

**ESTIMATING THE EFFECTS OF NEW PRODUCT PROMOTION
ON U.S. BEEF IN GUATEMALA**

A Thesis

by

AMANDA MARIE LEISTER

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

MASTER OF SCIENCE

August 2007

Major Subject: Agricultural Economics

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ABSTRACT

Estimating the Effects of New Product Promotion

on U.S. Beef in Guatemala. (August 2007)

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Chair of Advisory Committee: Dr. C. Parr Rosson III

The implementation of the Central America-Dominican Republic Free Trade Agreement (CAFTA-DR) has expanded trade opportunities for U.S. agricultural producers. U.S. beef is a critical product affected by the legislation, and the United States Meat Export Federation (USMEF) invested in a new product promotion program to increase exports of U.S. beef to Guatemala. The consumer responsiveness and effectiveness of the U.S. branded beef promotion program are analyzed in this study.

Demand responses to promotion activities that launched three new U.S. beef value cuts in Guatemala's Hotel, Restaurant and Institutional (HRI) sector were estimated by applying the Parks Model of Generalized Least Squares regression to pooled, time-series and cross sectional data. Results show a negative relationship between own price and sales quantity, while the effect of advertising on quantity sold is positive. Demand for the U.S. beef value cuts increased as a result of the promotion, although the costs of the promotion program exceeded the additional revenue generated as a result of promotion activities.

ACKNOWLEDGEMENTS

My experience as a graduate student at Texas A&M University has been incredibly rewarding. I have thoroughly enjoyed my time spent in College Station and appreciate the many individuals who have given me their endless support during my pursuit of the masters degree. My thesis committee, family, friends and faith continually inspired and lead me through this journey, for which I am overwhelmingly thankful.

Dr. Rosson has been an amazing advisor, and I can not thank him enough for his support of my adventurous spirit. I appreciate his willingness to allow me to work in Guatemala, and I will be forever grateful for his unwavering faith in my character and abilities. Dr. Capps was instrumental in helping with the quantitative aspects of my research, and this project could have not been done without his investment of time and patience. I have deeply enjoyed my time spent learning from such a gifted teacher.

My friends Kirsten, Katy, Hart, Emmy, Katie, Calli, Dustin, and Paco have been constant sources of joy and encouragement to me. I appreciate and care about you all. Thanks to my Aggie Family for making this experience and this place so wonderful.

Along with fabulous friends, I have been blessed with an amazing family. I have the best parents anyone could ask for. Dad continually amazes me with his patience and ability to “deal” with me, and my Mom is the most talented and creative woman I know. Papaw, Grandma, Dad, Mom, Justin and Brandon are my heroes. Words can not express how much they mean to me, and I strive to be more like each one of them. I could never come close to thanking them enough for shaping me into the person I am.

TABLE OF CONTENTS

	Page
ABSTRACT	iii
ACKNOWLEDGEMENTS	iv
TABLE OF CONTENTS	v
LIST OF FIGURES.....	vi
LIST OF TABLES	viii
CHAPTER	
I INTRODUCTION.....	1
Problem Statement	3
Objectives.....	3
Data and Methods.....	4
Expected Results	5
Organization of Remaining Chapters	5
II REVIEW OF LITERATURE.....	7
Summary	23
III METHODOLOGY	25
Data	26
Summary of Data	27
Empirical Model.....	54
IV RESULTS.....	62
V CONCLUSIONS AND IMPLICATIONS	69
REFERENCES.....	74
VITA	76

LIST OF FIGURES

FIGURE	Page
2.1 Perception of U.S. Beef in Guatemala City	16
2.2 Perception of U.S. Beef Attributes.....	17
2.3 Availability of U.S. Beef in Restaurants	18
2.4 Availability of U.S. Beef in Retail Shopping Outlets	19
2.5 Beef Country of Origin Importance	20
2.6 Recognition of United States Meat Export Federation Logo	21
2.7 Countries Thought of with Regard to Beef	22
3.1 Monthly Beef Value Cut Quantities	28
3.2 Monthly Beef Value Cut Prices per Pound	29
3.3 Comparison of Price and Sales Quantity of Petit Tender.....	30
3.4 Comparison of Price and Sales Quantity of California Steak	31
3.5 Comparison of Price and Sales Quantity of Texas Fillet	32
3.6 USMEF Press Conference in Guatemala City	33
3.7 Thawed Beef Value Cuts.....	34
3.8 U.S. and Guatemalan Flags Symbolize Trading Partnership.....	34
3.9 U.S. Meat Export Federation Spanish Logo	35
3.10 Example of Texas Fillet Banner.....	36
3.11 Example 2 of Texas Fillet Banner.....	37
3.12 Example of California Steak Banner.....	38

FIGURE	Page
3.13 Mini-Billboard Example	39
3.14 Beef Value Cut Logos	40
3.15 U.S. Beef Newspaper Advertisement.....	41
3.16 Restaurant Los Ranchos Entrance.....	42
3.17 Restaurant Los Ranchos Indoor Dining	43
3.18 Restaurant Los Ranchos Outdoor Dining Patio	43
3.19 Welcome to Cascadia	44
3.20 Restaurant Cascadia Lounge Entrance	45
3.21 Restaurant Cascadia Formal Dining Area.....	45
3.22 Restaurant Cascadia; Open Style Kitchen.....	46
3.23 Cascadia Menu Showcasing the California Steak.....	46
3.24 Restaurant Cascadia Owner and Head Chef	47
3.25 Prepared California Steak at the Restaurant Cascadia	47
3.27 Promotion Expenditures by Share of Total	49
3.28 Monthly Promotion Expenditures Incurred by USMEF	50
3.29 Comparison of Advertising and Petit Tender Sales Quantity	51
3.30 Comparison of Advertising and California Steak Sales Quantity.....	52
3.31 Comparison of Advertising and Texas Fillet Sales Quantity	53

LIST OF TABLES

TABLE		Page
3.1	Monthly Promotion Expenditures by Activity in U.S. Dollars	48
4.1	The Estimated Coefficients and Standard Errors of U.S. Beef Value Cut Demand Relationship	63
4.2	Degree of Correlation Among the Meat Cuts	64
4.3	Autocorrelation Coefficient for Each Beef Value Cut Cross-Section..	65

CHAPTER I

INTRODUCTION

The Central America-Dominican Republic Free Trade Agreement (CAFTA-DR) has created opportunities for the expansion of U.S. agricultural exports. The implementation of CAFTA-DR is critical in that it calls for the eventual duty-free, quota free access to all products traded among member nations. The United States Meat Export Federation (USMEF) is the trade association responsible for developing international markets for the U.S. red meat industry and is funded by the USDA, exporting companies, and the beef, pork, lamb, corn, sorghum and soybean checkoff programs. Guatemala was identified by USMEF as one of the priority markets within the Central and South American region. With a population of approximately 14 million, Guatemala is the largest country in Central America, and experiences an average of \$4 million in annual imports of U.S. beef. Guatemala previously imposed a 15% tariff on all U.S. beef imported into the country. Tariffs were eliminated immediately for Prime and Choice beef cuts and are gradually phased out for other beef products under the implementation of CAFTA-DR, which should allow U.S. beef to become more affordable for importation to Guatemala (Rosson 2006). Although U.S. meat is less cost prohibitive with the elimination of the import tariff, it still holds true that beef products of local origin continue to have a competitive advantage in price over U.S. beef cuts. For this

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reason, USMEF has devised a strategic plan to focus on the Hotel, Restaurant and Institutional (HRI) sector to appeal to Guatemalan consumers who have an increased demand for the high quality and increased value found in the new beef products that are being introduced into the sector (Vernazza-Paganini 2006).

In response to the tariff eliminations brought about by CAFTA-DR, USMEF implemented a marketing campaign to introduce three new U.S. beef value cuts in the upper-end foodservice segment of Guatemala. The introductory cuts include the Petit Tender, California Steak and Texas Fillet. Each of the three cuts are of the USDA quality grade Choice. The cuts were selected on the basis of price competitiveness while maintaining high quality attributes. The selected cuts also have a more competitive position than other US meats including the tenderloin, New York steak and Ribeye, when compared to close local substitutes, and have therefore been identified as the key cuts for the USMEF promotion (Vernazza-Paganini 2006).

It was decided as part of the USMEF marketing strategy for Central America that the most effective way to launch the new beef products was to focus on one specific importer of U.S. meat. The firm Alimentos Campeón was identified as the key HRI supplier to support the promotion. Marketing activities included educational seminars, newspaper advertisements, mini-billboards, television advertisements, menu inserts, table banners, tastings and cash incentives for sales associates and restaurant staff. The total expenditures of the promotion activities conducted by USMEF were \$77,878.85 (Vernazza-Paganini 2006). Understanding the demand responses to the promotion of

new products will help to evaluate the effectiveness of the program and provide implications for future promotion activities in the region.

Problem Statement

New duty-free, quota-free access to Guatemalan markets through CAFTA-DR provides expanded opportunities for U.S. beef producers. However, many beef products still remain unaffordable to many consumers in Guatemala. In an effort to increase U.S. market share, USMEF has strategically decided to focus on increasing sales in the Guatemalan HRI sector by appealing to the higher end consumer. This study attempts to identify the HRI consumer responses to the promotion of new U.S. branded beef products executed by USMEF. The effectiveness of the promotion program will be discussed.

Objectives

The objective of the study is to understand the behavior of Guatemalan consumers and their response to the promotion of the new U.S. beef value cuts. The effectiveness of the promotion will be essential for understanding the HRI market in Guatemala and consumer responses to the trade liberalization resulting from CAFTA-DR. By analyzing the strengths, weaknesses and impacts of the USMEF promotion of U.S. branded beef, U.S. enterprises and Guatemalan firms will have an increased knowledge and understanding of the effects of marketing and promotion in Guatemala. Although a psychological, qualitative study of consumer preferences before and after

promotion has been conducted, no economic analysis has been conducted to identify the statistic evidence of the effectiveness of the promotion campaign. It is hoped that this can serve as useful for the study of the responses of foreign HRI consumers to U.S. branded beef promotions. This study may also aid USMEF and other organizations to identify and implement strategic international market promotion programs.

