (Robinson 1963; Zeng and Vaupel 1989). In terms of male fertility and residence, men living in central cities also show higher childlessness rates than their counterparts who live in suburban or non-metropolitan areas (Bachu 1996). But fertility differences resulting from place of residence have not been shown to vary by gender. Thus, my hypotheses regarding residence and fertility are as follows:

Hypothesis 7: Residing in urban settings decreases the level of fertility for both men and women, controlling for other factors. And,

Hypothesis 8: Residential fertility differences do not vary depending on gender.

The last demographic characteristic that will be discussed is marital status. A positive association between being married and women's childbearing has been repeatedly found in the literature. Researchers have revealed a strong correlation between early marriage and a higher level of female fertility (Bongaarts 1982; Sanchez 1998; Zeng, Vaupel, and Yashin 1985). They also find that the majority of births occur in marital unions although increased non-marital fertility has been recently witnessed in the U.S. (Mosher, Johnson, and Horn 1986).

Discussions directly addressing the influence of marital status on men's fertility are rarely seen in the literature. However, a few studies do provide some evidence to link marriage and male fertility, through emphasizing different interruption effects of marriage on men's and women's educational career. Studies show that marriage interrupts both men's and women's educational career, with marriage being more detrimental to women's educational careers than men's (Alexander and Reilly 1981; Teachman and Polonko 1988). Since higher education plays an oppressive role on childbearing, it is reasonable to predict that both men's and women's childbearing behavior is somehow augmented by their decremented education caused by marriage. But because marriage has a stronger negative effect on women's educational career, marriage is likely to be associated with lower educational attainment among women than among men. Consequently, lower educational attainment of women caused by marriage results in female fertility to be higher than male fertility. In other words, marriage should have a stronger positive effect on female than on male fertility being mediated by people's educational achievements. On the basis of the above rationale, I state the following two hypotheses:

Hypothesis 9: With everything else being equal, marriage increases both men's and women's fertility. But,

Hypothesis 10: Marriage has a stronger positive effect on female than on male fertility, controlling for other factors.

Socioeconomic Characteristics and Childbearing

Socioeconomic status is also a primary determinant of fertility. Its effect is often discussed and assessed by looking at education, income, and occupational prestige. In terms of the educational impact on fertility, an inverse relationship has been well established in the literature (Anderson 1975b; Jain 1981; Lonon 1992; van de Walle 1980; Weinberger 1987); although a positive association is found in less-developed countries at the lower end of the educational range (Martin 1995). The major mechanisms that enable education to depress fertility include, enhancement of women's power to make reproductive choices, an increase in women's contraceptive use, a delayed age at marriage, and an increased female labor force participation (LFP) rate which reduces women's time for childbearing (Anderson 1975b; Cameron, Dowling, and Worswick 2001; Martin 1995; Rindfuss, Morgan, and Offutt 1996; Weinberger

1987). Education has also been found to influence women's fertility through many other channels. For instance, Kravdal (2002) points out that a higher average educational level in a community inhibits an individual woman's childbearing behavior. Skirbekk and colleagues (2004) illustrate that age at graduation from school can be an important factor that determines the timing of births and marriage. From a longitudinal point of view, the negative relationship between education and fertility is observed to vary at different stages in the life cycle. Rindfuss and colleagues (1980) reveal a reciprocal relationship between education and age at first birth. They emphasize that once the process of childbearing has started, education begins to have an indirect effect on fertility through mediating with age at first birth.

As to men, previous studies have provided some proof with regard to the correlation between their schooling and childbearing. My analyses of Taiwanese fertility have already shown a negative effect of education on men's childbearing, but such an effect is not as strong as on women's fertility a younger ages (see chapter IV). Through analyzing data from 20 countries participating in the World Fertility Surveys (WFS), Rodriguez and Cleland (1981) show similar findings. In Europe, researchers have conducted a series of studies examining male and female transitions to adulthood in 24 countries using survey data for the 1980s and 1990s. Their research confirms the results of previous analyses. Based on these results, education is expected to be more influential in decreasing women's than men's fertility, with everything else being equal. My next two hypotheses are therefore proposed as follows:

Hypothesis 11: Education has a negative correlation with both men's and women's fertility, controlling for other factors. However,

Hypothesis 12: The depressing effect of education on female fertility is stronger than on male fertility.

Other than education, family income has been found to be one of the principal links between socioeconomic status and fertility. Inconsistent findings have been shown regarding the impact of family income on fertility. According to studies analyzing macro-level data, some researchers argue that family income is positively related to fertility (Ben-Porath 1973; Easterlin 1973; Zhang, Poston, and Chang 2007), while others contend that there is a reverse relationship between these two, an increased family income is indeed one of the causes of fertility decline (Freedman and Thornto 1982; Li 1973; Muller and Cohn 1977; Poston 2000). Studies analyzing micro-data seem to support the latter, suggesting family income reduces female fertility (Thornto 1978; Westoff and Ryder 1977). Borg (1989) attempts to resolve the above conflict by demonstrating that the negative effect of income on fertility is disguised by some other factors, such as the net price of a child, the opportunity cost of the wife's time and supply factors, that play a role in income and fertility relation. Once these factors are controlled, the income effect on female fertility is positive and significant.

The income effect on male fertility has not been directly examined in the literature. But previous studies seem to provide some clue of an even stronger positive relationship between family income and male fertility. Freedman and Thornto (1982) show that husband's income has a positive relationship with family size. Butz and Ward

(1979) suggest women's income is negatively related to their childbearing, with the opposite for men's income. Based on these studies, I hypothesize the following:

Hypothesis 13: Family income has a positive effect on both men's and women's fertility, controlling for other factors. But,

Hypothesis 14: Family income has a stronger positive effect on male than on female fertility.

As a crucial socioeconomic variable, employment status has been linked to fertility in a negative manner. A number of studies have shown that increasing women's LFP results in decline (Devaney 1983; Lehrer and Nerlove 1986; Rodrigues and Cleland 1981; Smith-Lovin and Tickamyer 1978; Waite and Stolzenberg 1976). Various theories have been proposed to account for this inverse relationship. The role incompatibility theory argues that mother and worker roles are not compatible in a modern society with an industrialized economy. This is because the bureaucratic occupational structure in such a society does not allow for the flexibility required by childbearing. Moreover, the nuclear family system leaves women no alternatives but to take on the entire burden caring for children themselves (Smith-Lovin and Tickamyer 1978; Watkins 1986). As a result, women who participate in the labor force end up having fewer children. The microeconomic approach explains this inverse relationship from a cost/benefit point of view. With the rise in the costs of childbearing and the opportunity costs for being a mother, the benefits associated with working such as income and prestige outweigh the costs associated with childbearing. Consequently, women choose to have fewer children (Easterlin 1973; Mincer 1963).

Similar to the studies of other socioeconomic factors and fertility, the correlation between employment and male completed fertility has not been well documented. Most studies of men's employment and childbearing focus on examining young men's and women's entry into parenthood. Martin and Stanfors (2006) show that paternity is impacted by their LFP, but such an effect is in a different direction compared to the negative association between maternity and LFP. European studies of unemployment and parenthood transition also suggest that the effect of unemployment is gender-specific. Unemployment leads to men's postponement of marriage, whereas it affects women in two distinct ways. It either accelerates or slows down women's timing of marriage (Corijn and Klijzing 2001). In line with the above findings, I predict employment status has a similar impact on male completed fertility as on their paternity, that is:

Hypothesis 15: Labor Force Participation has significantly different effects on male and female fertility, with a negative effect on female fertility but a positive effect on male fertility.

Data, Methods and Measurements

To test the above hypotheses, I use data from the NSFG Cycle 6 male and female pooled dataset to conduct the analyses. Poisson and zero-truncated Poisson (ZTP) regression models are used as the statistical methods to examine male and female fertility. In terms of the measures of demographic characteristics, *age* is coded as a continuous variable, ranging from 15 to 44 for females and 15 to 45 for males. Respondent's *race and ethnicity* is measured via categorizing the respondent into one of the following four racial and ethnic groups: Hispanic origin, non-Hispanic White, Black and other. Non-Hispanic white is set up as the reference group. *Nativity* is a dummy variable which is coded as 1 if the respondent is foreign born and 0 otherwise. *Residence* is coded as a set of dummy variables, including central city in Metropolitan Statistical Areas (MSAs), other non-central city areas in MSAs, and areas in non-MSAs. The group of respondents who reside in central cities of MSAs is the reference group since they comprise nearly half of the total respondents. *Marital status* is often measured by the current marital status of the respondent, i.e., by placing the respondent into one of the following categories: married, never married, divorced/separate, and widowed. Given that the dependent variable, CEB, is a measure of completed fertility, current marital status may not be able to capture the influence of lifetime marital status on fertility. Thus, I decided to use *number of times the respondent had been married* to represent marital status, which is a continuous variable ranging from 0 to 4 for men and 0 to 5 for women. On average, women have a greater chance to be in a married setting than men (0.70 times for women and 0.62 times for men). In the NSFG dataset, there is another question that asks the respondent's marital status, i.e. if the respondent had ever been married. I did not choose this question as a measure of marriage is because *number of times the respondent had been married* seems to better represent the extent to which the respondent has been exposed to marital settings.

As to the measures of socioeconomic factors, I use the highest degree received to represent the respondent's *educational attainment*. Apparently, the majority of the respondents either have a high school diploma or have received college education.

Family income can be measured in multiple ways. It can be individual or family income, can be continuous or dichotomous; it can also be logged. In this study, family income is measured by total combined gross family income in 2001, which is coded by the NSFG into 14 categories, varying from under $5,000 to $75,000 or more. I here recode it into four categories: under $25,000, $25,000 to $49,999, $50,000 to $74,999 and $75,000 and over. People who had family income more than $75,000 in 2001 are defined as the reference category. There are also multiple measures representing employment status. For example, people can be classified into categories of currently working, unemployed, or not in the labor force. Since I examine how LFP plays a role in determining completed fertility, the ideal measure of employment ought to represent an employment status that occurs before the childbearing behavior took place. In the NSFG dataset, the variable *ever worked full time for more than six months* appears to be the best measure, which is coded as 1 if the respondent ever worked for more than six months and 0 otherwise.

My analyses also statistically control for the proximate determinants, i.e. *age at first sexual intercourse* and *if ever had sterilization operation*. These factors are controlled because they indicate people's biological maturation and the intermediate factors that regulate fertility outcomes (Bongaarts 1982; Miller and Heaton 1991). Ideally, contraceptive use should also be controlled as a proximate determinant. In the NSFG questionnaire, females are asked if they have ever used any birth control methods; however for males, there is no question directly asking such information. Men are asked their contraceptive use history associated with each of their female partners, but the response rates of men for those questions are low. I thus decided not to include contraceptive use as a control variable. Age at menarche could be another control variable as a proximate determinant, indicating biological maturation for females (Miller and Heaton 1991). Since the equivalent measurement for males is not available in the NSFG dataset, this variable is also not included in the analyses. In the study, I also include a variable *gender* to control for the overall gender effect in the equations, which is coded as 1 if male and 0 if female. Table 6-1 presents weighted descriptive estimates of all variables used in the study.

Table 6-1. Descriptive Statistics for Dependent, Independent and Control Variables: U.S., 2002

	Male(All Respondents)			Male (26 and Over)			Female(All Respondents)		
Variables	Mean (or %)	S.E.	N	Mean (or %)	S.E.	N	Mean (or %)	S. E.	N
Dependent variable									
CEB	1.2	0.04	4,117	1.5	0.04	2,126	1.3*	0.03	7,642
Independent variables									
<u>*Demographic factors*</u>									
Age (mean)	29.8	0.23	4,927	35.3	0.16	2,744	30.0	0.17	7,643
15 to 19	16.7						16.0		
20 to 24	16.2						16.0		
25 to 29	15.1						15.0		
30 to 34	16.6						16.7		
35 to 39	173						17.6		
40 to 44/45	18.2						18.7		
Race			4,927			2,744			7,643
Hispanic	16.7			16.2			14.8		
Non-Hispanic white	65.4			67.0			64.7		
Non-Hispanic black	11.9			10.9			14.0		
Non-Hispanic other	6.03			5.9			5.6		
Nativity-if foreign born			4,925			2,733			7,643
Native born	84.7			83.3			85.7		
Foreign born	15.3			16.7			14.3		
Metropolitan residence			4,927			2,744			7,643
MSA, central city	48.0			48.4			49.0		
MSA, other	33.3			32.4			33.3		
Not MSA	18.6			19.2			17.7		
Number of times R married	0.62	0.02	4,927	0.9	0.02	2,744	0.70	0.02	7,643

Table 6-1 Continued

Variables	Male(All Respondents)			Male (26 and Over)			Female(All Respondents)		
	Mean (or %)	S.E.	N	Mean (or %)	S.E.	N	Mean (or %)	S. E.	N
Socioeconomic factors									
Education			4,927			2,744			7,643
No diploma	22.9			15.6			21.2		
High school or less	31.5			33.5			28.3		
Some college/college	26.1			25.7			30.4		
University and above	19.5			25.3			20.1		
If R ever worked full time for 6+ months			4,925			2,742			7,636
Yes	79.1			96.7			74.1		
No	20.9			3.3			25.9		
Combined family income			4,927			2,744			7,643
Under $25,000	27.4			23.2			33.1		
$25,000 to $49,999	33.3			35.4			30.3		
$50,000 to $ 74,999	18.5			19.7			18.9		
$75,000 and over	20.8			21.8			17.7		
Proximate determinants									
Age at 1st sexual intercourse	17.0	0.08	4,108	17.4	0.1	2,612	17.3	0.06	6,785
If R ever had sterilization operation			4,925			2,742			7,643
Yes	6.4			9.8			18.2		
No	93.6			90.2			81.8		

Sources: derived from NSFG Cycle6 male and female datasets, 2002.
Note: some sub-categories may not add up to 100% due to rounding. * The CEB value for women who are 26 and over is 1.8 with a standard error of 0.04.

Results

I now examine the effects of demographic and socioeconomic factors on male and female fertility. Table 6-2 focuses on the association between demographic factors and childbearing, along with the gender interaction terms. Controlling only for gender and proximate determinants, model 1 shows that with increasing age, the average expected level of CEB also increases significantly. The significant interaction term of age and gender is clear evidence here for different magnitudes of age on male and female fertility. On average, the expected level of CEB for women increases by 5 percent ($e^{0.05}$) with every one year increase in age. However, being a man raises the average expected level of CEB by 7 percent ($e^{0.05+\ 0.02}$). These findings indicate a positive and greater impact of age on men's completed fertility than on that of women's completed fertility, which corroborate hypotheses 1 and 2.

Model 2 replaces age with variables representing the racial composition of the respondent. Model 2 shows that among the four racial groups, Hispanics' fertility is the highest, followed by that of blacks. Compared to non-Hispanic whites, being a Hispanic increases the expected level of CEB by 38 percent ($e^{0.32}$), being an African American multiplies the expected CEB level by a factor of 1.27 ($e^{0.24}$). Completed fertility of non-Hispanic whites and other racial groups does not show significant differentiation. The non-significant interaction terms between gender and racial variables indicate that fertility differences resulting from racial composition do not vary by gender. These results strengthen my hypothesis 3 but undermines hypothesis 4.

Model 3 examines nativity and male and female fertility. It shows that foreign-born individuals tend to have a greater number of children compared to their native-born counterparts. However, fertility differentials between men and women do not vary significantly across gender, which offers support for hypotheses 5 and 6. Models 4 and 5 further investigate the effects of residence and marital status on fertility, respectively. Unexpectedly, the CEB of respondents in non-central city areas is 10 percent ($e^{-0.10}$) lower than that of respondents who reside in central cities of MSAs. The fertility of respondents in non-MSAs does not show a significant difference compared to that of respondents living in MSA central cities. Men and women do not exhibit significant differentiation with regard to residential differences in fertility (see model 4). These results challenge hypothesis 7 but support hypothesis 8. Marriage, on the other hand, turns to be crucial in amplifying both men's and women's fertility, with a stronger impact on male than on female CEB. On average, with every one additional marriage, men's expected CEB is multiplied by a factor of 1.71 ($e^{0.31+0.23}$). Whereas for women, their expected CEB is only increased by 26 percent ($e^{0.23}$). These results confirm my hypothesis 9 but undermine hypothesis 10.

Model 6 combines all demographic characteristics, gender interaction terms, and control variables into one regression model. The Poisson regression results in model 6 are generally consistent with findings presented in the separate regression models. The effect of racial composition on fertility seems to be increased in the combined model. Fertility differences between non-Hispanic whites and other non-Hispanic racial groups become significant in model 6, while not significant in model 1. This is probably caused by a certain extent of correlation between racial composition and other demographic and control variables. Nativity exhibits significant influence on fertility in model 1, but such an effect disappears once other demographic variables and gender interaction terms are included in model 6. This eventually undermines hypothesis 5. The marriage variable shows a weaker impact on fertility and especially male fertility in model 6 than in model 5. This is perhaps because the marriage effect on fertility is oppressed by some of the other demographic characteristics. Thus, except for hypothesis 5, results in the combined model do not challenge the general findings of hypotheses testing in this study.

Table 6-2. Poisson Regression Coefficients for Demographic Factors, Gender Interaction Terms and CEB: All Male and Female Respondents, 2002

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Demographic factors						
Age	0.05***					0.05***
Gender (ref. = male)	-1.03***	-0.20***	-0.16***	-0.15***	-0.39***	-0.93***
Race (ref. group = Hispanic)						
Hispanic		0.25***				0.32***
Non-Hispanic black		0.10*				0.24***
Non-Hispanic other		0.10				0.18*
If foreign born			0.25***			0.04
Metropolitan residence (ref. = yes)						
MSA, central city				-		-
MSA, other				-0.10*		-0.09
Not MSA				-0.03		0.04
Number of times R has been married					0.31***	0.18***
Gender interaction terms						
Age * male	0.02***					0.02***
Race (ref. group = Hispanic)						
Hispanic * male		0.03				0.14
Non-Hispanic black * male		0.12				0.07
Non-Hispanic other * male		0.22				0.21
If foreign born * male			-0.04			-0.05
Metropolitan residence (ref. = MSA, central city)						
MSA, other * male				-0.07		-0.03
Not MSA * male				0.04		-0.08
Number of times R has been married * male					0.23***	0.16**
Socioeconomic factors						
Highest degree R ever earned	–0.08***	–0.06***	–0.07***	–0.07***	–0.07***	–0.06***
Total combined family income	–0.01**	0.00	–0.01	–0.01	–0.01**	–0.01**
If R ever worked full time for 6+ months	0.22***	0.70***	0.71***	0.69***	0.48***	0.20**
Proximate determinant						
Age at 1st sexual intercourse	-0.02***	-0.01*	-0.01**	-0.01	-0.01	-0.02***
If R ever had sterilization operation	0.36***	0.73***	0.74***	0.72***	0.52***	0.33***
Constant	-0.38***	0.25***	0.38***	0.48***	0.42***	-0.60***
N	10,877	10,877	10,850	10,877	10,877	10,850
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Sources: derived from NSFG Cycle 6 Male and Female Dataset, 2002.
Note: R refers to respondent. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed tests).

Considering the birth underreporting issue that may exists among younger men, I also conduct similar analyses that are restricted to female respondents and male respondents who are 26 and over. Table 6-3 presents the corresponding results based on Poisson regressions. For the most part, the results presented in Table 6-3 are consistent with the findings presented in Table 6-2, with the effect of marriage being slightly decreased for male fertility. Compared to findings in Table 6-2, the most significant difference lies in the effect of age on male and female fertility. Although age still has a positive relation with fertility, its magnitude in increasing male fertility declines in Table 6-3. Indeed, age shows a stronger effect on female than on male fertility. On average, with every on year increase in age, the expected level of female CEB is increased by 5 percent ($e^{0.05}$), but the CEB of males is only raised by 2 percent ($e^{0.05-0.02}$) (see model 6).

Why might excluding younger men change the results of the age and fertility relationship based on gender? The underreporting of births among younger men could be one explanation, which leads to the number of children reported by younger men being significantly fewer than that of the relatively older male population. This may indeed result in the strong positive effect of age on fertility among males. However, because excluding younger men does not significantly change the results estimated by using other demographic variables, underreporting may not be the real reason that has caused the discrepancy. There might be another more plausible explanation that deals with the patterns of male and female age-specific fertility. That is, as discussed earlier, the later peak of male fertility results in a quite low age-specific fertility in younger male groups. As a result, when the groups of younger men are included in the analyses, the age effect becomes stronger among men than among women. Thus, whether hypothesis 2 is supported depends upon the age distribution of males and females in the population. The general conclusion here is that except for the age effect on fertility, including younger men into the analyses will not significantly change the estimation results of completed fertility determined by demographic characteristics.

Table 6-3. Poisson Regression Coefficients for Demographic Factors, Gender Interaction Terms and CEB: All Females and Males 26 and Over, 2002

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Demographic factors						
Age	0.06***					0.05***
Gender (ref. = male)	0.34	0.01	0.07	0.07	0.02	0.34
Race (ref. group = Hispanic)						
Hispanic		0.21***				0.30***
Non-Hispanic black		0.09*				0.24***
Non-Hispanic other		0.08				0.18**
If foreign born			0.21***			0.02
Metropolitan residence (ref. = yes)						
MSA, central city				-		-
MSA, other				-0.12*		-0.09*
Not MSA				-0.05		0.03
Number of times R has been married					0.33***	0.18***
Gender interaction terms						
Age * male	-0.01***					-0.02***
Race (ref. group = Hispanic)						
Hispanic * male		0.09				0.08
Non-Hispanic black * male		0.18*				0.05
Non-Hispanic other * male		0.22				0.18
If foreign born * male			-0.04			-0.04
Metropolitan residence (ref. = MSA, central city)						
MSA, other * male				-0.01		-0.02
Not MSA * male				0.01		-0.10
Number of times R has been married * male					0.02	0.13**
Socioeconomic factors						
Highest degree R ever earned	–0.08***	–0.07***	–0.07***	–0.08***	–0.07***	–0.06***
Total combined family income	–0.01**	0.00	–0.01	–0.01	–0.01**	–0.01**
If R ever worked full time for 6+ months	0.07	0.40***	0.41***	0.40***	0.25***	0.20**
Proximate determinant						
Age at 1st sexual intercourse	-0.02***	-0.01**	-0.02**	-0.01*	-0.01*	-0.02***
If R ever had sterilization operation	0.37***	0.67***	0.67***	0.65***	0.50***	0.33***
Constant	-0.35***	0.68***	0.80***	0.90***	0.68***	-0.61***

Table 6-3 Continued

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
N	9,390	9,390	9,366	9,390	9,390	9,366
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Sources: derived from NSFG Cycle 6 Male and Female Dataset, 2002.
Note: R refers to respondent. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed tests).

The remaining component of the analyses concentrates on examining the influence of socioeconomic factors. Model 1 in Table 6-4 includes the education variables with respondents who had college degrees as the reference group. Because socioeconomic status is affected by demographic characteristics, I control for demographic factors along with the proximate determinants. Education exhibits a negative effect on fertility. As it is shown in the model, compared to the CEB of respondents with college degrees, the expected CEBs of respondents with no diploma and with high school diploma are increased by 39 percent ($e^{0.33}$) and 16 percent ($e^{0.15}$), respectively. However, the expected CEB of respondents who have a university degree is decreased by 12 percent ($e^{-0.13}$) compared to the reference group. This depressing effect of education on fertility reinforces my hypothesis 11. But hypothesis 12 regarding male and female fertility differentials appears not to be supported by the empirical findings, considering the non-significant interaction terms between gender and education variables.

In model 2 of Table 6-4, I replace the education variables with income variables. Total combined family income shows a negative effect on fertility. Additionally, the negative effect is stronger on women's than on men's fertility. To illustrate, compared to respondents who had combined family income in 2001 over $75,000, the expected CEB for women who reported lower than $25,000 family income is increased by 27 percent ($e^{0.24}$). But for men, their corresponding CEB level is only increased by eight percent ($e^{0.24-0.16}$). These results support both hypotheses 13 and 14.

The effect of ever working full time for more than six months in model 3 shows a much stronger positive impact on male than on female fertility. On average, the CEB of men who ever worked full time for more than six months is twice ($e^{0.77-0.06}$) as high as the CEB of men who did not have such a working experience. For women, the effect of LFP seems to be negative but not significant. So the finding partly supports hypothesis 15, i.e., LFP has a stronger and positive effect on male fertility, but the expectation of a significantly negative association between LFP and female fertility is not validated by the results.

After I combined all the socioeconomic characteristics and the gender interaction terms in model 4, I find that the results regarding education and employment based on separate models generally persist in the combined model, with slightly decreased effects of educational and income variables on fertility. Interestingly, the significant fertility difference across gender shown in the relation of income and fertility in model 2 disappears in model 4. This suggests that controlling for other socioeconomic factors along with the gender interaction effects with other socioeconomic variables eliminates fertility differences across gender that are caused by income inequality. This ultimately undermines hypothesis 14.

Table 6-4. Poisson Regression Coefficients for Socioeconomic Factors, Gender Interaction Terms and CEB: All Male and Female Respondents, 2002

Variables	Model 1	Model 2	Model 3	Model 4
Socioeconomic factors				
Highest degree R ever earned				
No diploma	0.33***			0.28***
High school or less	0.15***			0.14***
Some college/college	-			-
University and above	-0.13**			-0.12**
Combined family income				
Under $25,000		0.24***		0.13**
$25,000 to $49,999		0.05		-0.03
$50,000 to $74,999		-0.04		-0.06
$75,000 and over		-		-
If R ever worked full time for 6+ months (ref. = yes)			-0.06	0.03
Gender interaction terms				
Highest degree R ever earned				
No diploma * male	-0.02			0.07
High school or less * male	0.05			0.05
Some college/college * male	-			-
University and above * male	0.07			0.01
Combined family income				
Under $25,000 * male		-0.16*		-0.16
$25,000 to $49,999 * male		-0.02		-0.06
$50,000 to $ 74,999 * male		0.03		-0.00
$75,000 and over * male		-		
If R ever worked full time for 6+ months * male			0.77***	0.73***
Demographic factors				
Age	0.06***	0.05***	0.05***	0.05***
Gender (ref. = male)	-0.22***	-0.12	-0.90***	-0.85***
Race (ref. Group = Hispanic)				
Hispanic	0.39***	0.45***	0.48***	0.38***
Non-Hispanic black	0.29***	0.30***	0.34***	0.28***
Non-Hispanic other	0.30***	0.27***	0.29***	0.30***
If foreign born	0.02	0.04	0.06	0.01
Metropolitan residence (ref. = MSA, central city)				
MSA, other	-0.10*	-0.11*	-0.10*	-0.10*
Not MSA	0.03	0.05	0.08	0.02
Number of times R has been married	0.26***	0.27***	0.26***	0.26***
Proximate determinant				
Age at 1st sexual intercourse	-0.02***	-0.03***	-0.03***	-0.02***
If R ever had sterilization operation	0.30***	0.32***	0.34***	0.30***
Constant	–1.59***	–1.48***	–1.20***	–1.53***
N	10,852	10,852	10,850	10,850
Prob > F	0.0000	0.0000	0.0000	0.0000

Sources: derived from NSFG Cycle 6 male and female dataset, 2002.
Note: R refers to respondent. * p < 0.05, ** p < 0.01, *** p < 0.001 (two-tailed tests).

I now replicate the statistical procedures shown in Table 6-4 but eliminate males 25 and younger. The Poisson regression results are presented in Table 6-5. Compared to results based on analyzing all male and female respondents, significant male and female fertility differentials show up again in the relationship of family income and fertility. However, the differentials disappear in the combined model with respect to the association of LFP and fertility. In the family income and fertility relationship, interestingly, after excluding males 25 and younger, family income shows a negative effect on female fertility, but a positive effect on male fertility. To illustrate, compared to the CEB of respondents with over $75,000 combined family income, the expected CEB of male respondents who had family income under $25,000 is decreased by 7 percent ($e^{0.11-0.18}$). But for women with the same family income, their expected CEB is increased by 12 percent ($e^{0.11}$). These results suggest an increased family income indeed leads to a relatively higher fertility for men and lower fertility for women, which confirm both of my hypotheses about the income impact on fertility. The most remarkable finding here is that the effect of LFP does not vary by gender, and the main effect of LFP on fertility also turns to be non-significant. These results undermine my last hypothesis about LFP and fertility. I need to point out that I also ran Poisson regression models that included all demographic and socioeconomic variables as well as the gender interaction effects (results are not shown). I find that except for the effect of racial composition on fertility, results of including all variables are quite consistent with those shown in Table 6-5. Regarding the racial effect, compared to Caucasian men, being a Hispanic man increases his expected CEB by 60 percent ($e^{0.31+0.16}$); whereas being a Hispanic woman only multiplies her expected CEB by 36 percent ($e^{0.31}$) compared to Caucasian women. This finding supports hypothesis 4, suggesting that the fertility differentials by ethnicity do interact with gender.