Data and Methods

The HRI sector in Guatemala City is the empirical setting for this study. Monthly sales data are used to estimate parameters for a Generalized Least Squares Estimation by application of the Parks Model to a pooled sample of cross-sectional time-wise data set to relate promotional activities and own beef prices to sales quantities of the new beef value cuts in Guatemala City. Monthly sales data including sales quantity and sales price for the Petit Tender, California Steak and Texas Fillet U.S. beef value cuts from January, 2006 through February, 2007 are provided by Alimentos Campeón. The study is restricted to the changes in U.S. beef value cut quantity sold by Alimentos Campeón as a response to prices and the new product promotion activities conducted. The endogenous variable of the study is U.S. beef value cut sales quantity, while the key exogenous variables are the promotion expenditures of USMEF, along with prices of the U.S. beef value cuts; both in U.S. Dollars. The list of all promotional expenditures has been provided by USMEF, while prices were provided by Alimentos Campeón.

Preliminary emphasis will be given to promotion expenditures and changes in sales quantities as the measures used to analyze Guatemalan consumer responses during

the 14 month time period investigated. Costs of resources utilized in the promotion will be compared to corresponding changes in sales quantities and sales revenue to determine the effectiveness of the promotion. The study will include a quantitative analysis of costs and benefits of the promotion activities by estimating the elasticity of promotion to identify changes in consumption behavior as a result of the promotion activities conducted.

Expected Results

Preliminary research shows that sales of U.S. beef in Guatemala have increased over the stated 14 month period. Sales of the new beef value cuts positively increased from the initiation of promotion activities; however, the magnitude of the consumer response will be identified in the Results section of this thesis. The study examines the effectiveness of the promotion activities by understanding consumer responsiveness to promotion activities and prices. The overall impact of the USMEF promotion on U.S. beef value cut sales in Guatemala City is analyzed and discussed.

Organization of Remaining Chapters

The USMEF promotion of U.S beef value cuts will be analyzed and discussed in a total of five chapters. Chapter II will review literature of various methods for evaluating promotion programs and other demand responses to promotion in an effort to find the most appropriate methodology for this study. Chapter III will discuss the proposed regression models, the data, and methodology of the model. Chapter IV will

discuss the results, analysis and statistical tests conducted to test significance of the model estimation. This will include an aggregate assessment of U.S. beef value cut sales in Guatemala City. The conclusions and implications of the study will be summarized in Chapter V and considerations for future work will be discussed as well.

CHAPTER II

REVIEW OF LITERATURE

There are multiple ways to evaluate the effectiveness of a promotion program. This survey of literature was compiled to explore the various methodologies used in studies similar to the meat promotion program carried out by USMEF. Common tools used to analyze changes in sales or consumer demand, as a result of a promotion, are Regression Analysis, Distributed Lag Models or various Demand System Models. Upon completion of the literature review, the most appropriate method for evaluation will be used to analyze the USMEF promotion of US beef in Guatemala.

Richards, Van Ispelen and Kagan (1997) used a two stage Linear Expenditure System (LES)/Almost Ideal Demand System (AIDS) model to evaluate the effectiveness of export promotion in increasing market share and import consumption of U.S apples in foreign markets. Alternative goods in the first stage LES include banana, orange and grape imports, and market shares of various exporting countries are estimated in the second stage AIDS method. Promotion is the exogenous variable in both stages of the model. Singapore and the United Kingdom are used as case studies, and annual data are used for the time period 1962-93, with the first 26 years serving as the base, non-promotion years (Richards et al. 1997).

Results show that promotion increases consumer expenditures on U.S. apples in both Singapore and the U.K. Although positive, the magnitude of increased expenditures is small, resulting from free-riding by other countries. The study further

proved that promotions that are generic in nature rather than branded by country, provide increases in import expenditures from all countries, and have a higher effect on countries with more inelastic demand for apples. However, in order for other nations to benefit from U.S. branded promotions, the foreign product must be seen as a good substitute to the U.S. product. An important result from this study, which can be directly applied to the promotion of U.S. Beef in Guatemala, is the fact that promotion effects are more prominent when the product being promoted is differentiable. Therefore, it should hold that the effects of the promotion of U.S. quality cuts should be of a greater magnitude than a promotion of U.S. beef in general, because the three meat cuts being offered by the study are not available for import from any other nation (Richards et al. 1997).

The basis of most commodity promotion programs is to increase consumer demand, which should in turn increase producer profits due to higher prices and increased consumption. Although the marginal effects of demand are typically minute, the overall effect on producers is typically large given the magnitude of the quantity supplied of the given commodity. While the magnitude of these effects on one another has previously been studied, Davis contributes to the literature with a discussion of the relation of statistical significance of the promotional demand effect to the statistical significance of the promotion price effect and profit effect (Davis 2005).

This is an important point in the evaluation of a commodity promotion program because the principal findings of Davis suggest that understanding the significance of the promotion variable in a demand equation does not provide sufficient information to infer demand and/or price effects. In summary, a researcher must estimate both demand

effect and price effect equations to understand the direct impact of the promotion program on demand, price and profit (Davis 2005).

Funk, Meilke and Karl (1977) use a basic model to estimate retail demand for beef and to derive price and advertising elasticities in Canadian supermarkets. To estimate the retail demand for beef, the authors used a retail demand function with weekly beef sales as the dependent variable and the independent variables include own beef prices, own substitute prices of beef, pork and other meats, competitor substitute prices, own advertising for beef, pork and other meats, competitors' advertising and seasonal factors. The model excludes three variables commonly found in similar demand analyses including retail availability, creative aspects of advertising and consumer advertising, since the changes in these variables were negligible during the short timeframe of the study. The model does not include a variable measuring consumer income because the time frame of the study is 17 months, and it was assumed that no measurable changes in income of consumers would occur in the short time-frame used. This is helpful and gives further support for the exclusion of this same variable in the USMEF study, given the similar short timeline of 14 months of the promotion and sales information from Guatemala (Funk et al. 1977).

The information analyzed helped to determine the sales response to advertising and price changes in the Toronto market for the beef cuts aggregated and for the beef cuts individually. The conclusion of this work found beef sales to be price elastic. Advertising elasticities were also found to be positive, but less than the magnitude of the positive price elasticity (Funk et al. 1977). It is hypothesized that similar results will be

found in the responsiveness of Guatemalan consumers through the promotion of US beef. Although the timeframe of the Canadian study is short, and the market small in size, the relatively simple methodology allows the model to be applied to other studies with similar characteristics, and gives support for the exclusion of certain nonessential variables in similar situations such as that found in Guatemala.

Capps (1989) used a Seemingly Unrelated Regression model to estimate retail demand functions for beef products found in stores of a supermarket chain in Houston. The study uses scanner data provided from the retail grocery chain over an 18 month time period, and has highly disaggregated daily information. The size of the data set leads to the necessity of aggregating daily data into weekly observations. The dependent variable is pounds purchased of various meat cuts and explanatory variables considered in the estimation include own price, competing prices, seasonality factors including holidays, advertising and a dummy variable to account for the payday effect. The inclusion of this set of variables is beneficial for consideration in the USMEF study, however the more highly aggregated data set used and limited observations available does not permit for the inclusion of seasonality or payday effects in the model of this thesis. Capps found all own price elasticities to be negative and statistically significant, while advertising elasticities were positive and also significant. It is hypothesized that similar results will be found in this thesis (Capps 1989).

Parks (1967) discussed a method for estimating a system of regression equations when both serial and contemporaneous correlation are present. This method was later implemented when Capps and Havlicek (1978) used a generalized least squares (GLS)

model to estimate parameters for a demand analysis of energy use in agriculture. The data was a pooled set of time-series cross-sectional observations over a five year period. Heteroscedasticity and mutual correlation existed in the pooled series, and the Parks Model was found to be the most appropriate method of estimation. The coefficients estimated conformed to *a priori* assumptions when compared to typical demand models, with the exception of one variable which is not relevant to this thesis. The pooling of the cross-sectional time-wise data along with the methodology used in the estimation is of interest to this thesis. The double logarithmic form applied to the variables is also of interest because the estimated coefficients are the representative elasticities. The approach used to understand demand responses provides a plausible methodology to follow when estimating the Guatemalan consumer demand for U.S. beef (Capps 1978).

Brester and Schroeder (1995) use a nonlinear Rotterdam model to estimate the quarterly effects of meat advertising expenditures on meat demand. The study gives special attention to the substitution effects among beef, chicken and pork meat products and how generic and brand advertising affect the consumption of each meat product. The study discovered that branded advertising caused U.S. beef, pork and chicken demand to increase from 1980 through 1993. Advertising elasticities measured were small; however, the aggregate effects on demand were significant due to the large size of the meat commodity market (Brester 1995).

Although all types of advertising are typically intended to increase sales, it was discovered that beef and pork demand were not increased by generic advertising, since the marginal impacts of generic advertising on beef and pork demand are not

significantly different from zero in this case. It was also found that brand advertising of beef and chicken increased demand for all three meats as a group, and both brand and generic advertising created substitution among the three meat groups. The article suggests that advertising should always be considered when studies of meat demand such as this are conducted (Brester 1995).

In 1990, over \$300 million was spent by U.S. commodity organizations, which was followed by controversy in the measurement of generic advertising effects. Alston et al. (2000) discuss issues in studies of the demand response to generic advertising. The measurement of welfare effects, specifically distributional effects, on producers and consumers of beef, pork and poultry in the United States as a result of the generic advertising of beef is addressed in the article. Attention is given to the importance of taking all affected individuals into account when measuring the effects of check-off programs (Alston et al. 2000).

The work of Alston, Chalfant and Piggott proves beneficial to this study because it discusses the difficulties that arise when deciding whether to estimate a single demand equation or a system of demand equations when studying the effects of promotion on a specific good, along with other relevant difficulties that arise when estimating each equation such as which advertising costs to include, which variables should be included in the system and which prices to include as demand shifters (Alston et al. 2000).

The article also discusses the fact that smaller advertising elasticities are observed in Rotterdam models on meat demand than models such as the Almost Ideal demand system. The article questions if this is a consistent pattern and if so, why. The

authors call for greater understanding of the effects of modeling among researchers and specifically regarding the study of promotional effects. This factor could lead us to be more interested in using a distributed lag model to estimate effects rather than a demand system to analyze the impact of the U.S. beef promotion, which will be further explored in the study (Alston et al. 2000).

The market response to a communications mix is analyzed by Montgomery and Silk (1972). Although the study uses prescription drugs as a subject, there is great relevance to the USMEF promotion evaluation as it applies distributed lag models to time series data to measure changes in short run, intermediate and long term effects of market share of a specific prescription drug. The communications variables included different forms of advertising and it was found that each form had a different magnitude and timing effect on market share of the drug. The different forms of communication included as endogenous variables include product sampling and informational literature, media advertising and direct mail advertising. Although the mediums used are not identical to the methods utilized in the USMEF promotion, they are very similar in type and kind, rendering this study extremely useful as an example to follow for a reference of methodology used. The basic distributed lag model used is:

$$LMS(t) = \alpha_0 + \sum_{i=0}^I \alpha_{i+1} LJA(t-i) + \sum_{j=0}^J b_{i+1} LSL(t-j) + \sum_{k=0}^K c_{k+1} LDM(t-k) + e(t)$$

In the above equation, L represents the log of the variable and $e(t)$ is the error term. The dependent variable is the market share of the prescription drugs (MS) and explanatory variables are journal advertising (JA), samples and literature (SL) and direct mail advertising (DM).

The results of the study show how managers can be more successful in three different areas by learning from the nature of market responses to the communications mix used, identify problem areas of the communication mix and how to conduct market experiments to estimate future responses to changes in communication mixes (Montgomery 1972). Similar understanding is hoped to be gained from the USMEF meat promotion study to determine whether there are differing consumer responses to the various forms of communication media used in Guatemala City.

Zellner (1962) argues that it is often more beneficial to estimate a set of equations simultaneously rather than estimating each equation separately using least squares estimators. By applying Aitken's generalized least squares to all the equations simultaneously as a system, more efficient coefficients can be estimated than when single equation estimations are derived. Zellner further suggests various types of studies which would fit with this specific analytical tool. A demand analysis for consumption goods is included as a potential application of this method, which leads to the possible inclusion of a Seemingly Unrelated Regression analysis as a part of the USMEF study (Zellner 1962).

Qualitative evaluations before and after the promotion in Guatemala were conducted in an effort to determine the changes in consumer perception of US beef resulting from the promotion activities. USMEF conducted a consumer survey to 200 subjects in Guatemala City. The survey found that the promotion campaign was successful in increasing Guatemalan consumer perceptions of US beef. This increase was shown by a greater awareness of US beef, increased price awareness, increased

retail store awareness of US beef products, increased country of origin attention and an increase in the “share-of-mind” of US beef. This last term means that a larger percentage of consumers named the US when asked what country first comes to mind when thinking about beef (Vernazza-Paganini 2006).

Although the study was beneficial in that it shed light on the fact that Guatemalan consumers have a positive perception of US beef, there was no qualitative analysis to determine the direct effects of the promotion efforts on sales of the US Beef products. This fact supports Waugh’s view, which states that although psychological analysis is important, it is critical to have an economic evaluation of the effectiveness of farm products promotions. One of the purposes of this thesis is to answer the call that Waugh poses (Waugh 1959). Figure 2.1 and the following six figures show results from the consumer responses to the survey of questions asked before and after the promotion took place in Guatemala City.

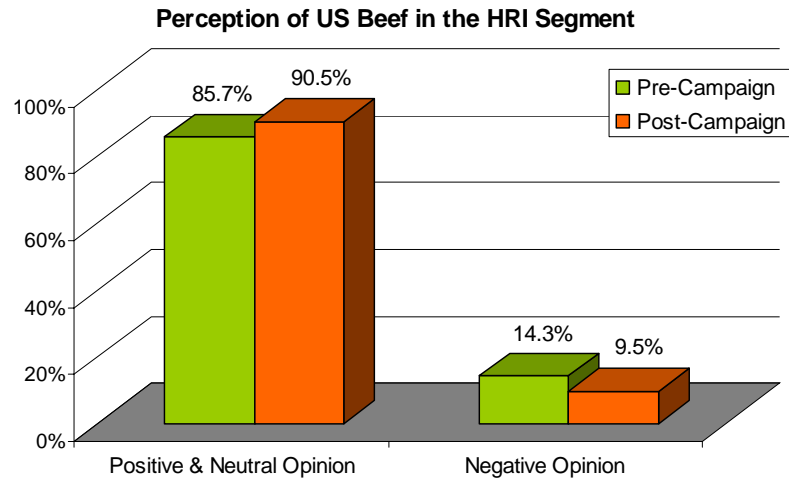


Figure 2.1 Perception of U.S. Beef in Guatemala City
(United States Meat Export Federation, 2006)

The above chart shows that after the promotion activities were carried out, an approximately 5% increase in positive or neutral opinion and approximately 5% reduction in negative opinion of U.S. beef in Guatemala City. It is assumed that this increase in non-negative opinions will translate into increased sales revenue as a result of the promotion activities. This hypothesis will be tested in this thesis.

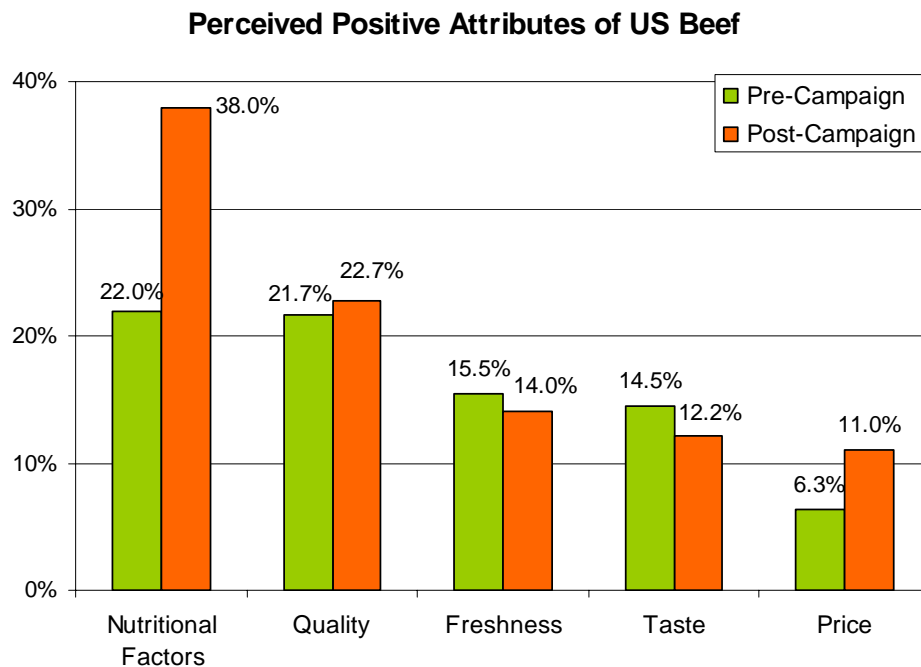


Figure 2.2 Perception of U.S. Beef Attributes
(United States Meat Export Federation, 2006)

The perception of U.S. attributes is graphically illustrated above in Figure 2.2. The most notable changes in perception are in regard to the nutritional factors found in U.S. Beef. There was a 16% increase in the perceived positive attributes of nutritional factors associated with U.S. beef. The perceived positive perception of quality increased 1% and the perceived positive perception of price increased nearly 5%. Although the previous three categories showed improvements in perceived perception in Guatemala City, consumer positive perception decreased with regard to freshness and taste of U.S. Beef.

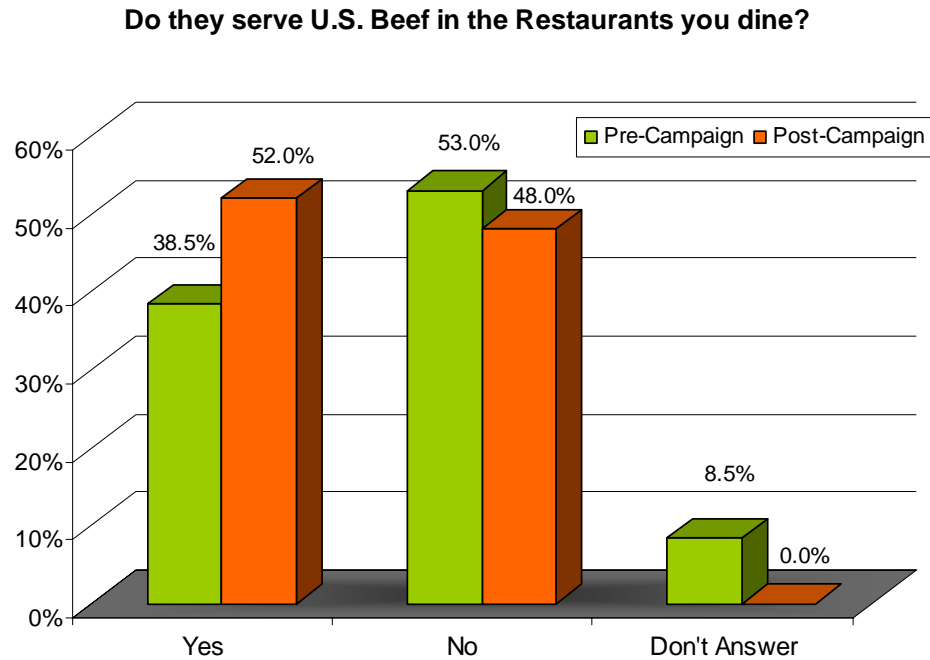


Figure 2.3 Availability of U.S. Beef in Restaurants
(United States Meat Export Federation, 2006)

Figure 2.3 shows that after the promotion program was implemented, the percentage of consumers who believe that U.S. Beef is available in restaurants frequented was nearly 14% higher. Results also show a 5% percent reduction in consumers who believe that U.S. Beef is not available in preferred restaurants.

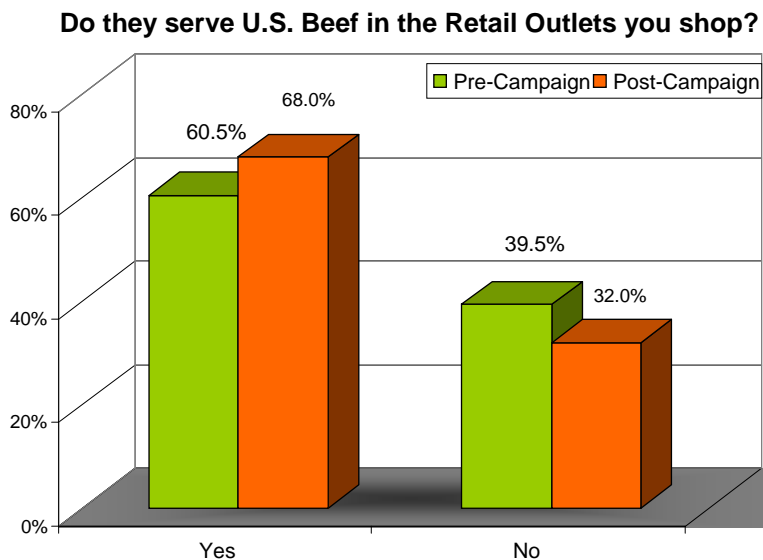


Figure 2.4 Availability of U.S. Beef in Retail Shopping Outlets
(United States Meat Export Federation, 2006)

Similar to the responses given by consumers concerning the availability of U.S. beef in restaurants, there was a 4.5% increase in consumers who believe that U.S. Beef is available in retail outlets shopped at and a 7.5% reduction in the amount of consumers who believe that U.S. beef is not available in retail outlets, as illustrated in Figure 2.4.