Table 6-5. Poisson Regression Coefficients for Socioeconomic Factors, Gender Interaction Terms and CEB: All Male and Female Respondents, 2002

Variables	Model 1	Model 2	Model 3	Model 4
Socioeconomic factors				
Highest degree R ever earned				
No diploma	0.30***			0.28***
High school or less	0.15***			0.14***
Some college/college	-			-
University and above	-0.13**			-0.12**
Combined family income				
Under $25,000		0.21***		0.11**
$25,000 to $49,999		0.04		-0.03
$50,000 to $74,999		-0.04		-0.06
$75,000 and over		-		-
If R ever worked full time for 6+ months (ref. = yes)			-0.01	0.09
Gender interaction terms				
Highest degree R ever earned				
No diploma * male	0.02			0.07
High school or less * male	-0.01			0.01
Some college/college * male	-			-
University and above * male	-0.03			-0.06
Combined family income				
Under $25,000 * male		-0.12*		-0.18*
$25,000 to $49,999 * male		-0.02		-0.08
$50,000 to $ 74,999 * male		0.03		-0.01
$75,000 and over * male		-		
If R ever worked full time for 6+ months * male			-0.14	-0.18
Demographic factors				
Age	0.04***	0.04***	0.04***	0.04***
Gender (ref. = male)	-0.08	-0.03	0.06	0.17
Race (ref. group = Hispanic)				
Hispanic	0.36***	0.452***	0.45***	0.35***
Non-Hispanic black	0.28***	0.30***	0.32***	0.27***
Non-Hispanic other	0.27***	0.24***	0.25***	0.27***
If foreign born	0.02	0.04	0.06	0.02
Metropolitan residence (ref. = MSA, central city)				
MSA, other	-0.09*	-0.11*	-0.10*	-0.09*
Not MSA	0.01	0.04	0.06	0.01
Number of times R has been married	0.23***	0.25***	0.25***	0.24***

Table 6-5 Continued

Variables	Model 1	Model 2	Model 3	Model 4
Proximate determinant				
Age at 1st sexual intercourse	-0.02***	-0.03***	-0.03***	-0.02***
If R ever had sterilization operation	0.34***	0.36***	0.37***	0.33***
Constant	–1.17***	–1.06***	–0.94***	–1.24***
N	9,368	9,368	9,366	9,366
Prob > F	0.0000	0.0000	0.0000	0.0000

Sources: derived from NSFG Cycle 6 male and female dataset, 2002.
Note: R refers to respondent. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed tests).

In the end, I conducted the ZTP regression models to compare the results with those of the Poisson regressions (see Appendices B-1 and B-2). Results show that removing male respondents 25 and over does not significantly change the regression results in the ZTP models. However, excluding respondents without children does change the effects of some demographic and socioeconomic factors on fertility. The most significant changes exist in the relationships of Hispanic origin, education and fertility. To illustrate, when respondents with children are compared to all respondents, Hispanic origin shows a significantly stronger effect on men's than on women's CEB. That is, compared to a Caucasian man, being a Hispanic man multiplies men's average expected CEB level by a factor of 1.35 ($e^{0.12+0.18}$). But compared to a Caucasian woman, being a Hispanic woman only increases women's CEB by a factor of 1.13 ($e^{0.12}$). This finding is consistent with the findings when analyzing all male and female respondents, and all demographic and socioeconomic variables, as well as the gender interaction effects are considered. The ZTP results also differ from those of the Poisson regression models in terms of the effect of education on fertility. That is, fertility differentials between people who have college degrees and who have bachelor's or higher level degrees disappear. Results based on the ZTP models eventually support hypothesis 4.

Conclusion and Discussion

In this chapter, I have examined how demographic and socioeconomic factors influence male fertility and distinguish the effects on male fertility from those on female fertility. I find that among demographic characteristics, age, racial composition marital status, and income have significantly different impacts on men's and women's fertility. Controlling for other factors, age significantly increases both male and female fertility, with age exhibiting a stronger effect on men's than on women's fertility when male and female respondents who are 15 to 44/45 are analyzed. But when males 25 and younger are eliminated from the analyses, age tends to have a stronger effect on women's than on men's fertility. I conclude that male and female fertility differentials caused by age are in large part due to the age distributions of males and females in a certain population. When similar numbers of males and females are distributed into various age groups, age should have a stronger positive effect on male than on female fertility.

Regarding the relationship between race and fertility, fertility differentials resulting from racial composition exist among both U.S. men and women. Race and ethnicity does not have significantly different impacts on men's and women's fertility until the interaction terms between gender and socioeconomic status are included in the models. This finding could be a statistical artifact because the variables and interaction terms are interrelated, one variable raises the importance of the other; or the results may have other meanings. If so, the result contains an important implication. That is, the cross gender racial effects on fertility depend on the interaction effects between gender and socioeconomic variables.

Marriage shows a consistently positive effect on men's and women's fertility, with a stronger impact on male than on female fertility. I expected the opposite pattern should be true, i.e., marriage should be more influential for female than for male fertility. The discrepancy could be due to the underreporting of non-marital births by men. Bachu (1996) indicates that underreporting of births in non-martial unions happens more frequently among men than among women. Whether underreporting of births by men has resulted in a stronger effect of marriage on male than on female fertility deserves further investigation. Another possible explanation for male and female fertility differentiation in the marriage and fertility association is that compared to women, the bearing and rearing of children in marital unions are perhaps more important for men. Men are probably more likely to have births after marriage, and when non-marital births occur, they may be more inclined to legitimate their births than women. Other demographic factors such as nativity and place of residence do not show significantly different effects on male and female fertility, which is consistent with my hypotheses.

In terms of the association between socioeconomic characteristics and fertility, education regulates fertility without showing significantly different impacts on male and female fertility. This is partly contradictory to my prediction because I expected education to generally oppress female fertility to a greater extent than male fertility. The finding based on this study probably suggests that in societies such as in the U.S. where gender inequality is perhaps less severe, the distinguishing effect of education on male and female fertility disappears. But fertility variation by gender caused by educational attainment may occur in societies with a greater level of gender inequality. Future research needs to conduct individual analyses with data from developing countries.

Family income first served as a depressing factor of fertility, with a stronger negative effect on women than on men. After controlling for the demographic characteristics, socioeconomic factors, and interaction effects between gender and other variables, the direction of family income on fertility changed. Family income showed a positive effect on male fertility, but a negative effect on female fertility. This result can perhaps be explained by the fact that people with higher family income are more likely to be in prestigious positions, which generate a greater extent of role conflict between work and childbearing for women. But for men, being in a prestigious position makes them more competitive in the marriage market and thus successful in childbearing and rearing. In the family income and fertility relationship, I have not controlled for factors such as costs of children, the opportunity cost of the wife's time, and supply factors that play a role in income and fertility relation. Further research needs to take these factors into consideration.

Despite the frequent emphasis in the literature about the relevance of LFP for women's fertility, I find such a factor to have a much stronger impact for men. This significant difference of LFP on male and female fertility, however, disappears when all demographic, socioeconomic, and interaction effects of gender and demographic and socioeconomic characteristics are taken into consideration. This could be due to a statistical artifact. If not, it requires some better measure of employment or has something to do with the changing institutional context of low fertility in the U.S. It has eased the incompatibility between mother and worker roles and made the negative association of LFP and fertility non-significant for women (Rindfuss, Guzzo, and Morgan 2003). But this does not provide a sound explanation for the non-significant effect of employment on men's fertility. Furthers research needs to use more employment variables to test this relationship, not only on completed fertility, but also on other measures of fertility.

The limitations associated with this research are mainly the problems caused by measurement difficulties and lack of important control variables, which may result in the non-significant effects of some independent variables. For example, nativity is measured here by place of birth which does not take the assimilation process into consideration. Duration of residence in the U.S. might be a better measure. While examining the effect of age on male fertility, age of the male respondent's female partner is not controlled, which may have an interaction with male age and in turn influence male fertility. Also, the marital status of men's female partners is not controlled, which has been shown to be important in previous research (Levin and O'Hara 1978). Future research could develop more appropriate measures and control variables to improve studies of male fertility.

CHAPTER VII

COHABITATION, SEXUAL EXPERIENCE, AND MEN'S AND WOMEN'S CHILDBEARING

In this chapter, I explore the links between cohabitation, sexual experience, and men's and women's childbearing behavior. During the past few decades, the number of unmarried partner households has increased dramatically in the U.S. In the mid 1970s, only 7 percent of women reported cohabitation experience by the age of 25. In the later 1980s, there were already two-fifths of married individuals living in informal unions before they entered marriage. By 1995, around half of the U.S. women aged 25 to 29 had cohabitation experience (Bumpass and Sweet 1989; Bumpass and Lu 2000). Cohabitation seems to be more acceptable today in the U.S. society. Indeed, by the mid 1990s, American high school senior students even considered cohabitation as a "good idea" (Raley 2001: 59).

Along with the increasing proportion of cohabitants in the U.S., there is also a marked shift in people's sexual experience. This shift is indicated by the occurrence of sexual activity during early adolescence and the practice of multiple sexual partners in one's lifetime. As a result, a high teenage pregnancy rate and a prevalence of multipartnered fertility are part of current trends in marriage and family in the U.S. (Alan Guttmacher Institute 1994; Browning, Leventhal, and Brook-Gunn 2004; Carlson and Furstenberg 2006; Cooksey, Rindfuss, and Guikey 1996; Harknett and Knab 2007).

Recognizing these changes, researchers have attempted to understand the roles of cohabitation and sexual experience in the American family system. Most recent research on the topic of cohabitation has been geared toward an exploration of the factors influencing the outcome of cohabiting (Berrington 2001a; Heuveline and Timberlake 2004; Manning 1993; Manning 2001; Phillips and Sweeney 2005; Qian, Lichter, and Mellott 2005; Steele, Kalis, and Joshi 2006; Wu 1996), the determinants of cohabiting women's childbearing (Wu 1996), and the influence of cohabitation on the timing of first birth and the pace of family formation (Manning 1993; Manning 1995). Regarding the studies of sexual experience, many have concentrated on examining the determinants of age at first sexual intercourse, race and gender differences in the odds of experiencing early sexual activity, and problems associated with early sexual intercourse. These problems are such as ineffective contraceptive use, exposure to transmitted sexual diseases and unwanted fertility (Alexander, Ensmiger, Kim, Smth, Johnson, and Dolan 1989; Browning, Leventhal, and Brook-Gunn 2004; Rosenthal, M.A., and de Visser 1999; Singh, Wulf, Samara, and Cuca 2000; Sonenstein, Pleck, and Ku 1989).

One limitation of the above studies is that they seldom pay attention to the contribution of cohabitation and sexual experience to overall fertility outcomes in American families. As an important dimension of the family system, childbearing and childrearing behavior must have a certain correlation with people's sexual experience and patterns of coresidence with their sexual partners. Thus, it is necessary to know how fertility behavior is shaped in the situation of increased cohabiting couples and mulitpartnered relationships. The other weakness of previous literature is that even though some analyses have addressed the influence of cohabitation and early sexual activity on fertility, most are very female oriented. They have rarely compared the manners in which sexual experience and cohabitation determine men's and women's fertility. Thus, the objectives of this chapter are to determine the following: first, whether cohabitation has an effect on fertility outcomes, specifically, whether people who have ever cohabited and who have greater number of cohabitation partners are more likely to have more children. Second, whether sexual experience influences childbearing behavior. That is, whether people who start their sexual activity in younger ages and who experience a greater number of sexual partners tend to have more children. Last, whether the effects of cohabitation and sexual experience on men's and women's childbearing behavior differ.

Linking Cohabitation and Sexual Experience to Fertility

Previous studies link cohabitation and fertility by comparing the fertility level of cohabitants to that of married couples and not-cohabiting singles. Some researchers contend that cohabitation may have a negative effect on fertility given the application of contraception and the low expectation of childbearing in cohabiting unions (Bachrach 1987; Manning 1995). Also, cohabitation is often associated with less traditional points of view towards marriage and childbearing (Axinn and Thornto 1992). So cohabitants are more likely to delay their entry into marriage and also postpone childbearing.

This argument is, however, attacked by other researchers who expect cohabitation to have a positive effect on fertility. These researchers argue that cohabitants are exposed to a marriage-like setting in which sexual frequency and risk of pregnancy are high. They are therefore more likely to have a greater number of children. Moreover, cohabitants may enter into marriage earlier than people who have never cohabited because women who are pregnant in cohabiting unions are more inclined to legitimate their first births than women who are not cohabiting (Manning 1993). Entering into marriage would further augment the level of their fertility given that marriage has a positive effect on childbearing, a finding shown repeatedly in the literature (Bongaarts 1982; Sanchez 1998; Zeng, Vaupel, and Yashin 1985). The assumption of a positive relation between cohabitation and childbearing is indeed supported by empirical analyses. For instance, Bachrach (1987) finds that cohabiting women have a higher expected rate of fertility than non-cohabiting singles. Manning's (1993) research on pregnancies between 1970 and 1984 also demonstrates that pregnant cohabitants have higher rates of marriage than pregnant singles.

Evidence corroborating this positive effect of cohabitation on fertility also comes from the analyses of fertility among married couples and cohabitants. Researchers find that cohabitants' fertility was once lower than that of married couples; but it then began to catch up to that of marital fertility. As Rindfuss and VandenHeuvel (1990) find, in the late 1970s, by age 25, cohabitants' fertility was more similar to singles than married couples. Examining the 1982 wave of the NSFG, Bachrach (1987) also finds a lower fertility level among cohabiting couples than married couples. Similar findings are reported in the literature examining marital fertility in European countries as well (Blanc 1984; Carlson 1986). Moving towards the late 1980s, however, the number of births to cohabitants is found to be nearer that of married couples. Raley (2001) examines the 1995 NSFG dataset and the 1987-1988 National Survey of Families and Households (NSFH) and indicates that there is an increasing similarity in cohabiting and married couples' childbearing, which is explained by the increasing proportions of women who bear children outside of marriage, especially in cohabiting unions (Bumpass and Sweet 1989; Cherlin 1992).

Taken together, prior literature and empirical evidence seem to suggest that cohabitation is a push factor for fertility. This is especially the case in recent decades when non-marital fertility is high and cohabitation has become an alternative to marriage with regard to childbearing. Thus, I propose the following hypothesis:

Hypothesis 1: Cohabitation has a positive effect on fertility outcomes, controlling for all the other factors.

Since cohabitation is predicted to have a positive effect on fertility, I further expect that people who expose themselves to cohabitating unions more often, i.e., having a greater number of cohabitation partners, are more likely to have more children. Thus, my next hypothesis is as follows:

Hypothesis 2: The number of cohabitation partners is positively related to fertility, holding all the other variables constant.

In terms of the fertility differentials among men and women in the relation of cohabitation and childbearing, prior literature has not provided direct evidence. Previous studies have mainly focused on comparing the impact of children on men's and women's entry into marital and cohabiting unions and on the union's stability (Berrington 2001a; Stewart, Manning, and Smock 2003). Researchers have found that nonresidential children influence men's union formation in a positive way, with the opposite for women. But the gender differences exhibited in the relationship of children and partnership stability is believed to be artificial, which is in fact caused by the incomplete reporting of births among men (Berrington 2001a). Given that previous literature has not shown significant gender differences with respect to cohabitation and fertility, I propose the following hypotheses:

Hypothesis 3: The effect of cohabitation on fertility does not vary by gender, controlling for all the other factors. And,

Hypothesis 4: Male and female fertility differentials in the relationship of number of cohabitation partners and fertility are not significant.

As to the influence of sexual experience on fertility, researchers have suggested a positive relationship between early sexual initiation and childbearing. They have found that early sexual intercourse is often associated with a high risk of unintended pregnancy due to the lack of using contraception (Hayes 1987; Mosher and McNally 1991). Women who begin sexual activity at younger ages also tend to have a high premarital childbearing rate and are more likely to marry young (Miller and Heaton 1991). Furthermore, the heterosexual intimacy created by early sexual activity (Thornto 1990) may also hasten the timing of first birth and entry into marriage (Miller and Heaton 1991). Based on these finings, I set forth my next hypothesis as follows:

Hypothesis 5: Age at first sexual intercourse is negatively related to fertility, holding all the other factors constant. In other words, early sexual activity has a positive effect on fertility.

In this chapter, I am also interested in examining whether having multiple sexual partners in one's lifetime increases the number of children ever born. This has not been addressed in the previous literature. I admit that, to a certain extent, the number of sexual partners overlaps with the number of cohabitation partners. But on the other hand, cohabitation exposes people to a greater risk of having children due to its family-like setting and the longer duration of partner relationship. Thus, it is necessary to distinguish the effect of sexual partners and the effect of cohabitation partners on fertility. Following the similar arguments about the influence of cohabitation partners on fertility, having multiple sexual partners is expected to be a push factor for fertility with other things being equal. So my next hypothesis is as follows:

Hypothesis 6: The number of lifetime sexual partners is positively related to childbearing, controlling for other factors.

With regard to the gender differences in the patterns of age at first sexual intercourse and childbearing, I expect that early sexual activity to have a stronger positive effect on women's than on men's fertility. This is because although researchers report that men tend to have higher odds of having early sexual activity than females and are more likely to initiate first sexual intercourse before marriage (Alexander et al. 1989; Singh, Wulf, Samara, and Cuca 2000), women are more likely to be influenced by early sexual activity. It is found that age at first birth caused by early sexual activity is more critical for women than for men, given more barriers could be set up to women's educational and occupational outcomes (Miller and Heaton 1991; Rosenfeld 1980). Lower educational and occupational achievements caused by having early sexual activity in turn lead to a stronger positive effect on women's than on men's fertility outcomes (Dribe and Stanfors 2006; Smith-Lovin and Tickamyer 1978). Based on this rationale, I set forth the following hypothesis for testing:

Hypothesis 7: Early sexual activity has a stronger positive effect on women's than on men's fertility, controlling for other factors.

My prediction on whether number of sexual partners has significantly different effects on men's and women's fertility falls in line with the arguments regarding cohabitation partnership and childbearing stated in hypothesis 4. Thus, I propose the following:

Hypothesis 8: The effect of number of sexual partners on fertility does not vary by gender, controlling for all the other factors.

Data, Methods and Variables

To test the above hypotheses, I use the same data from the NSFG Cycle 6 as previous chapters. Poisson and zero-truncated Poisson (ZTP) regression models are applied to conduct the analyses. Variables used are discussed below and are presented in Table 7-1.

The dependent variable is, again, CEB. In terms of the independent variables, cohabitation is measured by two basic measures: *ever cohabited* and *number of cohabitation partners*. *Ever cohabited* is a dummy variable based on the NSFG question regarding whether the respondent ever cohabited. It is coded as 1 if the respondent ever cohabited and 0 otherwise. The majority of the respondents in the dataset reported having never cohabited (70.5 percent for men and 80.3 percent for women). This is probably because respondents in the NSFG dataset are relatively young-around half of the respondents are 29 years or younger. *Number of cohabitation partners* is a continuous variable, which ranges from 0 to 40 for male respondents and from 0 to 13 for female respondents. On average, male respondents reported a greater number of cohabitation partners than their female counterparts (0.6 versus 0.3). And there is more variation in number of cohabitation partners among men than among women. For this measure of cohabitation, I also recode the original variable into a set o dummy variables: 0, 1, 2, and 3 and over (see Table 7-1). Respondents with no cohabitation partners are classified as the reference category since they have the highest percentage distribution among all respondents. In the NSFG questionnaire, there is also a question asking the age at which the respondent began cohabiting with the first partner. But the response rates are low for both sexes, especially for woman (only 472 cases). I thus decided not to use this measure.

When male respondents who were 25 and younger are dropped from the dataset, the percentage of male respondents with cohabiting experience increases from 29.5% to 35.3%. Accordingly, the average number of cohabitation partners reported by men changes from 0.6 to 0.8. For women who are in the age group of 26 to 44, the percentage of respondents with cohabitation experience is amplified from 19.7% to 23.6% (not reported in Table 7-1). But the average number of cohabitation partners stated by females stays almost the same, with a similar standard deviation. This indicates that in the U.S., with increasing age, people are more likely to have cohabitation experience. However, the correlation between number of cohabitation partners and age tends to be stronger among men than among women.

Sexual experience is measured by two variables: *age at first sexual intercourse* and *number of lifetime sexual partners*. *Age at first sexual intercourse* ranges from 4 to 43 for men and 3 to 39 for women. The very few cases of respondents who claimed extraordinarily young ages of starting sexual activity are most likely the result of reporting deviation and have been eliminated from the analyses. On average, male and female respondents reported comparable average ages at first sexual intercourse (17.0 for men and 17.3 for women) with male respondents having a relatively higher standard deviation (0.08 and 0.06, respectively) than females. When male respondents who are 25 and younger are dropped from the analyses, the corresponding value becomes 17.4, with a standard deviation of 0.10. Such an average age is still younger than that (17.6, which is not shown in Table 7-1) of their female counterparts in a similar age group. Including younger men in the dataset is not likely to cause significant changes in the age pattern of sexual activity initiation. In the analyses, I also recode age at first sexual intercourse into a set of dummy variables: 18 and younger, 19 to 25, and 26 and over. The majority of the respondents are found to have begun sexual activity at ages 18 or younger (77.4% for men and 74.1% for women). The respondent pool without younger men shows relatively older ages of starting sexual activity. This finding echoes the trend of the U.S. population starting sexual activity in younger ages.

Number of lifetime sexual partners is the second measure of sexual experience. It is based on the questions in the NSFG, which ask for men “the number of female sexual partners in lifetime” and ask for women “the number of male sexual partners in entire life.” On average, females reported a greater number of lifetime sexual partners (5.0

versus 4.2), with a larger standard deviation compared to males (0.11 and 0.06, respectively). When male respondents who are 25 and younger are excluded, the average number of lifetime partners increases to 5.0 for men and 6.0 for women, with the standard deviation remaining the same for males and increasing to 0.15 for females. It suggests a larger variation in number of sexual partners reported by women than by men, especially when respondents are restricted to all females and males 26 and older. I then recode this variable into a group of dummy variables: 0, 1, 2 to 3, 4 to 6, and 7 and over. Strikingly, the sub-group with the highest percentage of respondents is the one that reported seven or more sexual partners. And there is a higher percentage of men falling into this group compared to women (38.9% and 22.4%, respectively). From this point of view, men are more likely to have a greater number of sexual partners than women. This is consistent with the finding that men reported more cohabitation partners than women. The greater average number of sexual partners reported by women is likely due to the higher percentages of females falling into the categories with six or less sexual partners.

Table 7-1. Descriptive Statistics for Dependent, Independent and Control Variables: U.S., 2002

	Male (All Respondents)			Male (26 and Over)			Female (All Respondents)		
Variables	Mean (or %)	S.E.	N	Mean (or %)	S.E.	N	Mean (or %)	S.E.	N
Dependent variable									
CEB	1.1	0.04	4,117	1.5	0.04	2,622	1.3*	0.03	7,642
Independent variables									
Cohabitation variables									
If ever cohabited			4,927			2,744			7,643
Yes	29.5			35.3			19.7		
No	70.5			64.7			80.3		
Number of partners ever cohabited with	0.6	0.03	4,926	0.8	0.05	2,743	0.3	0.01	7,643

Table 7-1 Continued

Variables	Male (All Respondents)			Male (26 and Over)			Female (All Respondents)		
	Mean (or %)	S.E.	N	Mean (or %)	S.E.	N	Mean (or %)	S.E.	N
0	70.5			64.7		2,743	80.3		7,643
1	16.2			17.6			14.1		
2	7.2			9.2			4.0		
3 and over	6.1			8.5			1.6		
Sexual experience variables									
Age at 1st sexual intercourse	17.0	0.08	4,108	17.4	0.1	2,612	17.3	0.06	6,785
18 and younger	77.4			74.4			74.1		
19 to 25	19.5			21.3			23.4		
26 and over	3.2			4.4			2.5		
Number of lifetime sexual partners	4.2	0.06	4,927	5.0	0.06	2,744	5.0	0.11	7,620
0	13.2			3.0			13.6		
1	13.1			12.0			21.4		
2 to 3	15.0			14.2			20.5		
4 to 6	19.8			21.7			22.1		
7 and over	38.9			44.1			22.4		
Control variables									
Demographic factors									
Age (mean)	29.8	0.23	4,927	35.3	0.16	2,744	30.0	0.17	7,643
Race			4,927			2,744			7,643
Hispanic	16.7			16.2			14.8		
Non-Hispanic white	65.4			67.0			64.7		
Non-Hispanic black	11.9			10.9			14.0		
Non-Hispanic other	6.03			5.9			5.6		
Nativity-if foreign born			4,925			2,733			7,643
Native born	84.7			83.3			85.7		
Foreign born	15.3			16.7			14.3		
Number of times R has been married	0.62	0.02	4,927	0.90	0.02	2,744	0.72	0.02	7,643
Metropolitan residence			4,927						
Yes	81.4			80.8		2,744	82.3		7,643
No	18.6			19.2			17.7		
Socioeconomic factors									
Education			4,927			2,744			7,643
No diploma	22.9			15.6			21.2		
High school or less	31.5			33.5			28.3		
Some college/college	26.1			25.7			30.4		
University and above	19.5			25.3			20.1		
If R ever worked full time for 6+ months			4,925			2,742			7,636
Yes	79.1			96.7			74.1		
No	20.9			3.3			25.9		

Table 7-1 Continued

Variables	Male (All Respondents)			Male (26 and Over)			Female (All Respondents)		
	Mean (or %)	S.E.	N	Mean (or %)	S.E.	N	Mean (or %)	S.E.	N
Combined family income	$35,000 - $39,999		4,927	$35,000 - $39,999		2,744	$30,000 - $34,999		7,643
Socialization factors									
Mother's education	Some college		4,927	Some college		2,744	High school		7,643
Father's education	Some college		4,505	High school		2,504	Some college		6,896
Lived in intact family till 18			4,927			2,744			7,643
Yes	68.4			70.8			65.3		
No	31.6			29.2			34.7		
If raised up with a religious affiliation			4,910			2,734			7,620
Yes	81.3			83.7			85.9		
No	18.7			17.3			14.1		
Proximate determinant									
If R ever had sterilization operation			4,925			2,742			7,643
Yes	6.4			9.8			18.2		
No	93.6			90.2			81.8		

Sources: derived from NSFG Cycle6 male and female datasets, 2002.
Note: some sub-categories may not add up to 100% due to rounding. * The CEB value for women who are 26 and over is 1.8 with a standard deviation of 0.04.

Four types of control variables are included in the analyses: demographic composition, socioeconomic status, socialization factors, and proximate determinants. Extensive research exists in the literature on the relationships between demographic and socioeconomic factors and fertility (Ballard 2004; Bloom and Trussell 1984; Ellison, Echevarria, and Smith 2005; Freedman, Wehelpton, and Campbell 1961; Lehrer 1996; Rindfuss, Morgan, and Swicegood 1988; Sander 1992). In this analysis, age, gender, race and ethnicity, nativity, metropolitan residence, and number of times the respondent has married are controlled as demographic factors. Education, total combined family income, and whether the respondent worked full time for more than six months are used as measures of socioeconomic status. The measure of these demographic and socioeconomic variables is the same as in the previous chapter.

Measures of socialization include mother's education, father's education, whether the respondent lived in an intact family till age 18, and whether the respondent was raised with a certain religious affiliation at age 14. These socialization variables are controlled because previous research shows that women from families with lower social economic status reflected by parent's relatively lower educational attainment and income are more likely to enter motherhood sooner than those from families with higher social economic status (Manning 1995). Experiencing parental separation is also found to be related to an increasing likelihood of cohabiting, which impacts family formation and childbearing (Althaus 1997; Berrington and Diamond 1999). Additionally, as a socialization factor, religion is also found to have a positive effect on fertility (Bloom and Trussell 1984; Jurecki-Tiller 2004; McLanahan and Bumpass 1988; Mosher, Johnson, and Horn 1986; Rindfuss, Morgan, and Swicegood 1988).

The proximate determinant measure is sterilization, which represents whether the respondent had a sterilization operation. Ideally, contraceptive use should also be included as a control variable. In the NSFG questionnaire, females are asked if they have ever used any birth control methods; but for males, there is no question directly asking such information. Men are asked their contraceptive use history associated with each of their female partners. But the response rates of men for those questions are low. I thus decided not to include contraceptive use as a control variable. Age at menarche could be another control variable as a proximate determinant, indicating biological maturation for females (Miller and Heaton 1991). Since the equivalent measure for males is not available in the NSFG dataset, this variable is also not included in the analyses. Descriptive information for all variables discussed is presented in Table 7-1.

Results

Since the variable *number of cohabitation partners* contains information also found in the variable *ever cohabited*, a collinearity problem may exist between these two variables. In the analyses, I treat these two variables as alternative measures of cohabitation and place them into separate regression models. Table 7-2 shows the Poisson regression results focusing on the effects of cohabitation variables on CEB. The first three panels show results analyzing all male and female respondents and the last three panels display the results excluding male respondents 25 and younger. *Age at first sexual intercourse* can be viewed as a control variable here. The variable *number of sexual partners* is dropped from the analyses given that sexual partners may to a certain extent overlap with cohabitation partners.