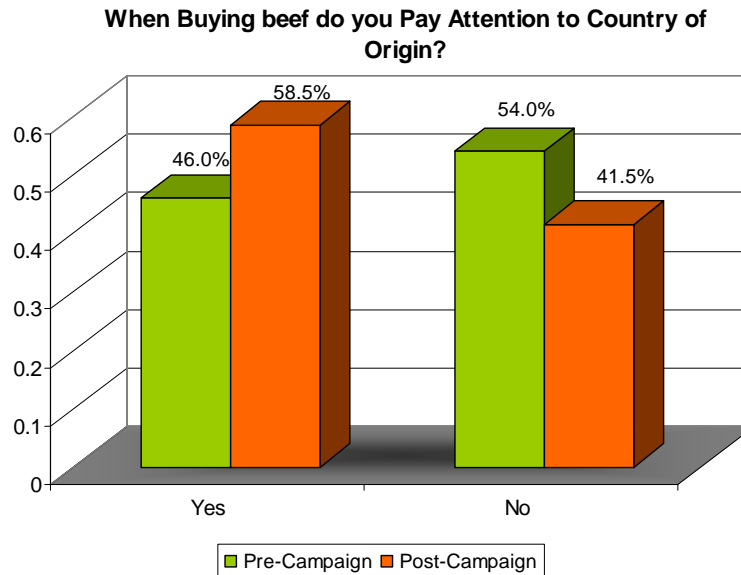


Figure 2.5 Beef Country of Origin Importance
(United States Meat Export Federation, 2006)

Figure 2.5 shows that the amount of consumers who consider the country of origin when purchasing beef increased 2.5% after the USMEF promotion. The amount of consumers who disregard country of origin when purchasing beef decreased by 2.5% after the implementation of the program. This shows the increased attention given to country of origin of beef among the consumers interviewed.

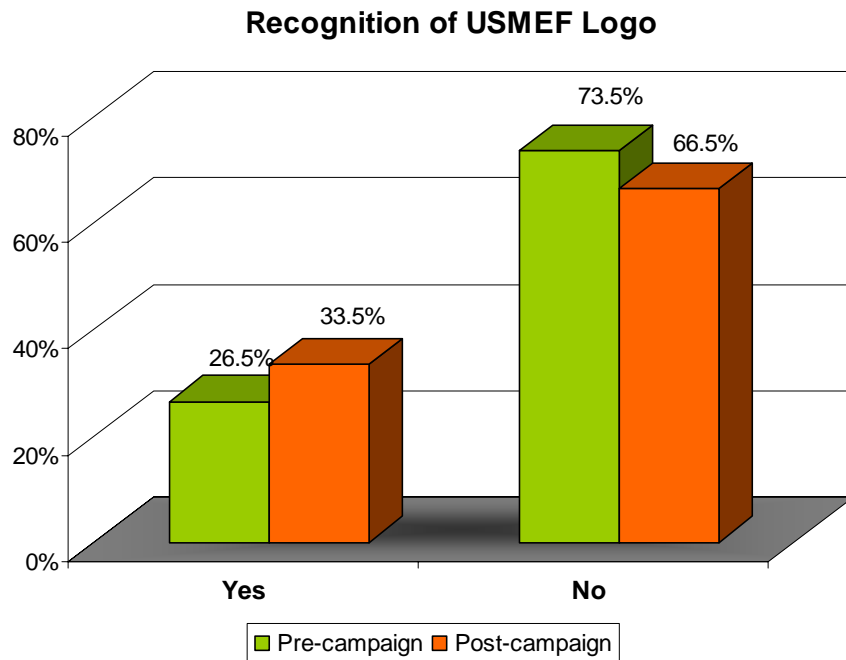


Figure 2.6 Recognition of United States Meat Export Federation Logo
(United States Meat Export Federation, 2006)

Figure 2.6 shows that among the consumers surveyed in Guatemala City, recognition of the USMEF logo increased after the promotion program was carried out. Even after the promotion, over 65% of consumers surveyed still did not recognize the USMEF logo in Guatemala City.

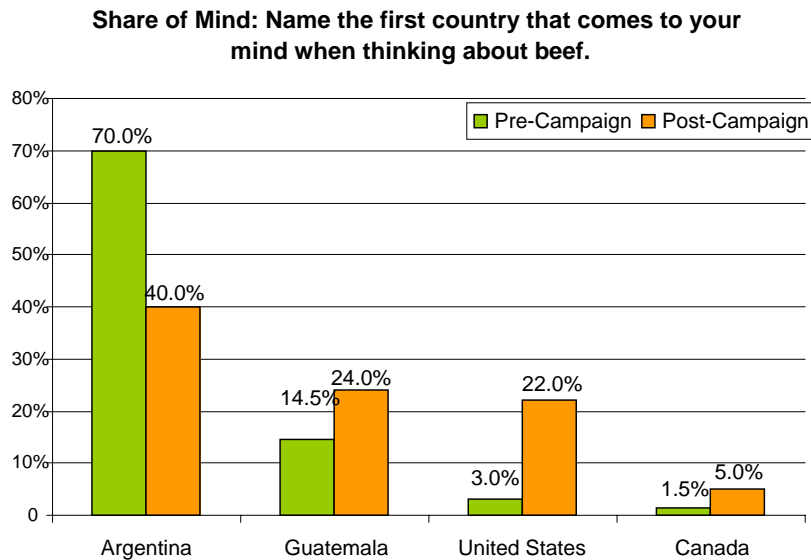


Figure 2.7 Countries Thought of with Regard to Beef
(United States Meat Export Federation, 2006)

The share of mind of beef among Guatemalan consumers is represented above in Figure 2.7. Share of mind is a measure used in the survey to identify the countries that are thought of most when consumers think about beef. The most often thought of countries in order include Argentina, Guatemala, the United States and Canada. The order of most often thought of countries did not change after the promotion was carried out in Guatemala City; however, there was a 19% increase in the amount of consumers surveyed who thought of the United States first when asked to name the first country brought to mind when thinking about beef.

Summary

Several methods of evaluating promotion activities and consumer demand response to advertising were surveyed in the review of literature. Methodologies used include the use of demand systems, single equation estimators and the use of distributed lags on the advertising variables in the model. While there are multiple ways to effectively evaluate demand responses to promotion and pricing, the appropriate model to utilize in this thesis was selected from a large survey of past work completed.

Zellner (1962) discusses the idea that it is often more beneficial to estimate a set of equations simultaneously rather than estimating each equation separately using least squares estimators. More efficient estimations can be found by applying Aitken's generalized least squares to all the equations simultaneously as a system, rather than deriving single equation estimators. Demand analysis for consumption goods is considered as an appropriate application of this method (Zellner 1962).

Brester and Schroeder (1995) use a nonlinear Rotterdam model to estimate the quarterly effects of meat advertising expenditures on meat demand. The study measured small advertising elasticities, which will offer further support if similar measurements are found in this thesis. Richards et al., (1997) evaluated the effectiveness of a U.S. export promotion program by using a two stage Linear Expenditure System/Almost Ideal Demand System model. While insightful, the model specifications do not reflect the information available in the USMEF study.

Montgomery and Silk (1972) study consumer responsiveness to advertising in the prescription drug market. The study includes the use of distributed lags in the model,

which illustrates the common finding that a lagged response rather than an immediate response is typically found when evaluating the effects of advertising or promotion. Funk et al., (1977) use a basic model to estimate retail demand for beef and to derive price and advertising elasticities in Canadian supermarkets, which has a short timeframe similar to the study of this thesis. Capps (1989) used a Seemingly Unrelated Regression model to estimate retail demand functions for beef products located in supermarkets. The study has similar objectives, yet uses scanner data over an 18 month timeframe, which is much more highly disaggregated than the data available for the evaluation of the USMEF promotion program.

Capps and Havlicek (1978) used a generalized least squares (GLS) model to estimate parameters for a demand analysis of energy use in agriculture. The data was a pooled set of time-series cross-sectional observations that was heteroscedastic and mutually correlated. The Parks Model application of GLS regression was found to be the most appropriate method of estimation in this demand analysis. Although the variables measured by Capps and Havlicek differ from those found in the USMEF study, the methodology used for the demand analysis appears to be the most appropriate model to explain the consumer demand responses in Guatemala City. Although USMEF has a qualitative study that explores perceptions of U.S. beef before and after the promotion, this thesis is the first study that quantifies the consumer responses to promotion in Guatemala City. The application of the Parks model is further discussed in the methodology section of this thesis.

CHAPTER III

METHODOLOGY

The primary objective of this research is to understand consumer responsiveness to branded beef promotion activities in Guatemala City over the 14 month time period of January, 2006 through February, 2007. The secondary objective is to understand consumer sensitivity to changes in prices over the same timeframe. Given the small amount of observations, the data are pooled to insure an adequate number of observations from a statistical standpoint. Pooling the data results in increased degrees of freedom, which will allow us to conduct statistical tests with increased power. After a careful review of literature and examination of the data, the most appropriate method for this analysis is the Parks Model (Capps 1978). This model allows the analysis of observations from each of the time-wise cross-sections being pooled, along with their corresponding error structure. The Parks Model allows for the correction of the heteroskedastic and autoregressive behavior within the data set for each beef value cut, so that the estimated coefficients have increased efficiency.

The Parks Model is applied to the set of pooled U.S. beef value cut sales quantities in an attempt to evaluate advertising and price effects on U.S. beef consumption in Guatemala City. The model aims to uncover the effects of advertising on sales. Therefore, the dependent variable corresponds to volume (quantity in pounds) while the independent variables are aggregate promotion expenditures and beef value cut prices, all in nominal U.S. dollars.

Data

Data for monthly quantities are used to estimate parameters for a pooled time-series and cross-sectional Parks Model of Generalized Least Squares regression relating promotional expenditures and prices to the sales quantities of the three new U.S. beef value cuts in Guatemala City's Hotel, Restaurant and Institutions (HRI) sector. The U.S. beef value cuts introduced by USMEF in 2006 include the Petit Tender, California Steak and Texas Fillet. The Guatemalan importer Alimentos Campeón was identified by USMEF as the in-country partner for the promotion program. Monthly sales data including quantity and prices in the Guatemalan Quetzales currency for three U.S. beef value cuts in 2006 and 2007 are provided by Alimentos Campeón. Prices were converted into U.S. Dollars by using exchange rate values from the National Bank of Guatemala (2007) for the 14 month time period. The key explanatory variables are the various expenditures related to the promotion and prices of the beef value cuts. A list of all promotional expenditures, descriptions and dates of promotion activities have been provided by USMEF.

Promotion expenditures incurred by USMEF and corresponding changes in monthly quantities are the measures used to analyze Guatemalan consumer responses to the U.S. beef value cut promotion activities in Guatemala City during the 14 month period of the study. Expenditures of resources utilized in the promotion program are compared to corresponding incremental changes in monthly sales revenue by using a Benefit Cost Ratio to determine the overall effectiveness of the promotion program. This study includes a quantitative analysis of demand responses to changes in price, as

well as costs and benefits of the promotion activities by estimating parameters for the Parks Model of Generalized Least Squares regression. Appropriate lags on the advertising variable, to identify changes in consumption behavior during and after the promotion activities are also analyzed.

Summary of Data

The dependent variable in the study is the pooled set of monthly quantities (in pounds) of U.S. beef value cuts including the Petit Tender, California Steak and Texas Steak in Guatemala City, Guatemala. Explanatory variables are prices of each value cut and aggregate promotion expenditures. The quantities of each value cut sold, and the corresponding prices of each cut were recorded monthly by Alimentos Campeón. The beef value cut sales quantities, and the monthly prices of each cut are illustrated for the 14-month time period in Figures 3.1 and 3.2.

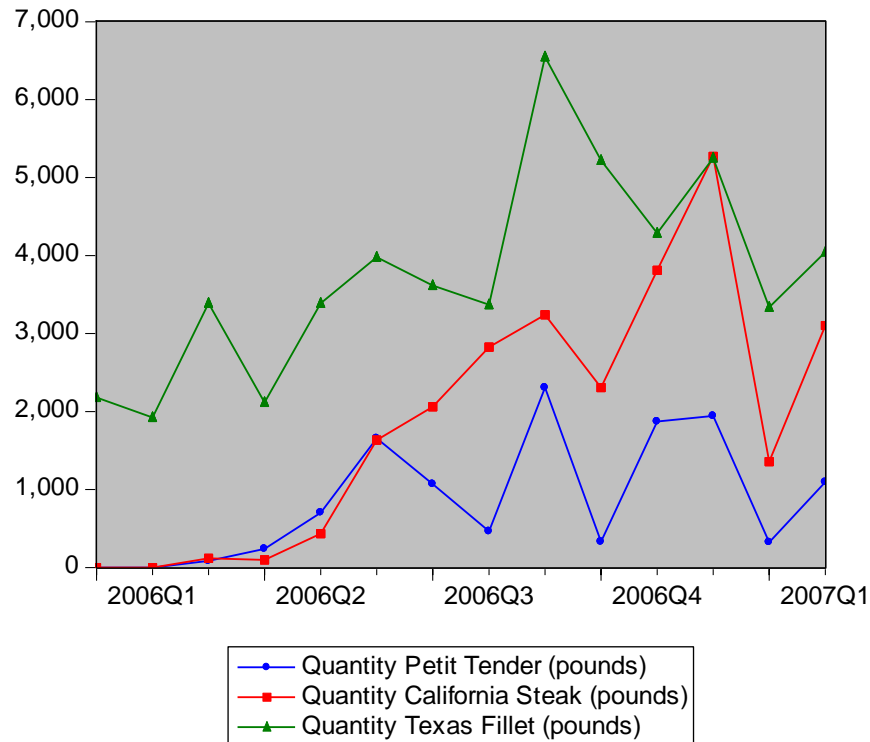


Figure 3.1 Monthly Beef Value Cut Quantities
(Alimentos Campeón, 2007)

The Texas Fillet clearly holds the largest market share throughout the timeframe, and accounts for 58% of the total quantity of beef value cuts sold from January 2006 to February 2007. The California Steak comprises 29% of total quantity sold and the Petit Tender held the remaining 13% of sales quantity. Sales of all value cuts follow a general upward trend throughout 14 month timeframe analyzed.

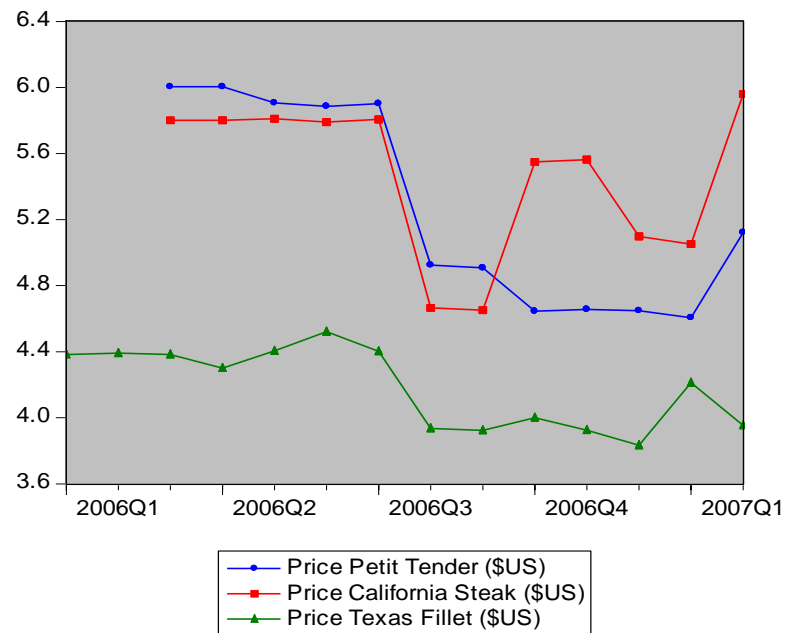


Figure 3.2 Monthly Beef Value Cut Prices per Pound
(Alimentos Campeón, 2007)

The Petit Tender and California Steak were not available for sale to consumers in Guatemala until the month of March, 2006, so there are no price data in the months of January 2006 and February 2006. Also important is the fact that all quantities of the Petit Tender and California Steak recorded in March were given as trial samples to various clients of Alimentos Campeón. Although there was no price charged to restaurants for either cut during March, this thesis assumes the prices would have followed a similar pattern to the Texas Fillet. Therefore, monthly prices for March are assumed to be equal to those incurred in April for each value cut. This imputation allows for the inclusion of the March quantities in the model, which is important given the limited number of observations available.

The relationships between own prices and quantities of each beef value cut sold are illustrated in Figures 3.3-3.5. The charts depict the negative relationship between own price and quantity sold of each for the beef value cuts individually. The downward sloping demand curves are expected, and verify that as the own price of each beef value cut increases, *ceteris paribus*, quantity sold of each cut decreases. The one-on-one relationship between price and quantity sold of each cut is considered individually in Figures 3.3-3.5. A regression line has been imposed on each figure to show the general relationship between price and quantity for each cut. The Petit Tender shows typical demand responsiveness. As price of the cut increases, the quantity demanded decreases. For example, 2,307 pounds were sold in September 2006 when the price was \$4.91 per pound. The price was increased to \$5.12 per pound in February, 2007 and quantity sold decreased to 1,095 pounds. This negative own price relationship is expected.

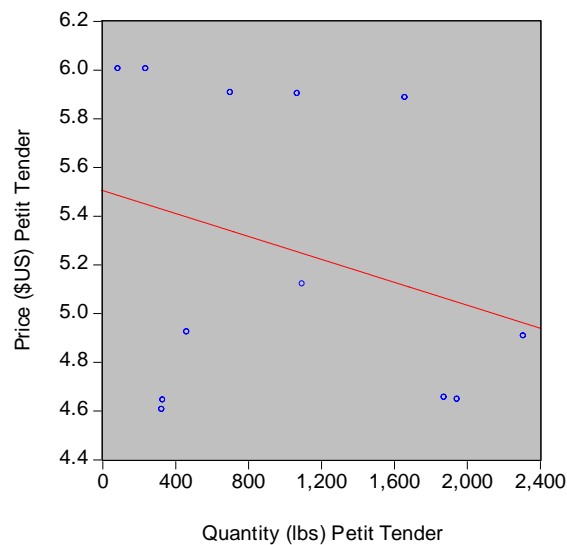


Figure 3.3 Comparison of Price and Sales Quantity of Petit Tender
(Alimentos Campeón, 2007)

The California Steak shows that as own price of the cut increases, quantity demanded decreases. In 2006, the October price of \$5.55 per pound yielded sales of 2,306 pounds. Sales increased to 5,272 pounds in December when the price decreased to \$5.10 per pound. This downward sloping demand curve is illustrated in Figure 3.4, which shows the negative relationship between own price and demand.

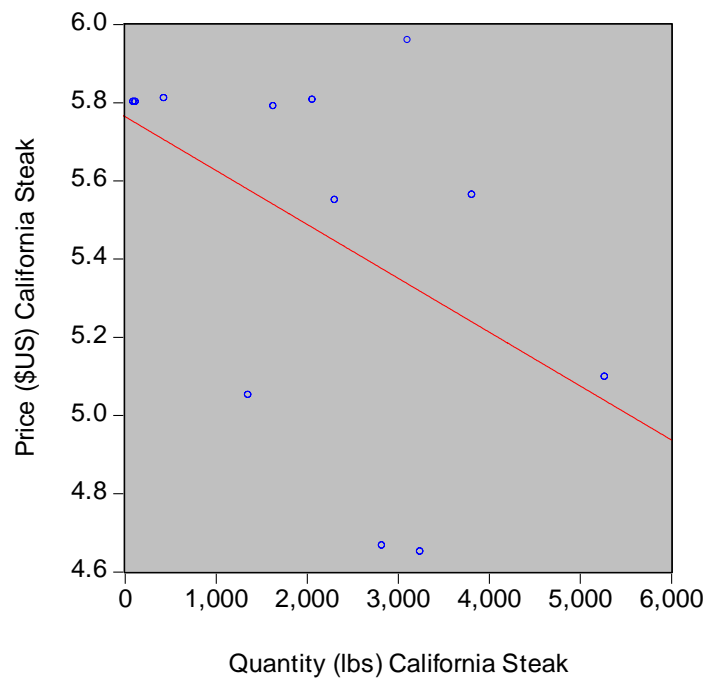


Figure 3.4 Comparison of Price and Sales Quantity of California Steak
(Alimentos Campeón, 2007)

Figure 3.5 illustrates that demand for the Texas Fillet decreases as price of the cut increases. In October, 2006, sales were 5,221 pounds with a price of \$4.00 per pound. Sales decreased to 3,335 pounds in January, 2007 when price increased to \$4.21 per pound. Own price and quantity demand are negatively related, which is expected.