In models 1 and 4, I include the variable *ever cohabited* and other control variables to test hypothesis 1, which focuses on whether experiencing cohabitation has an effect on fertility. Clearly, the regression coefficients for the variable *ever cohabited* in both models are not significant, which undermines hypothesis 1. It means cohabitation experience does not tend to make a significant difference in people's overall fertility. I then replace the variable *ever cohabited* with the variable *number of cohabitation* *partners* as a continuous variable to test hypothesis 2 in models 2 and 4. Results do not support this hypothesis due to the non-significant regression coefficients. Variable *number of cohabitation partners* is then transformed into a group of dummy variables in models 3 and 6 to further test hypothesis 2. Such a hypothesis is still challenged by the non-significant regression coefficients. It suggests that the number of cohabitation partners does not have a significantly positive effect on CEB.

Table 7-2. Poisson Regression Coefficients for Cohabitation Experience and CEB: U.S., 2002

	All male and female respondents			Males 26 + and all females		
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Cohabitation variables						
If ever cohabited (ref. = yes)	0.02	-	-	-0.03	-	-
Number of partners ever cohabited with	-	0.02	-	-	0.01	-
None (ref. group)			-			-
1			-0.04			-0.07
2			-0.10			-0.16
3			0.12			0.06
Sexual experience variables						
Age at 1st sexual intercourse	–0.03***	–0.02***	–0.03***	–0.03***	–0.02***	–0.02***
Number of lifetime sexual partners	–0.01***	–	–	–0.01***	–	–
Demographic factors						
Age	0.05***	0.05***	0.05***	0.04***	0.04***	0.04***
Gender (ref. = male)	–0.20***	–0.20***	–0.19***	–0.09***	–0.08*	–0.08***
Race (ref. group = Hispanic)						
Hispanic	0.31***	0.32***	0.32***	0.27***	0.29***	0.29***
Non-Hispanic black	0.24***	0.25***	0.25***	0.23***	0.24***	0.24***
Non-Hispanic other	0.27**	0.26**	0.26**	0.25***	0.25**	0.26**
If foreign born	0.01	0.02	0.02	0.00	0.00	0.00
Metropolitan residence (re. = yes)	-0.02	-0.03	-0.03	0.00	-0.01	-0.01
Number of times R has been married	0.26***	0.26***	0.25***	0.24***	0.24***	0.23***
Socioeconomic factors						
Highest degree R ever earned	–0.05***	–0.05***	–0.05***	–0.05***	–0.06***	–0.06***
Total combined family income	–0.01**	–0.01*	–0.01*	–0.01**	–0.01	–0.01**
If R ever worked full time for 6+ months	0.26***	0.24***	0.24***	0.14*	0.11	0.12

Table 7-2 Continued

	All male and female respondents			Males 26 + and all females		
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Socialization factors						
Mother's education	0.00	0.00	0.00	0.00	0.00	0.00
Father's education	-0.04*	-0.04*	-0.04*	-0.03	-0.03	-0.03
Lived in intact family till age 18	0.02	0.02	0.02	0.02	0.03	0.03
If raised up with a religious affiliation age 14 (ref. = yes)	0.22***	0.23***	0.23***	0.21***	0.23***	0.22***
Proximate determinant						
If R ever had sterilization operation	0.30***	0.29***	0.29***	0.33***	0.33***	0.32***
Constant	–1.01***	–1.17***	–1.13***	–0.54***	–0.70***	–0.65***
N	9,732	9,751	9,751	8,392	8,411	8,411
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Sources: derived from NSFG Cycle 6 male and female datasets, 2002.
Note: R refers to respondent. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed tests).

Although Table 7-2 focuses on the effects of cohabitation variables on fertility, the significant regression coefficients for the two sexual experience variables displayed in this table have already provided evidence to corroborate hypothesis 5 and not confirm hypothesis 6. According to model 1, on average, with every one year increase in age at first sexual intercourse, the expected level of CEB decreases by 3% ($e^{-0.03}$). This finding supports hypothesis 5. But the negative regression coefficients in models 1 and 4 for the variable *number of lifetime sexual partners* presented in the same table challenge hypothesis 6, indicating people with more sexual partners actually tend to have fewer children.

In order to test hypotheses 5 and 6 in a finer manner, I run Poisson regression analyses treating sexual experience variables as sets of dummy variables. As Table 7-3 shows, models 1 and 2 examine the influence of early sexual intercourse on fertility, and models 2 and 4 shift the interest to the effect of number of sexual partners. In general, the results shown in Table 7-3 support the findings in Table 7-2 regarding hypotheses 5 and 6. But additional information is also presented in Table 7-3 which has not been shown by simply treating the sexual experience measures as continuous variables in Table 7-2. That is, compared to respondents who initiated sexual activity at ages 18 or younger, respondents who started sexual intercourse between ages 19 and 25 do not show a significantly lower level of CEB. However, respondents who initiated sexual activity at 26 or older have significantly fewer numbers of children. On average, these respondents' expected CEB is 34% ($e^{-0.41}$) lower than that of respondents who started their sexual activity at age 18 or younger. Similar results can be found when analyzing all females and males 26 and older (see model 4). Indeed, significant fertility differentials between respondents who started sexual activity at ages 19 to 25, and those started it at 26 and older are also found in the analyses (results are not shown in Table 7-3). So the story shown here is that starting sexual intercourse at younger ages does have a positive effect on fertility, but significant fertility differences won't show up except for people who start their sexual intercourse at ages 26 or later being compared to their counterparts who initiate sexual activity earlier.

With respect to the effect of number of sexual partners on fertility, the CEBs of respondents who had one, two, or three sexual partners are significantly higher than that of the respondents who had seven or more sexual partners. To illustrate, the average expected level of CEB for respondents with only one sexual partner is 1.42 ($e^{0.35}$) times of the CEB for those who reported seven or more sexual partners (see model 2). Respondents who reported two to three sexual partners also have a CEB that is 1.12 times ($e^{0.11}$) as high as that for respondents who reported seven or more sexual partners. The results of CEBs based on other combinations show that the group of respondents with only one sexual partner in their lifetime distinguish themselves with a significantly greater number of children than any other groups. Results rooted in other combinations do not show significant fertility differences. These results suggest that number of sexual partner does affect fertility in a negative direction, but significant fertility differentials do not exist with every one additional increase in number of sexual partners. Instead, having only one sexual partner in lifetime is the key that largely promotes childbearing behavior.

Table 7-3. Poisson Regression Coefficients for Ever Cohabited, Sexual Experience and CEB: U.S., 2002

	All Male and Female Respondents		Males 26 + and All Females	
Variables	Model 1	Model 2	Model 3	Model 4
Sexual experience variables				
Age at 1st sexual intercourse		-0.04***	-	-0.04***
18 and younger (ref. group)	-		-	
19 to 25	-0.05		-0.05	
26 and over	-0.36***		-0.39***	
Number of lifetime sexual partners	-0.01**		-0.01**	
0		0.01		0.08
1		0.35***		0.38***
2 to 3		0.11*		0.14**
4 to 6		0.04		0.06
7 and over (ref. group)		-		-
Continued				
Cohabitation variable				
Number of partners ever cohabited with	0.03	0.04	0.01	0.00

Table 7-3 Continued

Variables	All Male and Female Respondents		Males 26 + and All Females	
	Model 1	Model 2	Model 3	Model 4
Demographic factors				
Age	0.05***	0.05***	0.04***	0.04***
Gender (ref. = male)	–0.19***	–0.15***	–0.07***	–0.03
Race (ref. group = Hispanic)				
Hispanic	0.31***	0.30***	0.28***	0.26***
Non-Hispanic black	0.27***	0.26***	0.25***	0.25***
Non-Hispanic other	0.26**	0.24**	0.25**	0.22**
If foreign born	0.02	0.01	-0.02	-0.01
Metropolitan residence (re. = yes)	-0.03	-0.03	-0.01	-0.01
Number of times R has been married	0.26***	0.27***	0.24***	0.25***
Socioeconomic factors				
Highest degree R ever earned	–0.05***	–0.05***	–0.06***	–0.05***
Total combined family income	–0.01**	–0.01*	–0.01**	–0.01*
If R ever worked full time for 6+ months	0.26***	0.28***	0.13	0.16*
Socialization factors				
Mother's education	0.00	0.00	0.00	0.00
Father's education	-0.04*	-0.04*	-0.03	-0.02
Lived in intact family till age 18	0.01	0.03	0.01	0.02
If raised up with a religious affiliation age 14 (ref. = yes)	0.21***	0.21***	0.21***	0.21***
Proximate determinant				
If R ever had sterilization operation	0.31***	0.29***	0.34***	0.32***
Constant	–1.43***	–1.11***	–0.94***	–0.63***
N	9,732	9,732	8,392	8,392
Prob > F	0.0000	0.0000	0.0000	0.0000

Sources: derived from NSFG Cycle 6 male and female datasets, 2002.
Note: R refers to respondent. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed tests).

So far I have tested the effects of cohabitation and sexual experience on fertility. Now I move to analyses of whether these effects vary by gender. Table 7-4 presents Poisson regression results for interaction terms of the cohabitation variables and gender on CEB, which test hypotheses 3 and 4. Model 1 concentrates on showing the interaction effect between *ever cohabited* and gender. Models 2 and 3 examine whether *number of cohabitation partners* affects men's and women's fertility differently. Models 4 through 6 are the Poisson regression results without including younger male respondents. Apparently, significant fertility differences among men and women do not show up in either of the relationships. That is, *ever cohabited* and *number of cohabitation partners* do not impact men's and women's childbearing in a significantly different manner, which supports hypotheses 3 and 4. Surprisingly, when male respondents 25 and younger are removed from the equation, variable *ever cohabited* shows a significantly stronger positive effect on female than on male fertility. It shows a positive effect on women's fertility but a negative effect on men's fertility. On average, women with cohabitation experience reported an average CEB that is 1.07 times of CEB for women who did not have such an experience. For men, however, having cohabitation experience decreases their average expected by 11 percent ($e^{0.07-0.19}$). In this sense, hypothesis 3 is undermined by the results. I will discuss why this discrepancy occurs in the conclusion.

Table 7-4. Poisson Regression Coefficients for Cohabitation Variables, Gender Interaction Terms and CEB: U.S., 2002

	All male and female respondents			Males 26 + and All Females		
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Cohabitation variable						
If ever cohabited	0.07	-	-	0.07*	-	-
Number of partners ever cohabited with	-	0.00		-	0.00	
None (ref. group)			-			-
1			-0.01			-0.01
2			-0.05			-0.05
3 and over			0.16			0.17

Table 7-4 Continued

Variables	All male and female respondents			Males 26 + and All Females		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Sexual experience variables						
Age at 1st sexual intercourse	–0.03***	–0.02***	–0.03***	–0.03***	–0.02***	–0.02***
Number of lifetime sexual partners	–0.01***	-	–	–0.01***	-	–
Gender interaction terms						
Ever cohabited * male	-0.11	-		–0.19*	-	
Number of cohabitation partners * male	-	-0.02			0.01	
None * male (ref. group)			-			-
1 * male			-0.07			-0.13
2 * male			-0.09			-0.20
3 and over * male			-0.06			-0.17
Demographic factors						
Age	0.05***	0.05***	0.05***	0.04***	0.04***	0.04***
Gender (ref. = male)	–0.17***	–0.20***	-0.17	–0.04***	–0.09***	-0.04
Race (ref. group = Hispanic)						
Hispanic	0.30***	0.32***	0.32***	0.27***	0.29***	0.29***
Non-Hispanic black	0.24***	0.25***	0.25***	0.23***	0.24***	0.24***
Non-Hispanic other	0.26**	0.26**	0.26**	0.24**	0.25**	0.24**
Number of times R has been married	0.26***	0.26***	0.26***	0.24**	0.24***	0.23***
Socioeconomic factors						
Highest degree R ever earned	–0.05***	–0.05***	–0.05***	–0.05***	–0.06***	–0.06***
Total combined family income	–0.01**	–0.01**	–0.01*	–0.01**	–0.01	–0.01*
If R ever worked full time for 6+ months	0.26***	0.24***	0.24***	0.13	0.11	0.11
Socialization factors						
Father's education	-0.04*	-0.04*	-0.04*	-0.03	-0.03	-0.03
If raised up with a religious affiliation age 14 (ref. = yes)	0.22***	0.23***	0.23***	0.21***	0.23***	0.22***
Proximate determinant						
If R ever had sterilization operation	0.29***	0.30***	0.29***	0.32***	0.33***	0.32***
Constant	-1.01***	-1.15***	–1.14***	–0.54***	–0.70***	–0.66***
N	9,732	9,751	9,751	8,392	8,411	8,411
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Sources: derived from NSFG Cycle 6 male and female datasets, 2002.
Note: R refers to respondent. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed tests). The regression results for variables nativity, metropolitan residence, mother's education and lived in intact family are not presented here due to the non-significant regression coefficients.

The tests of hypotheses 7 and 8 are presented in Table 7-5. In models 1 and 4, the two sexual experience variables are both treated as continuous variables. These two variables are then considered as sets of dummy variables in the rest of the models. The effect of age at first sexual intercourse on fertility does not seem to vary depending on gender (see models 1, 2, 4 and 5), which fails to confirm hypothesis 7. However, significant male and female fertility differences do show in the relationship of *number of sexual partners* and CEB. For women, respondents who reported two to three sexual partners show a fertility level that is 1.22 ($e^{0.20}$) times that of women who reported seven or more sexual partners. For men, such a value changes to 1.5 ($e^{0.20 + 0.21}$) times that of respondents who reported seven or more sexual partners (see model 3). When younger men are removed from the equations, male and female fertility differences between groups of respondents who reported two to thee sexual partners and who reported seven or more sexual partners become not significant. Significant male and female fertility differences show between respondents who reported with only sexual partner and respondents who reported seven or more sexual partners. That is, on average, female respondents with only one sexual partner has an expected CEB that is 1.40 ($e^{0.34}$) times that of females who reported seven or more sexual partners. For men, the effect of having only one sexual partner on fertility is even substantial, the corresponding value changes to 1.68 ($e^{0.18+0.34}$) (see model 6). It is noticeable that significant male and female fertility differences also occur among respondents with zero sexual partners. And being a man also considerably drops the respondent's CEB. This phenomenon occurs because in the NSFG dataset, there is a higher percentage of women who reported having children but at the same time claimed they had no sexual partners. Taking all these findings together, the point highlighted by the results here is that having fewer number of sexual partners has a positive effect on fertility, and this effect is much stronger on male fertility than on female fertility. This finding undermines hypothesis 8. Generally, except for the discrepancy regarding hypothesis 3, analyses excluding younger men show consistent findings with the estimations of all male and female respondents.