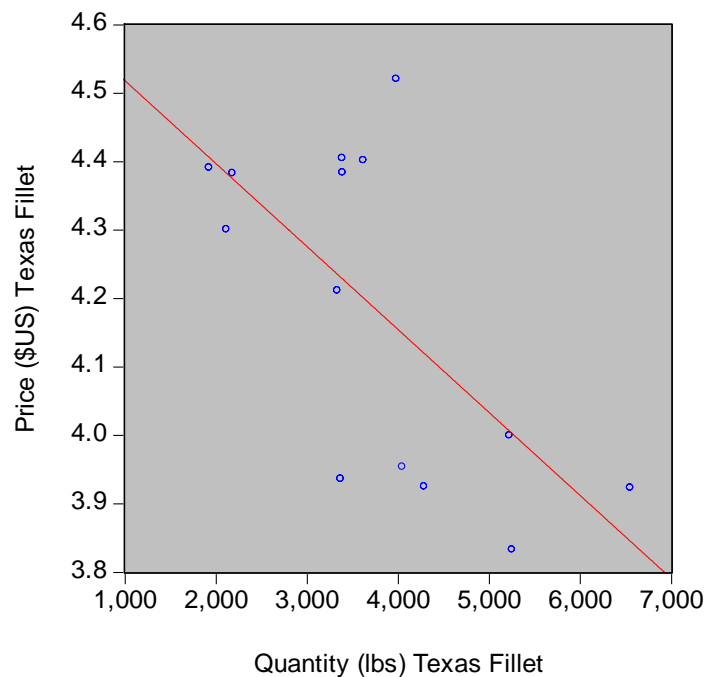


Figure 3.5 Comparison of Price and Sales Quantity of Texas Fillet
(Alimentos Campeón, 2007)

The promotion activities were divided into different communication media. The various activities utilized by USMEF include newspaper advertising, mini-billboards, television communication, banners, taste testings, educational seminars, and cash awards for sales and service associates. The three value cuts are available in the United States;

however, the names of the cuts were created to specifically target Central and South American Consumers. The California Steak is commonly referred to as the Flat Iron Steak, the Texas Steak is called the Ranch Cut and the Petit Tender retains the same name in the United States. Just as the names of the cuts were altered, the activity for the promotion of these cuts was specifically tailored for Guatemalan consumers. The promotion targeted Guatemala City as a whole, and examples of the promotional materials are shown on the following pages.

The USMEF Promotion was introduced during a press conference in Guatemala City on June 8, 2006. Figures 3.6-3.8 are photographs from the press conference including images from the introductory presentation and the three beef value cuts in thawed form being displayed for attendees. The title of the presentation below translated into English says, “American Beef, Flavor and Quality Your Way.” The USMEF and USDA logos are also displayed in the presentation.



Figure 3.6 USMEF Press Conference in Guatemala City



Figure 3.7 Thawed Beef Value Cuts



Figure 3.8 U.S. and Guatemalan Flags Symbolize Trading Partnership

Each advertisement in the promotion displays the USMEF logo depicted below in Figure 3.9 and states, “U.S. Meat. Quality in Beef.” This is important in that increased recognition of the USMEF logo was a goal of the promotion program.



Figure 3.9 U.S. Meat Export Federation Spanish Logo

Figure 3.10 is a banner that showcases the Texas Fillet. The sign reads, “American Beef, Quality and Flavor Your Way. If today you feel audacious, brave, tenacious, determined, strong, enthusiastic...try a succulent cut: Texas Fillet. Always a cut for your style. Quality that marks the difference.”



Figure 3.10 Example of Texas Fillet Banner

The following banner illustrated in Figure 3.11 also displays the Texas Fillet, and reads, “American Beef...Flavor with Quality. If today you feel audacious, brave, tenacious, determined, strong, enthusiastic...try a succulent cut: Texas Fillet. Always a cut for your style. Quality that marks the difference.”



Figure 3.11 Example 2 of Texas Fillet Banner

Figure 3.12 advertises the California Steak and reads, “American Beef...Flavor guaranteed. If today you feel happy, jovial, optimistic, sociable, competent, innovative...there is a new cut to taste: California Steak. Always a cut for your style. Quality that marks the difference.”



Figure 3.12 Example of California Steak Banner

An example of one of the many billboards found in Guatemala City during the months of June, July and August is shown below in Figure 3.13. The mini-billboards were located in the more affluent and tourist areas, which included Zone 10 and Zone 7 of Guatemala City. Each sign sits vertically, on heavily trafficked streets, and is easily visible by pedestrians and motorists alike. This mini-billboard reads, “American Beef, Quality and Flavor Your Way.” The three value cuts, California Steak, Petit Tender and Texas Fillet are listed at the bottom, along with the USMEF website www.usmef.org. Restaurants featuring the U.S. beef value cuts are listed on the right side of the sign.



Figure 3.13 Mini-Billboard Example

Each of the beef value cuts has a specific logo included in promotion media. The individual logo for each cut is shown in Figure 3.14.



Figure 3.14 Beef Value Cut Logos

Weekly newspapers advertisements were run in the leading Guatemalan newspaper Prensa Libre for eight weeks from May 2006 through July 2006. Two advertisements were run per week for the first four weeks, and one advertisement per week was run for the last four weeks. The advertisement reads, “The U.S. Beef cuts are much more smooth and exquisite.” An example of the quarter page, full color advertisement used is shown below in Figure 3.15.



Figure 3.15 U.S. Beef Newspaper Advertisement

Various restaurants in Guatemala City created specials and offerings of the U.S. beef value cuts for customers. Photographs of the restaurants Los Rancos and Cascadia, located in Zone 10 of the city, are shown on the following pages in Figures 3.16-3.25. Los Rancos and Cascadia are elegant upscale restaurants in Guatemala City and serve as good examples of the fine dining establishments involved with the introduction of the U.S. beef value cuts to Guatemala City.



Figure 3.16 Restaurant Los Rancos Entrance



Figure 3.17 Restaurant Los Ranchos Indoor Dining



Figure 3.18 Restaurant Los Ranchos Outdoor Dining Patio

Cascadia is a fine dining restaurant, which has a weekly rotating menu. The U.S. beef value cuts have been included in the menu during various weekly offerings. The kitchen has an open style and is located in the center of the restaurant. Lush tropical plants, fountains and comfortable lounge area create the ultimate dining experience.



Figure 3.19 Welcome to Cascadia

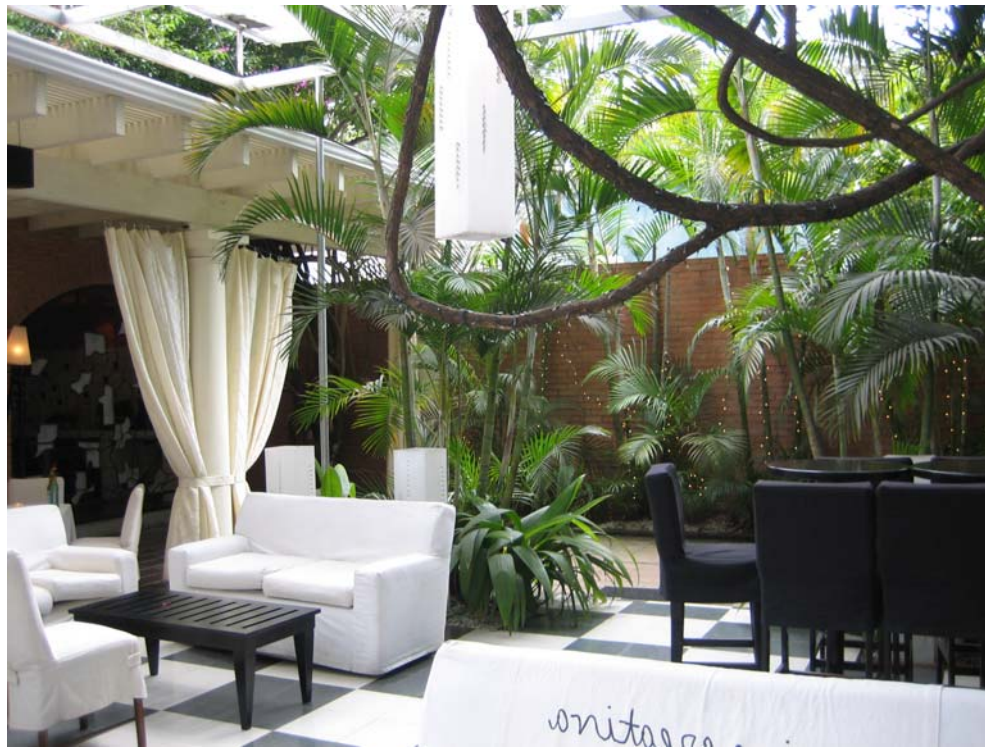


Figure 3.20 Restaurant Cascadia Lounge Entrance



Figure 3.21 Restaurant Cascadia Formal Dining Area



Figure 3.22 Restaurant Cascadia; Open Style Kitchen



Figure 3.23 Cascadia Menu Showcasing the California Steak



Figure 3.24 Restaurant Cascadia Owner and Head Chef
(Lacayo, 2006)



Figure 3.25 Prepared California Steak at the Restaurant Cascadia

All promotion expenditures were incurred by USMEF in the months of April, May, June, July and August. The promotion expenditures are further illustrated in Table 3.1, Figure 3.27 and Figure 3.28.

Table 3.1 Monthly Promotion Expenditures by Activity in U.S. Dollars

	Newspaper Ads	Mini- Billboards	TV Ads	Printing/Photo Costs	Tastings	Educational Seminars	Cash Awards	Monthly Total
Jan	0	0	0	0	0	0	0	0
Feb	0	0	0	0	0	0	0	0
Mar	0	0	0	0	0	0	0	0
Apr	0	0	0	525	0	22870	0	23395
May	1102	1246	0	1154	0	0	0	13901
Jun	8816	14063	1037	0	1750	0	0	25665
Jul	3306	5625	1037	0	1750	0	0	11718
Aug	0	0	0	0	0	0	3200	3200
Sep	0	0	0	0	0	0	0	0
Oct	0	0	0	0	0	0	0	0
Nov	0	0	0	0	0	0	0	0
Dec	0	0	0	0	0	0	0	0
Jan	0	0	0	0	0	0	0	0
Feb	0	0	0	0	0	0	0	0
Total	13224	20933	2073	12079	3500	22870	3200	77879

(United States Meat Export Federation, 2006)

As shown in Table 3.1, the largest amount of spending on the promotion program occurred in the months of April and June. The educational seminars and mini-billboards were the most costly of the promotion activities, and accounted for over fifty percent of total spending. Additional activities by level of spending include newspaper advertisements, cash awards for sales and service associates, tastings of the value cuts, cash awards and television advertising, respectively as illustrated in Figure 3.27.

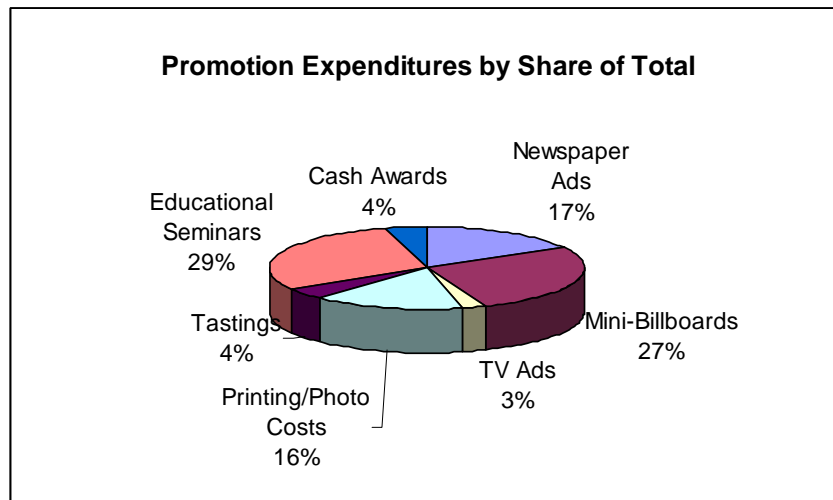


Figure 3.27 Promotion Expenditures by Share of Total
(United States Meat Export Federation, 2006)

Due to the small quantity of observations available during the 14 month timeframe, it is necessary to aggregate all advertising expenditures into a single variable to estimate the effectiveness of the promotion efforts as a whole in an attempt to conserve valuable degrees of freedom in the model. The aggregate monthly expenditures of the promotion are illustrated in Figure 3.28.

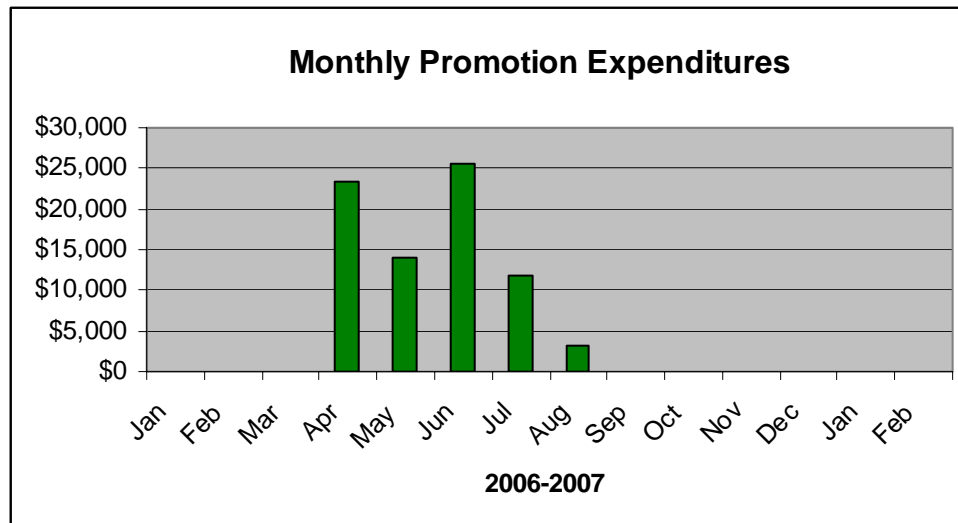


Figure 3.28 Monthly Promotion Expenditures Incurred by USMEF
(United States Meat Export Federation, 2006)

The one-on-one relationship between advertising and the quantities of each cut sold are of interest in this study. The square root of advertising and the corresponding changes in sales quantity of each cut are illustrated below in Figures 3.29-3.31. The square root of advertising is used in order to show the diminishing marginal effects of advertising on quantity of the beef value cuts. As shown below, increased advertising results in increased quantity when the appropriate lag structure is estimated for each cut. This situation is true for each of the beef value cuts when only the relationship between advertising and sales quantities is considered. When evaluating the individual effects of advertising on quantity, it was found that a one period lag of advertising is appropriate for the Petit Tender, while a two period lag of advertising is appropriate for the California Steak and the Texas Fillet. This means that it takes one month for advertising to impact sales quantity of the Petit Tender and two months for the promotion

expenditures to impact the sales quantities of the California Steak and Texas Fillet, when only advertising is considered and no other variables are taken into account.

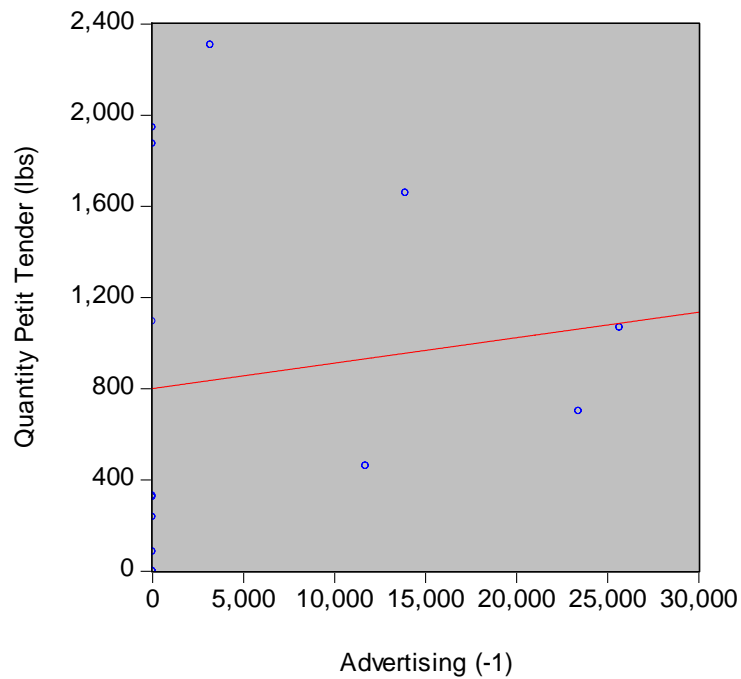


Figure 3.29 Comparison of Advertising and Petit Tender Sales Quantity

Figure 3.29 illustrates that as advertising increases, quantity sold of the Petit Tender increases as well. The most appropriate lag structure identified for the Petit Tender was one month. Therefore, demand responses to promotion occurred one month after the promotion activity when only advertising and no other explanatory variable is considered.

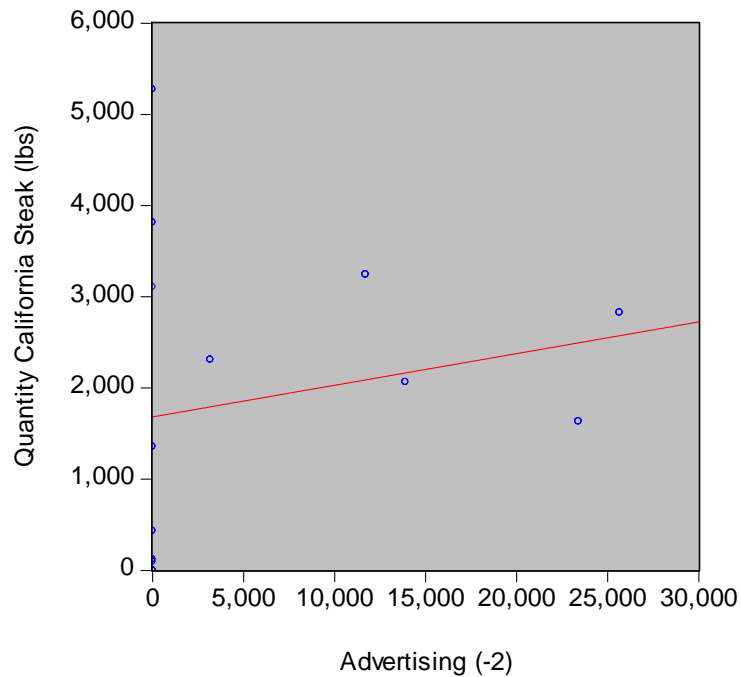


Figure 3.30 Comparison of Advertising and California Steak Sales Quantity

As shown above in Figure 3.30, there is a positive relationship between advertising expenditures and quantity sold of the California Steak. The lag structure identified shows that when advertising expenditures are increased, the increase in demand is experienced with a delay of two months.

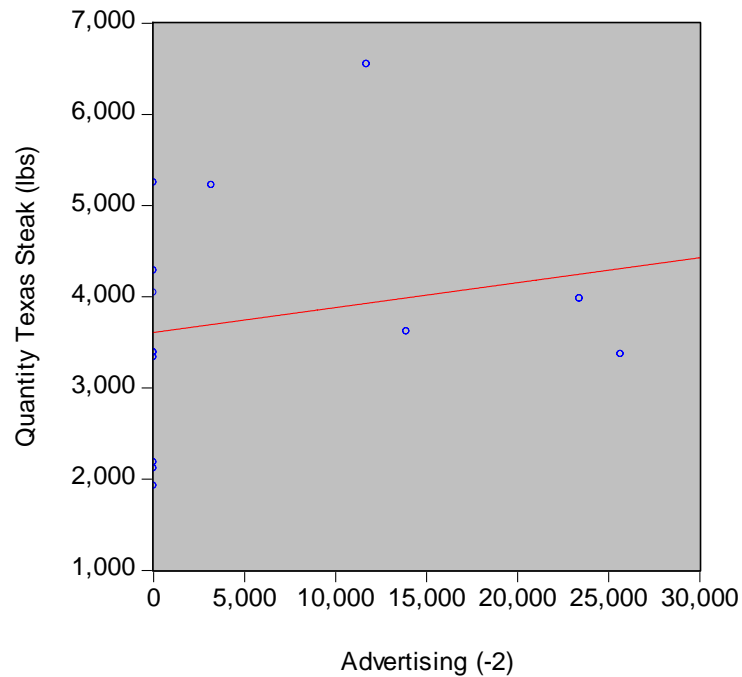


Figure 3.31 Comparison of Advertising and Texas Fillet Sales Quantity

Figure 3.31 shows that quantity sold of the Texas Fillet increases as advertising expenditures increase. This positive relationship shows promise in the estimation of the effect of advertising in the model. The appropriate lag structure identified is two months when only the effect of advertising is considered, which is also true for the California Steak.