Table 7-5. Poisson Regression Coefficients for Sexual Experience, Gender Interaction Terms and CEB: U.S., 2002

	All male and female respondents			Males 26 + and all females		
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Sexual experience variables						
Age at 1st sexual intercourse	–0.03***		-0.04***	-0.03***		-0.04***
18 and younger (ref. group)		-				
19 to 25		-0.09*			-0.09*	
26 and over		-0.41***			-0.39***	
Number of lifetime sexual partners	–0.01***	-0.01**			–0.01***	
0			0.10			0.13
1			0.38***			0.34***
2 to 3			0.20***			0.18***
4 to 6			0.12**			012**
7 and over (ref. group)			-			-
Cohabitation variable						
If ever cohabited	0.02	0.04	0.04		-0.01	0.00
Gender interaction terms						
Age at 1st sexual intercourse * male	–0.00			–0.00		
18 and younger * male (ref. group)		-			-	
19 to 25 * male		0.10			0.09	
26 and over *male		0.10			-0.00	
Number of lifetime sexual partners * male	–0.02	-		–0.05***	-	
0 * male			-24.1***			-23.0***
1 * male			0.01			0.18*
2 to 3 * male			0.21*			-0.10
4 to 6 * male			-0.16			-0.14
7 and over (ref. group) * male			-			-
Demographic factors						
Age	0.05***	0.05***	0.05***	0.04***	0.04***	0.04***

Table 7-5 Continued

Variables	All male and female respondents Model 1	Model 2	Model 3	Males 26 + and all females Model 4	Model 5	Model 6
Gender (ref. = male)	–0.16	–0.21***	-0.07	0.33	–0.09***	0.00
Race (ref. group = Hispanic)						
Hispanic	0.31***	0.31***	0.29***	0.27***	0.28***	0.26***
Non-Hispanic black	0.25***	0.27***	0.26***	0.23***	0.25***	0.24***
Non-Hispanic other	0.26**	0.26**	0.24**	0.24**	0.25**	0.22**
Number of times R has been married	0.26***	0.26***	0.27***	0.24**	0.24***	0.25***
Socioeconomic factors						
Highest degree R ever earned	–0.05***	–0.06***	–0.05***	–0.05***	–0.06***	–0.05***
Total combined family income	–0.01**	–0.01**	–0.01**	–0.01**	–0.01**	–0.01***
If R ever worked full time for 6+ months	0.26***	0.25***	0.28***	0.12	0.13	0.15*
Socialization factors						
Father's education	-0.04*	-0.04*	-0.04*	-0.03	-0.03	-0.03
If raised up with a religious affiliation age 14 (ref. = yes)	0.22***	0.21***	0.21***	0.21***	0.21***	0.20***
Proximate determinant						
If R ever had sterilization operation	0.29***	0.30***	0.29***	0.32***	0.33***	0.32***
Constant	-0.98***	-1.43***	–1.14***	–0.56***	–0.94***	–0.60***
N	9,732	9,751	9,732	8,392	8,392	8,392
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Sources: derived from NSFG Cycle 6 male and female datasets, 2002.
Note: R refers to respondent. * p < 0.05, ** p < 0.01, *** p < 0.001 (two-tailed tests). The regression results for nativity, metropolitan residence, mother's education and lived in intact family are not resented here due to the non-significant regression coefficients.

Similar to the analyses in previous chapters, I run negative binomial Poisson (NBP) and zero-truncated Poisson (ZTP) regression models considering nearly half of the respondents reported zero children. Results show the NBP regressions can be reduced to the Poisson regressions. The results of the ZTP regressions (see Appendices C-1 through C-4) are distinct from those of the Poisson regression models in the following aspects: First, number of cohabitation partners shows a significantly positive effect on fertility in the ZTP regression models, which is not shown in the Poisson regression results. This finding supports hypothesis 2 and suggests that cohabitation does play a role in determining fertility through the increased number of cohabitation partners, rather than whether having a cohabitation experience. A second distinction is that the significant overall effect of gender on fertility shown in the Poisson regression models disappears in the ZTP regression models. This could be due to the fact that there is a higher percentage of men who reported zero children compared to women. That is, it is not necessarily caused by underreporting of birth by men but could be due to the age pattern of male fertility that starts in later ages. Third, significant male and female fertility differences in the link of *ever cohabited* and CEB shown in the Poisson regression models disappear in the ZTP models. Moreover, significant fertility differentials between men and women in the effect of *number of sexual partners* on fertility still exist, but such differentials only occur when respondents with one sexual partner to the ones that reported seven or more sexual partners. Additionally, effects of some control variable on fertility are weakened or even disappear in the ZTP models. For example, the coefficient for the employment variable becomes non-significant, and the magnitude of racial composition and marriage on fertility are reduced in the ZTP models. A possible explanation for this phenomenon is that demographic and socioeconomic characteristics are influential to people's childbearing decision-making. But once people enter parenthood, the influence of these factors is diminished. Compared to the Poisson regression results, the ZTP estimations of respondents with and without younger men are more similar than dissimilar to one another. In sum, except for the effect of *number of cohabitation partners* on fertility, leaving out respondents with zero children does not extensively change the general findings based on the Poisson regressions.

Conclusion and Discussion

Cohabitation, early sexual activity and multi-partnered fertility have become more popular and acceptable in the U.S. today. Previous research has paid considerable attention to the consequences of these behaviors on family formation and union stability. Little is known about the influence of these behaviors on childbearing and overall fertility outcomes. Whether such influence varies by gender has not been discussed in the literature. So the primary goal of this chapter was to elucidate these issues in the American family system.

My expectations, based on previous studies, were that the cohabitation experience should have a positive effect on fertility, and an increased number of cohabitation partners should be associated with a greater number of children born to respondents. Unexpectedly, having a cohabitation experience does not appear to be a factor that considerably improves people’s childbearing behavior. But the empirical findings do provide support for the hypothesis that an increased number of cohabitation partners raises the level of fertility. These results suggest that fertility is augmented by cohabitation not through people entering cohabiting unions, but via the extent to which people are exposed to cohabiting settings.

I should point out that the effect of an increased number of cohabitation partners on fertility only exists among respondents with at least one child. So from this point of view, such an effect on fertility must be associated with people's experience of entering parenthood. Bachrach (1987) finds that formally married cohabiting women have a relatively higher level of fertility than cohabiting women who never married because formally married women tend to practice contraception less uniformly and are more likely to seek pregnancy. My research indicates that it is probably not only the formal martial status but the formal childbearing behavior along with the number of times people expose themselves to cohabitation, that play a role in how cohabiting unions determine fertility.

Then why does a cohabitation experience itself have no significant influence on fertility? This is a key question, especially under the situation that the premarital childbearing rate in cohabiting union is rising and cohabitation is claimed to now be "an alternative to marriage" (Raley 2001: 66). My analyses show that the influence of cohabitation on fertility remains significant in regression models until *age at first sexual intercourse* and the *socioeconomic* variables are controlled in the analyses (regression models are not shown). As shown in this chapter, people who initiated sexual intercourse in early ages are more likely to bear a greater number of children. Theoretically speaking, these people are also likely to have a higher risk of entering into cohabiting unions. Thus, it is possible that a higher level of fertility in cohabiting unions is not due to the cohabitation experience itself, but due to an early timing of sexual intercourse. Similarly, people with lower socioeconomic status tend to have more children, which has been shown in many previous studies. Previous research also shows that people with lower socioeconomic status are more likely to cohabit than people with more economic resources (Martin and Bumpass 1989; Raley 2000). Thus, there is the possibility that the role of cohabitation in shaping people's childbearing behavior is indeed mediated by their socioeconomic status. The positive effect of cohabitation on fertility demonstrated in previous studies may be spurious because these studies are largely based on descriptive analyses without controlling other important demographic and socioeconomic dimensions. Another possible explanation for the non-significant impact of cohabitation on fertility is that fertility among singles has been rising rapidly in recent years (Raley 2001), which diminishes the importance of cohabitation in childbearing.

Based on my findings, age at first sexual intercourse is negatively related to fertility. But such a negative effect is only significant for people who begin to have sexual activity at ages 26 and over. Another notable finding is that an increased number of sexual partners is strongly related to having fewer numbers of children, controlling for other factors. Most striking, people with only one sexual partner in their lifetime have a considerably higher level of fertility than those who had multiple sexual partners. This is probably because people with only one sexual partner in their lifetime are more likely to be conservative and follow a traditional way of family formation and childbearing. They are also more likely to be staying in a stable and secure relationship compared to those who had multiple sexual partners. As a result, these people end up having a greater number of children.

One of the most important findings in this chapter concerns male and female fertility differences in the linkages between cohabitation, sexual experience and childbearing. Having a cohabitation experience was first found to have a stronger impact on female than on male fertility, when the analyses are based on male respondents 26 and older and all female respondents. After the analyses are restricted to people with children, fertility differences no long vary by gender. This finding echoes the results in Poisson regression when analyzing all male and female respondents. Fertility differences by gender shown in the analyses that exclude males 25 and younger are perhaps due to the fact that there are a higher percentage of men without children compared to women in cohabiting unions in the NSFG dataset. Once respondents without children are removed from the analyses, such differences are no longer significant. The reason male and female fertility differentials did not show up in the analyses with all male and female respondents may be because including males 25 and younger increases the percentage of male respondents without a cohabitation experience. These men are not likely to significantly increase the reported number of children, but they may lead to a decrease of the percentage of men who are in cohabiting unions. Consequently, there are relatively equivalent percentages of men and women who reported having children in cohabiting unions. This eliminates the significant differences that lie in male and female fertility. So I conclude whether cohabitation experience has a stronger positive effect on female than on male fertility depends on the age structure and the percentage of childless people in the population.

Gender differences are also shown in the correlation between number of sexual partners and childbearing. Having only one sexual partner contributes to male fertility to a greater extent than to female fertility. Following this rationale, a monogamous family system might impel male fertility to a higher level than female fertility. Such a finding provides another perspective to explain why male fertility used to be higher than female fertility a few decades ago when sexual activity was restricted to married couples and premarital sex rate was low.

Even though men are found to have a greater average number of cohabitation partners, the influence of *number of cohabitation partners* on male and female fertility does not differ significantly. The effect of *age at first sexual intercourse* on fertility does not vary by gender even when respondents without children are eliminated from the analyses. This is possibly due to the similar age patterns of men and women starting their first sexual activity.

Several policy implications emerge from this analysis. Since early sexual intercourse is found to have a positive effect on fertility, family planning policies in countries with high fertility rates may need to work on sex education programs that reduce early sexual activity and prevent unintended pregnancies among teenagers. The disapproving impact of multiple sexual partnerships on fertility on the other hand reminds policy makers in low fertility countries to advocate incentives of marrying early and to encourage home-based sexual activities. This orientation is especially crucial for men as a means to enhance their fertility. Additionally, cohabitation does not seem to show a significant effect in determining fertility although an increasing number of births now occurs in cohabiting unions. This implies that the meaning of bearing and rearing children in cohabiting unions and in families is probably still different. Societies that desire people to have more births may need to improve their welfare systems for the purpose of promoting family formation and union stability.

This chapter is a first step at understanding male and female fertility differentials in the linkages between cohabitation, sexual experience and childbearing. The limitations of this research are the following: First, number of times the respondent married is controlled in the analyses, considering that marriage has a crucial effect on fertility. But marriage duration has not been taken into consideration. This variable is important because it represents the risk of being exposed to conception and childbearing, which is a proximate determinant of fertility (Bongaarts 1982). Moreover, previous research shows that the amount of time spent living together affects the timing of marital motherhood rather than having a cohabitation experience (Manning 1995). This chapter has not examined if cohabitation still influences fertility depending upon gender after controlling the duration of time coresiding. Future research should take cohabitation duration into consideration. The third limitation, as noted earlier, lies in the lack of other direct measures of the proximate determinants. Future work should take into account contraceptive use and biological maturation for both men and women.

CHAPTER VIII

CONCLUSION

The primary goal of this dissertation was to draw attention to male fertility. Demographic studies of fertility have almost always focused on females; the childbearing patterns of men have been overlooked. In this dissertation, I have attempted to address this void and examine the manner in which male fertility is similar to or different from female fertility. I have compared not only male and female fertility rates at the aggregate level, but also their determinants at the individual level. My analyses of fertility differentials in rates by gender and their determinants are a step toward bringing men into fertility studies.

I began this dissertation by providing an overview of male fertility literature by paying particular attention to social and demographic studies of male reproduction and its related issues. I pointed out that cross-sectional analyses of fertility differentials between men and women have rarely been conducted, and studies of male fertility patterns and their determinants have largely been ignored by researchers. To fill these voids, chapter III concentrated on cross-sectional analyses of fertility rates for both sexes in 43 countries and places; chapter IV investigated the changing patterns of male and female fertility in Taiwan. In terms of fertility determinants, I used fertility theories based on Taiwanese women's fertility decline to explain Taiwanese men's fertility reduction. Chapters V to VII further examined how religion and religiosity, demographic and socioeconomic characteristics, and cohabitation and sexual experiences impact men's and women's childbearing behaviors differently.

Summary of Findings

The most significant findings I show in this dissertation are that male and female fertility rates are not identical, and that some fertility determinants impact men's and women's childbearing differently. Based on examining the age-specific fertility rates (ASFRs) and the total fertility rates (TFRs) for men and women during the 1990 to 1998 period in 43 countries and places, I found that male and female age-specific fertility mainly differs in the older age groups, i.e., age groups 40 to 44 and 45 to 49. In those age groups, male fertility largely outnumbers female fertility. And this pattern is especially apparent in low fertility countries (TFR<2,200). With regard to total fertility, male and female TFRs tend to be similar in countries with TFR values lower than 2,200 where female fertility tends to be higher than male fertility. In countries and places with both male and female TFRs above 2,200, MFF tend to be dissimilar rather than similar, and male fertility is higher than female fertility. The increasing numbers of immigrants in industrialized countries and emigrants in less developed nations, both of which are dominated by men are most likely the reason that has caused male and female fertility differentiation at the country level in the 1990s.

In the analysis of Taiwan fertility, results revealed that male and female TFRs for most years during 1975 to 2004 are far from identical. In the early years, the male TFRs were higher than the female TFRs, and the opposite situation has been true since the late 1980s. The age-specific fertility rates (ASFRs) for men and women also differed over time and varied by people's educational attainment. Education is found to be more influential in inhibiting men's fertility for people 30 years and over, with the opposite pattern to be true for younger age groups. Cross-sectionally, fertility rates were shown to fluctuate by gender among most of the 23 subregions of Taiwan in the year 2002. My estimations also show that although fertility determinants at the aggregate level impact men's and women's fertility similarly, models combining these factors are more powerful when explaining female than male fertility. Coupled with the findings in 43 world countries, my findings in Taiwan suggest that men's fertility is not always the same as that of females and cannot be predicted in the same way as female fertility. There must be mechanisms that drive men's childbearing to differ from that of women.

To further explore these mechanisms, I conducted individual level analyses and showed that age, Hispanic origin, marriage, family income, labor force participation, whether cohabited, and number of lifetime sexual partners have significantly different impacts on men's and women's fertility. Age, marriage, and Hispanic origin increase men's fertility to a greater extent compared to women's fertility. Family income increases men's fertility but decreases women's fertility. Labor force participation (LFP) shows a much stronger positive effect on male than on female childbearing. Cohabitation experience, however, has a significantly stronger impact increasing women's than men's fertility. And an increased number of sexual partners is more likely to reduce men's children compared to women.

It is worth mentioning that there are some prerequisites for the above fertility differentials to be exhibited. The stronger effect of age on male than on female fertility requires similar numbers of men and women to be distributed into various age groups in the population. The cross gender influence of being Hispanic on fertility depends on the interaction effects between gender and the socioeconomic variables. In addition, the differentiation effects of family income and cohabitation experience on fertility by gender occur only when males 25 years of age and younger are excluded from the analyses. Furthermore, the effect of LFP on fertility by gender exists only when the interaction effects of gender and demographic factors are not considered.

These results have advanced our understanding of male fertility patterns and determinants. They should call researchers to carefully examine male fertility instead of assuming that it is in the same pattern and is shaped in the same way as that of females. Findings based on this research also encourage us re-evaluate fertility theories when they are applied to males. Thus, the development of fertility theories for men is warranted.

Policy Implications

Because fertility patterns and outcomes directly reflect the goals and effectiveness of family planning programs in various countries, findings of this research contain important policy implications. Marriage is shown to be a stronger push factor for an individual man's childbearing than for a woman. In Taiwan, delayed marriage is also found to reduce male fertility to a greater extent than female fertility. These findings should remind family planning policy makers in high fertility countries to encourage later marriage, particularly for men. Providing education loans to encourage people pursuing higher education in order to delay age at marriage could be another strategy. In low fertility countries, family planning policies may need to offer special welfare to married couples as incentives.

With the process of urbanization and industrialization, people's age at first sexual intercourse tends to occur even earlier (Alan Guttmacher Institute 1994; Browning, Leventhal, and Brook-Gunn 2004). With early sexual activity, family planning policies in countries with high fertility rates may need to highlight the importance of sex education to reduce early sexual activity and prevent unintended pregnancies among teenagers. The strong disapproving impact of multiple sexual partnerships on fertility should lead policy makers in low fertility countries to advocate marrying early and to encourage home-based sexual activities. This orientation is especially crucial for men as a means to enhance their fertility.

Moreover, the much stronger positive effect of LFP on men's than on women's fertility suggests the importance of offering job opportunities for men. This could be a possible solution for low fertility countries to increase fertility. Since some implications here emphasize offering particular family planning policies for men, policy makers may face the dilemma of gender equality and regulating fertility. They need to balance out these two and find suitable strategies to manage people's childbearing behavior.

Limitations and Future Prospects

Although this dissertation is among the first to provide a relatively comprehensive assessment of male fertility, this research has several limitations that need to be highlighted. First, my interpretations of male fertility determinants are hindered by the information provided by the 2002 NSFG dataset. Questions about births of men in the NSFG Cycle 6 were not directly designed to study male fertility. Thus, measures of fertility are limited. The reliability of male fertility has also not been systematically examined and reported, which requires researchers using this dataset to study male fertility with caution. For independent variables, incomplete data about the proximate determinants of male fertility, such as men's contraceptive use and age at biological maturation also limit the analyses of male fertility. Moreover, since the dependent variable, CEB, is considered as a representation of completed fertility, it demands the independent variables to represent the features of respondents before birth events occur. Due to data constraints, some of the independent variables drawn from the NSFG are unable to capture such features and thus are only considered as proxies of the real measures. For example, the measure of economic determinant of fertility, total combined family income in 2001, would obviously occur after the event of birth.

Past studies have provided evidence that both structural and individual characteristics shape the changing patterns of fertility (Mason 1997; Poston 2000; Watkins 1986; Watkins 1992). In my research, however, I am not able to conduct analyses by incorporating aggregate level factors into the estimation since data from the NSFG are restricted to the individual level. Future research could consider conducting multi-level analyses of male fertility.

Another limitation of this research is that I have by no means exhausted the list of fertility determinants. For example, I have not included in my analyses socialization factors, such as sex education, number of children born to the mother, menarche or the indicator of men's biological maturation. They have been shown to affect fertility behavior (Aneshensel, Fielder, and Becerra 1989; Ballard 2004; McKibben 2003;

Singley and Landale 1998). And there is a possibility that the roles such factors play in explaining childbearing behavior could very well differ by gender.

Additionally, the effects of fertility determines shown in my results are all direct effects. Longitudinal analyses of how demographic, socioeconomic and other factors shape male fertility have not been examined. Researchers could estimate the indirect effects of these factors on male fertility and estimate the time influence on male fertility. Data from the National Longitudinal Survey of Youth (NLSY) provide the possibility of studying male fertility determinants over various time periods.

Besides these limitations, this research also raises some additional questions to be pursued in future work. For example, although this research greatly expands the patterns of male fertility in non-European countries, such as Taiwan, that have not been studied in previous work, I have not explored the reasons for male and female fertility differentials in Taiwan. Immigration and emigration are obviously not very important variables for explaining such differentials by gender because the in- and out-migration rates in Taiwan are fairly low (Ministry of the Interior of Republic of China 2005).

Previous studies have shown that mate availability in the marriage market is strongly related to the level of fertility. An abundance of eligible males in the local marriage market is found to increase the rate of women entering into marriage and the risk of nonmarital childbearing (Fossett and Kiecolt 1993; South 1996; South and Lloyd 1992). In Taiwan, due to the son preference tradition, there are now a large number of extra boys born each year (Hudson and den Boer 2004; Poston and Zhang 2007; Tucker, Hendersona, Wang, and al. 2005). It is possible that the extra males resulting from the unbalanced sex ratios at birth (SRB) have led to more men available in the marriage market than women. Thus, the relatively higher female marital rate could be a cause of higher female than male fertility. Whether fertility differentials by gender are caused by mate availability in Taiwan deserves investigation in future studies.

When examining male and female fertility, I have generated ratios of male and female TFRs and ASFRs, as well as the gender interaction terms in the analyses. The models in this research, however, are still considered as one-sex models. This is because I have not solved the problem of taking both men's and women's fertility determinants into consideration in the same models. Take the individual level analyses as an example. Although demographic and socioeconomic factors for male and female respondents are both included in the analyses, the characteristics of the respondent's spouse or partner have not been added in. This is due to the fact that male and female respondents in the NSFG were not husbands and wives living in the same households. Future research needs to collect couples' data from married/cohabiting individuals or use existing datasets to address this issue. The Demographic and Health Surveys (DHS) and the Mexican Migration Projects (MMP) both contain fertility information for husbands and wives. Incorporating husband's and wife's characteristics, such as both their ages, racial compositions, and sexual histories into regression models would help to address the problem of constructing two-sex fertility models.

Reliability of the Male Fertility Data

The last issue I would like to address in this chapter deals with the quality of male fertility data in the 2002 NSFG. The quality of birth data gathered from men is always a concern of researchers when studying male fertility. In the literature review, I illustrated some of the issues in previous studies about the reliability of male fertility data. Most studies suggest that men tend to underreport the number of children born to them, especially children outside of marriage and from previous marriages. As mentioned earlier, the problem of underreporting in the 2002 NSFG dataset has been found by Rendall and associates (Rendall et al. 2006). In order to assess the reliability of the male fertility data in the NSFG and to avoid spurious results that could possibly have resulted from male underreporting of their births, I conducted analyses with and without male respondents 25 and younger in the research. This is because the underreporting of births often occurs among men at the younger ages. My results show that, in general, findings based on analyzing all respondents and excluding younger men are consistent with one another except for the differences that lie in the effects of cohabitation, LFP and family income (see the discussions in chapters V-VII). These results suggest that the underreporting of births by men may not be as serious a problem in the NSFG dataset. There is certainly a great deal of work remaining in terms of evaluating male fertility reports. Applying multiple measures of fertility in future studies would be necessary.

Together with lowest-low fertility, unbalanced sex ratios at birth, and the demography of gay males and lesbians, male fertility and men's influence on decisions about bearing and rearing children are emerging issues of population study. This research in my dissertation is only a beginning step studying this important topic. Both quantitative and qualitative research is needed for us to gain a more comprehensive understanding of the dynamics of male fertility.

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APPENDIX A-1

Appendix A-1. Zero Truncated Poisson Regression Coefficients for Religious Affiliation, Participation, Beliefs and CEB: All Male and Female Respondents in the U.S., 2002

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Religious variables					
Current religious affiliation (ref. = Catholic)					
Fundamentalist Protestant	0.04			0.04	0.03
Other Protestant	0.04			0.04	0.02
Other non-Christian religion	-0.09			-0.09	-0.09
Religiosity					
Frequency attending religious services		0.02		0.01	
Importance of religious beliefs			0.08***		0.08***
Demographic factors					
Age	0.04***	0.09***	0.09***	0.09***	0.09***
Gender (ref. = male)	-0.10***	-0.10**	-0.09***	-0.10***	-0.09***
Race (ref. group = Hispanic)					
Hispanic	0.12*	0.09*	0.08*	0.12**	0.09*
Non-Hispanic black	0.12*	0.12*	0.10	0.11*	0.09
Non-Hispanic other	0.20	0.17	0.15	0.19	0.17
If R has ever been married	0.22***	0.22***	0.21***	0.21***	0.21***
Socioeconomic factors					
Highest degree R ever earned	-0.06***	-0.06***	-0.07***	-0.06***	-0.06***
Total combined family income	-0.02*	-0.02***	-0.02***	-0.02*	-0.02***
Constant	-0.28***	-0.27*	-0.42**	-0.81*	-0.44***
N	5,304	5,299	5,299	5,299	5,299
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000

Sources: derived from NSFG Cycle 6 male and female datasets, 2002.

Note: R refers to respondent. * p < 0.05, ** p < 0.01, *** p < 0.001 (two-tailed tests). Variables nativity and ever work have been dropped from the regression due to non-significant regression coefficients.

APPENDIX A-2

Appendix A-2: Zero Truncated Poisson Regression Coefficients for Religious Affiliation, Participation, Beliefs and CEB: Male Respondents 26 and Over and All Female Respondents in the U.S., 2002

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Religious variables					
Current religious affiliation (ref. = Catholic)					
Fundamentalist Protestant	0.04			0.04	0.02
Other Protestant	0.04			0.04	0.02
Other non-Christian religion	-0.11			-0.10	-0.11
Religiosity					
Frequency attending religious services		0.02		0.01	
Importance of religious beliefs			0.08**		0.08**
Demographic factors					
Age	0.04***	0.04***	0.04***	0.04***	0.04***
Gender (ref. = male)	-0.08*	-0.09**	-0.07***	-0.8*	-0.07***
Race (ref. group = Hispanic)					
Hispanic	0.11*	0.09*	0.07*	0.11*	0.08
Non-Hispanic black	0.11*	0.18*	0.09	0.11*	0.09
Non-Hispanic other	0.19	0.15	0.14	0.19	0.16
If R has ever been married	0.21***	0.21***	0.21***	0.21***	0.21***
Socioeconomic factors					
Highest degree R ever earned	-0.06***	-0.06***	-0.07***	-0.06***	-0.06***
Total combined family income	-0.02*	-0.02***	-0.01**	-0.02**	-0.02***
Constant	-0.18***	-0.17*	-0.33**	-0.81*	-0.34***
N	5,130	5,125	5,125	5,125	5,125
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000

Sources: derived from NSFG Cycle 6 male and female datasets, 2002.

Note: R refers to respondent. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed tests). Variables nativity and ever work have been dropped from the regression due to non-significant regression coefficients.

APPENDIX A-3

Appendix A-3. Zero Truncated Poisson Regression Coefficients for Religious Variables, Gender Interaction Terms and CEB: U.S., 2002

	All Male and Female Respondents			Males 26 + and All Females		
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Religious variables						
Current religious affiliation (ref. = Catholic)						
Fundamentalist Protestant	0.05	0.04	0.03	0.05	0.04	0.03
Other Protestant	0.04	0.04	0.02	0.04	0.04	0.02
Other non-Christian religion	-0.04	-0.04	-0.03	-0.04	-0.04	-0.03
Religiosity						
Frequency attending religious services		0.03			0.03*	
Importance of religious beliefs			0.10**			0.11**
Interaction terms						
Current religious affiliation (ref. = Catholic)						
Fundamentalist Protestant * gender	-0.02	0.01	-0.01	-0.03	-0.00	-0.02
Other Protestant * gender	0.00	0.02	0.00	-0.01	0.02	-0.00
Other non-Christian religion * gender	-0.10	-0.09	-0.12	-0.14	-0.13	-0.15
Religiosity						
Frequency attending religious services * gender		-0.04			-0.04	
Importance of religious beliefs * gender			-0.05			-0.05
Demographic factors						
Age	0.04***	0.04***	0.04***	0.04***	0.04***	0.04***
Gender (ref. = male)	-0.09	0.01	0.05	-0.06	0.04	0.08
Race (ref. group = Hispanic)						
Hispanic	0.12**	0.12**	0.09*	0.11*	0.11*	0.08
Non-Hispanic black	0.12**	0.11*	0.09	0.11*	0.11*	0.09
Non-Hispanic other	0.20	0.20	0.18	0.19	0.19	0.17
If R has ever been married	0.22***	0.21***	0.21***	0.21***	0.21***	0.21***
Socioeconomic factors						
Highest degree R ever earned	-0.06***	-0.06***	-0.06***	-0.06***	-0.06***	-0.07***
Total combined family income	-0.02**	-0.02**	-0.02**	-0.02**	-0.02**	-0.02**
Constant	-0.29***	-0.36***	-0.51**	-0.19	-0.26	-0.42***
N	5,304	5,299	5,299	5,130	5,125	5,125
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Sources: derived from NSFG Cycle 6 Male and Female Datasets, 2002.
Note: R refers to respondent. * p < 0.05, ** p < 0.01, *** p < 0.001 (two-tailed tests). Variables nativity and ever work have been dropped from the regression due to non-significant regression coefficients.

APPENDIX B-1

Appendix B-1: Zero-Truncated Poisson Regression Coefficients for Demographic Factors, Gender Interaction Terms and CEB: U.S., 2002

Variables	All Male and Female Respondents Model 1	Female Respondents and Males 25 and Over Model 2
Demographic factors		
Age	0.03***	0.03***
Gender (ref. = male)	-0.44*	**-0.07**
Race (ref. group = Hispanic)		
Hispanic	0.12*	0.12*
Non-Hispanic black	0.10	0.10
Non-Hispanic other	0.05	0.05
If foreign born	-0.02	-0.02
Metropolitan residence (ref. = yes)		
MSA, central city	-	-
MSA, other	-0.00	-0.00
Not MSA	0.04	0.04
Number of times R has been married	0.04	0.04
Gender interaction terms		
Age * male	0.01	0.01
Race (ref. group = Hispanic)		
Hispanic * male	0.18*	0.18*
Non-Hispanic black * male	0.11	0.11
Non-Hispanic other * male	0.18	0.18
If foreign born * male	0.34	0.34
Metropolitan residence (ref. = MSA, central city)		
MSA, other * male	0.01	0.01
Not MSA * male	-0.10	-0.10
Number of times R has been married * male	0.09	0.09
Socioeconomic factors		
Highest degree R ever earned	–0.06***	–0.06***
Total combined family income	–0.01**	–0.01**
If R ever worked full time for 6+ months	-0.11	-0.13
Proximate determinant		
Age at 1st sexual intercourse	-0.02***	-0.02***
If R ever had sterilization operation	0.26***	0.26***
Constant	0.20	0.20
N	6,130	5,903
Prob > F	0.0000	0.0000

Sources: derived from NSFG Cycle 6 male and female dataset, 2002.
Note: R refers to respondent. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed tests).

APPENDIX B-2

Appendix B-2. Zero-Truncated Poisson Regression Coefficients for Socioeconomic Factors, Gender Interaction Terms and CEB: All Male and Female Respondents, 2002

Variables	All Male and Female Respondents Model 1	Female Respondents & Males 25 and Over Model 2
Socioeconomic factors		
Highest degree R ever earned (ref. = Some college)		
No diploma	0.25***	0.25***
High school or less	0.10**	0.10**
University and above	-0.05	-0.05
Combined family income (ref. = $75,000 and over)		
Under $25,000	0.08	0.07
$25,000 to $49,999	0.01	0.01
$50,000 to $74,999	-0.03	-0.03
If R ever worked full time for 6+ months (ref. = yes)	-0.12	-0.11
Gender interaction terms		
Highest degree R ever earned (ref.= Some college/college * male)		
No diploma * male	0.03	0.04
High school or less * male	-0.02	-0.02
University and above * male	-0.02	-0.03
Combined family income (ref. = $75,000 * male)		
Under $25,000 * male	-0.00	0.02
$25,000 to $49,999 * male	0.01	0.03
$50,000 to $ 74,999 * male	-0.01	-0.00
If R ever worked full time for 6+ months * male	0.05	-0.02
Demographic factors		
Age	0.04***	0.03***
Gender (ref. = male)	-0.09	-0.01
Race (ref. group = Hispanic)		
Hispanic	0.21***	0.21***
Non-Hispanic black	0.15**	0.15**
Non-Hispanic other	0.21*	0.19*
If foreign born	-0.03	-0.02
Metropolitan residence (ref. = MSA, central city)		
MSA, other	-0.06	-0.00
Not MSA	0.01	0.01
Number of times R has been married	0.08**	0.07*
Proximate determinant		
Age at 1st sexual intercourse	-0.02***	-0.02***
If R ever had sterilization operation	0.25***	0.25***
Constant	–0.60***	–0.48***
N	6,130	5,903
Prob > F	0.0000	0.0000

Sources: derived from NSFG Cycle 6 male and female dataset, 2002.
Note: R refers to respondent. * p < 0.05, ** p < 0.01, *** p < 0.001 (two-tailed tests).

APPENDIX C-1

Appendix C-1. Zero-truncated Poisson Regression Coefficients for Cohabitation Experience and CEB: U.S., 2002

	All male and female respondents			Males 26 + and all females		
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Cohabitation variables						
If ever cohabitated (ref. = yes)	0.02	-	-	-0.02	-	-
Number of partners ever cohabitated with	-	0.03**	-	-	0.03*	-
None (ref. group)			-			-
1			-0.07			-0.06
2			-0.03			-0.04
3			0.17			0.15
Sexual experience variables						
Age at 1st sexual intercourse	–0.02***	–0.01**	–0.02***	–0.02***	–0.01*	–0.02***
Number of lifetime sexual partners	–0.01**	–	–	–0.01**	–	–
Demographic factors						
Age	0.04***	0.04***	0.04***	0.03***	0.03***	0.03***
Gender (ref. = male)	–0.05	–0.06	–0.05	–0.02	–0.06	–0.02
Race (ref. group = Hispanic)						
Hispanic	0.17***	0.18***	0.18***	0.16***	0.18***	0.18***
Non-Hispanic black	0.15***	0.16**	0.16***	0.15**	0.15***	0.16***
Non-Hispanic other	0.21*	0.20*	0.20*	0.20*	0.19*	0.19*
If foreign born	-0.04	-0.03	-0.04	-0.04	-0.03	-0.03
Metropolitan residence (re. = yes)	0.03	0.01	0.02	0.03	0.01	0.02
Number of times R has been married	0.07*	0.07*	0.07*	0.07*	0.07*	0.07*
Socioeconomic factors						
Highest degree R ever earned	–0.04***	–0.04***	–0.05***	–0.04***	–0.05***	–0.05***
Total combined family income	–0.01*	–0.01	–0.01	–0.01*	–0.01	–0.01
If R ever worked full time for 6+ months	-0.06	-0.08	-0.08	-0.06	-0.08	-0.08
Socialization factors						
Mother's education	0.00	0.00	0.00	0.00	0.00	0.00
Father's education	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Lived in intact family till age 18	0.02	0.02	0.02	0.02	0.02	0.02
If raised up with a religious affiliation age 14 (ref. = yes)	0.13*	0.15**	0.14***	0.12*	0.14***	0.13***
Proximate determinant						
If R ever had sterilization operation	0.24***	0.24***	0.24***	0.24***	0.24***	0.24***
Constant	0.01	–0.16	–0.09	0.14	–0.03	0.03
N	5,416	5,434	5,434	5,218	5,236	5,236
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Sources: derived from NSFG Cycle 6 male and female datasets, 2002.
Note: R refers to respondent. * p < 0.05, ** p < 0.01, *** p < 0.001 (two-tailed tests).

APPENDIX C-2

Appendix C-2. Zero-truncated Poisson Regression Coefficients for Ever Cohabited, Sexual Experience and CEB: U.S., 2002

	All Males and Females		Males 26 + and All Females	
Variables	Model 1	Model 2	Model 3	Model 4
Sexual experience variables				
Age at 1st sexual intercourse		-0.03***		-0.03***
18 and younger (ref. group)	-		-	
19 to 25	-0.02		-0.02	
26 and over	-0.31***		-0.31***	
Number of lifetime sexual partners	-0.01*		-0.01*	
0		0.26***		0.27***
1		0.31***		0.32***
2 to 3		0.13*		0.15*
4 to 6		0.07		0.08
7 and over (ref. group)		-		-
Cohabitation variable				
Number of partners ever cohabitated with	0.03	0.05	0.03	0.05
Demographic factors				
Age	0.03***	0.04***	0.03***	0.03***
Gender (ref. = male)	–0.04	–0.00	–0.01	–0.00
Race (ref. group = Hispanic)				
Hispanic	0.17***	0.16***	0.16***	0.15***
Non-Hispanic black	0.17***	0.16***	0.16***	0.16***
Non-Hispanic other	0.21**	0.19	0.20**	0.18
If foreign born	-0.06	-0.05	-0.05	-0.05
Metropolitan residence (ref. = yes)	0.02	0.02	0.03	0.02
Number of times R has been married	0.08*	0.09**	0.07*	0.08**
Socioeconomic factors				
Highest degree R ever earned	–0.05***	–0.05***	–0.05***	–0.04***
Total combined family income	–0.01**	–0.01*	–0.01**	–0.01*
If R ever worked full time for 6+ months	-0.07	-0.04	-0.06	-0.04
Socialization factors				
Mother's education	0.00	0.00	0.00	0.00
Father's education	-0.02	-0.02	-0.02	-0.02
Lived in intact family till age 18	0.01	0.02	0.01	0.01
If raised up with a religious affiliation age 14 (ref. = yes)	0.13***	0.12*	0.12*	0.11*
Proximate determinant				
If R ever had sterilization operation	0.25***	0.24***	0.25***	0.24***
Constant	–0.28*	–0.09	–0.13	0.04
N	5,416	5,416	5,218	5,218
Prob > F	0.0000	0.0000	0.0000	0.0000

Sources: derived from NSFG Cycle 6 male and female datasets, 2002.
Note: R refers to respondent. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed tests).

APPENDIX C-3

Appendix C-3. Zero-truncated Poisson Regression Coefficients for Cohabitation Variables, Gender Interaction Terms and CEB: U.S., 2002

	All male and female respondents			Males 26 + and All Females		
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Cohabitation variable						
If ever cohabited	0.05	-	-	0.04	-	-
Number of partners ever cohabitated with	-	0.02		-	0.02	
None (ref. group)			-			-
1			-0.05			-0.05
2			0.02			0.14
3 and over			0.20			0.20
Sexual experience variables						
Age at 1st sexual intercourse	–0.02***	–0.02***	–0.02***	–0.02***	-0.01***	–0.02***
Number of lifetime sexual partners	–0.01**	-	–	–0.01**	-	–
Gender interaction terms						
Ever cohabited * male	-0.06	-		-0.05	-	
Number of cohabitation partners * male	-	0.01		-	0.01	
None * male (ref. group)			-			-
1 * male			-0.06			-0.03
2 * male			-0.09			-0.10
3 and over * male			-0.05			-0.07
Demographic factors						
Age	0.05***	0.04***	0.04***	0.03***	0.03***	0.03***
Gender (ref. = male)	–0.03	–0.06	-0.03	–0.01	–0.04	-0.01
Race (ref. group = Hispanic)						
Hispanic	0.17***	0.18**	0.18***	0.16***	0.18**	0.18***
Non-Hispanic black	0.15***	0.15**	0.16***	0.15***	0.15**	0.16***
Non-Hispanic other	0.21**	0.20*	0.20*	0.20**	0.19	0.19
Number of times R has been married	0.07*	0.07*	0.07***	0.07*	0.07*	0.07***
Socioeconomic factors						
Highest degree R ever earned	–0.04***	–0.04***	–0.05***	–0.04***	–0.05***	–0.05***
Total combined family income	–0.01*	–0.01	–0.01	–0.01*	–0.01	–0.01
If R ever worked full time for 6+ months	-0.07	-0.08	-0.08	-0.06	-0.08	-0.08
Socialization factors						
Father's education	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
If raised up with a religious affiliation age 14 (ref. = yes)	0.13***	0.15***	0.14***	0.13*	0.14***	0.14***
Proximate determinant						
If R ever had sterilization operation	0.24***	0.24***	0.23***	0.24***	0.25***	0.24***

Appendix C-3 Continued.

	All male and female respondents			Males 26 + and All Females		
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	0.01	-0.05	-0.10	0.14	-0.02	0.02
N	5,416	5,434	5,434	5,416	5,236	5,236
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Sources: derived from NSFG Cycle 6 male and female datasets, 2002.

Note: R refers to respondent. * p < 0.05, ** p < 0.01, *** p < 0.001 (two-tailed tests). The regression results for variables nativity, metropolitan residence, mother's education and lived in intact family are not presented here due to the non-significant regression coefficients.

APPENDIX C-4

Appendix C-4. Zero-truncated Poisson Regression Coefficients for Sexual Experience, Gender Interaction Terms and CEB: U.S., 2002

	All male and female respondents			Males 26 + and all females		
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Sexual experience variables						
Age at 1st sexual intercourse	–0.02***		-0.03***	-0.02***		-0.03***
18 and younger (ref. group)		-				
19 to 25		-0.08			-0.07	
26 and over		-0.36***			-0.34***	
Number of lifetime sexual partners	–0.01*	-0.01**		-0.01*	–0.01*	
0			0.26***			0.26***
1			0.26**			0.26**
2 to 3			0.16***			0.16***
4 to 6			0.10*			0.10*
7 and over (ref. group)			-			-
Cohabitation variable						
If ever cohabited	0.04	0.03	0.04		0.03	0.05
Gender interaction terms						
Age at 1st sexual intercourse * male	–0.01			-0.01		
18 and younger * male (ref. group)		-			-	
19 to 25 * male		0.13			0.13	
26 and over *male		0.10			0.07	
Number of lifetime sexual partners * male	–0.05*	-		–0.05*	-	
0 * male			-			-
1 * male			0.18*			0.20*
2 to 3 * male			-0.07			-0.04
4 to 6 * male			-0.07			-0.07
7 and over (ref. group) * male			-			-
Demographic factors						
Age	0.04***	0.04***	0.04***	0.03***	0.03***	0.03***
Gender (ref. = male)	0.35	–0.07	0.00	0.45	–0.04	0.02
Race (ref. group = Hispanic)						
Hispanic	0.16***	0.17***	0.16***	0.15**	0.17***	0.15***
Non-Hispanic black	0.15***	0.17***	0.16***	0.15**	0.16***	0.16***
Non-Hispanic other	0.21*	0.22*	0.19	0.20**	0.20*	0.18
Number of times R has been married	0.08*	0.08*	0.09**	0.07*	0.07*	0.08***
Socioeconomic factors						
Highest degree R ever earned	–0.04***	–0.05***	–0.04***	–0.04***	–0.05***	–0.04***
Total combined family income	–0.01*	–0.01*	–0.01*	–0.01*	–0.01*	–0.01*
If R ever worked full time for 6+ months	-0.08	-0.07	-0.05	-0.08	-0.07	-0.05

Appendix C-4 Continued.

Variables	All male and female respondents			Males 26 + and all females		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Socialization factors						
Father's education	-0.02	-0.02	-0.02	-0.02	-0.02	-0.03
If raised up with a religious affiliation age 14 (ref. = yes)	0.12*	0.13*	0.12***	0.12*	0.12*	0.12*
Proximate determinant						
If R ever had sterilization operation	0.23***	0.25***	0.24***	0.24***	0.25***	0.24***
Constant	-0.03	-0.28*	–0.06	0.10	–0.14	0.08
N	5,416	5,416	9,732	5,218	5,218	5,218
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Sources: derived from NSFG Cycle 6 male and female datasets, 2002.
Note: R refers to respondent. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed tests). The regression results for nativity, metropolitan residence, mother's education and lived in intact family are not resented here due to the non-significant regression coefficients.

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