Empirical Model

The primary objective of this research is to evaluate the consumer responsiveness to promotion activities of USMEF in Guatemala City, Guatemala. In an attempt to answer this question, the relationships among quantity, advertising expenditures and prices are analyzed. The most appropriate method to evaluate these relationships is to apply the Parks Model to estimate the parameters for the pooled time-series and cross-sectional data set. One may question why Multivariate Ordinary Least Squares (OLS) Regression or Seemingly Unrelated Regression (SUR) would not serve as the preferred alternative method for estimation. The difficulty with using OLS regression for this type of analysis is that it does not take into account serial correlation that may be present in each of the equations. The Parks Model accounts for any potential serial correlation that may arise. Statistical tests will be conducted to ensure that estimated coefficients for price and advertising are not statistically different when each meat type is estimated separately by using SUR, thus ensuring that an estimated Parks Model using the pooled cross-sectional data series is appropriate.

Pooling the data is the preferred method of estimation because this allows the addition of a greater number of observations into the model. The pooled data series conserves degrees of freedom and therefore generates more powerful statistical tests and gains in efficiency in the explanatory power of the model. By pooling the data, the observations for each value cut are stacked on top of one another to include information from all three beef value cuts within the same model. When the data is pooled, it is implicitly assumed that the whole pooled data set has the same error structure. Each

value cut has its own σ and its own autoregressive format. By applying the Parks Model to the pooled sample, there will be a reduction in the standard errors of the coefficients, which strengthens the explanatory power of the model when compared to OLS Regression results (Capps 1978).

The Parks Model modifies the OLS Regression,

$$\hat{\beta} = (x^T x)^{-1} x^T y$$

$$VAR(\hat{\beta}) = (x^T x)^{-1} \sigma^2$$

to a Generalized Least Squares (GLS) Estimation:

$$\hat{\beta} = (x^T \Omega^{-1} x)^{-1} x^T \Omega^{-1} y$$

$$VAR(\hat{\beta}) = (x^T \Omega^{-1} x)^{-1}$$

Where:

$$\Omega = \begin{bmatrix} \sigma_1^2 P_1 & 0 & \dots & 0 \\ 0 & \sigma_2^2 P_2 & \dots & 0 \\ \vdots & \vdots & & \vdots \\ 0 & 0 & \dots & \sigma_N^2 P_N \end{bmatrix}$$

And:

$$P_i = \begin{bmatrix} 1 & \rho_i & \rho_i^2 & \dots & \rho_i^{T-1} \\ \rho_i & 1 & \rho_i & \dots & \rho_i^{T-2} \\ \vdots & \vdots & \vdots & & \vdots \\ \rho_i^{T-1} & \rho_i^{T-2} & \rho_i^{T-3} & \dots & 1 \end{bmatrix}$$

(Kmenta, 1986)

The above model means that each cross-sectional unit is mutually independent from other cross-sections. Each ρ_i for each meat type shows that the error term in time

period t depends on previous error terms $t-1$, so that $\varepsilon_{it} = \rho\varepsilon_{i,t-1} + u_{it}$, where ρ typically varies from one cross-section to another. The Parks Model takes this autoregressive scheme into consideration when estimating the coefficients in the model to correct for autocorrelation that exists within each cross-section (Kmenta 1986).

Another version of the Parks Model takes into consideration the mutual correlation among cross-sectional units (meat types). This version of the Parks Model takes into account the mutual dependency among cross-sections into account when estimating the structural parameters of the model. The GLS estimation for the mutually correlated estimation using the Parks Model is:

$$\hat{\beta} = (x^T \Omega^{-1} x)^{-1} x^T \Omega^{-1} y$$

$$VAR(\hat{\beta}) = (x^T \Omega^{-1} x)^{-1}$$

Where:

$$\Omega = \begin{bmatrix} \sigma_{11}P_{11} & \sigma_{12}P_{12} & \dots & \sigma_{1N}P_{1N} \\ \sigma_{21}P_{21} & \sigma_{22}P_{22} & \dots & \sigma_{2N}P_{2N} \\ \vdots & \vdots & & \vdots \\ \sigma_{N1}P_{N1} & \sigma_{N2}P_{N2} & \dots & \sigma_{NN}P_{NN} \end{bmatrix}$$

And:

$$P_{ij} = \begin{bmatrix} 1 & \rho_j & \rho_j^2 & \dots & \rho_j^{T-1} \\ \rho_i & 1 & \rho_j & \dots & \rho_j^{T-2} \\ \rho_i^2 & \rho_i & 1 & \dots & \rho_j^{T-3} \\ \vdots & \vdots & \vdots & \dots & \vdots \\ \rho_i^{T-1} & \rho_i^{T-2} & \rho_i^{T-3} & \dots & 1 \end{bmatrix}$$

The above matrices are represented by:

$\sigma_{11}P_{11}$ = variance/covariance matrix of the Petit Tender

$\sigma_{22}P_{22}$ = variance/covariance matrix of the California Steak

$\sigma_{33}P_{33}$ = variance/covariance matrix of the Texas Steak

σ_{11} = variance of the Petit Tender

σ_{22} = variance of the California Steak

σ_{33} = variance of the Texas Fillet

$\sigma_{21}P_{21} = \sigma_{12}P_{12}$ = covariance between the Petit Tender and California Steak

$\sigma_{31}P_{31} = \sigma_{13}P_{13}$ = covariance between the Petit Tender and Texas Fillet

$\sigma_{23}P_{23} = \sigma_{32}P_{32}$ = covariance between the California Steak and Texas Fillet

ρ_1 = autocorrelation coefficient for the Petit Tender

ρ_2 = autocorrelation coefficient for the California Steak

ρ_3 = autocorrelation coefficient for the Texas Fillet

(Kmenta, 1986)

In this thesis there are three cross-sectional time-wise autoregressive data series.

Mutual dependence among cross sections is hypothesized and the following statistical model was estimated:

$$\text{Log } Q_{it} = A_0 + \beta_0 \text{Log } PR_{it} + \beta_1 \text{Sqrt } ADV_{i(t-1)} + \varepsilon_{it}$$

Where:

Q_{it} = Quantity of beef value cuts sold (pounds)

PR_{it} = Own price of beef value cut

$ADV_{i(t-1)}$ = Advertising expenditure in time period t-1

ε_{it} = Residual

i = Subscript representing beef value cut type

t = Subscript denoting time period (month)

Log = Prefix denoting transformation to logarithms

Sqrt = Prefix denoting transformation to square root

A_0 = Constant

β_0 = Coefficient of the own beef value cut price variable (US\$)

β_1 = Coefficient of the advertising expenditure variable (US\$)

The results from the Parks Model estimation are used to describe the behavior of the pooled sales quantity of the U.S. beef value cuts as a result of advertising expenditures and pricing. Statistical tests will be conducted to verify that the Parks Model is the more appropriate method for estimation rather than Multivariate Ordinary Least Squares (OLS) Regression or Seemingly Unrelated Regression analysis. If the null hypothesis, that coefficients of common explanatory variables are equal to each other when estimated separately rather than pooled, is not rejected; then the pooled GLS method using the Parks Model is verified as the appropriate model. As previously stated, use of the pooled cross-sectional data allows increased explanatory power and strength of the estimation.

The Parks Model is estimated using a double logarithmic form. Taking the log of each variable will prove useful, as the coefficients of the logged variables are the corresponding elasticities for each explanatory variable. The advertising coefficient is the only variable that will not be estimated in log form, so the advertising coefficient is not the elasticity of advertising because the square root of advertising is used as the control variable. The square root of advertising is used to take into account the diminishing marginal effects of the promotion and to allow for zero levels of advertising expenditures. Advertising elasticities are calculated separately and reported in the Results section of the thesis. Understanding the meaning of these elasticity measurements is of the utmost importance in that it allows for the estimation of how sales quantities respond given a fluctuation in prices or a change in promotion expenditures. Advertising effects are also explained in more detail according to the appropriate lag structure estimate from the advertising variable. Key importance in this study is given to identifying the appropriate lag structure used because this critical point explains the estimated length of time it takes for the promotion to impact sales quantity of the values cuts. The Schwarz (1978) and Akaike (1978) information criteria were used to arrive at the appropriate lag of advertising. These criteria measure the goodness of fit of a statistical model, and the lag structure that minimizes these criteria is the more appropriate specification. As previously argued, the lag of advertising is either one or two periods. The one period lag is used in the estimation as it minimizes the Schwarz and Akaike information criteria.

The study consists of a 14 month time series. However, the Petit Tender and California Steak were not introduced into the Guatemala market until March, 2006. Accordingly, the January and February observations from 2006 are eliminated in the pooled sample in order for the model to achieve a balanced design. This means that each cross-section will include the same number of observations included in the model. It is important to note that the length of the series included in the model is a 12 month timeframe of monthly observations from March 2006 through February 2007.

Additional points of discussion include the use of nominal rather than real prices in the model specification. Differences in nominal and real prices were small, given the short duration of the study, and results show negligible differences in estimated coefficients. Conversion from nominal to real prices was consequently disregarded. Measurements of other relevant product prices were also excluded in the model due to the unavailability of data. Therefore, own price values was the only pricing information considered. The pay-day effect is also of interest in developing countries such as Guatemala, but this could not be accounted for due to the unavailability of more highly disaggregate information for sales quantity and price measurements (Capps 1989). Seasonality is also ignored due to the nonexistence of a lengthier timeframe necessary to account for such specifications. Income variables are also commonly found in demand models, but were not included in this thesis. The model does not include a variable measuring consumer income because the time frame of the entire study is 14 months and it was assumed that no measurable changes in income of consumers would occur during this short time-frame. The exclusion of these measurements is further supported by the

work of Funk et al. (1977) who found similar cause to eliminate such variables in his similarly short time-series study.

The application of the Parks model under the stated specifications allows for the simultaneous analysis of the Petit Tender, California Steak and Texas Fillet U.S. beef value cuts responsiveness to promotion expenditures and beef value cut prices. The data will be analyzed using econometric software. Quantitative analysis will be conducted by using the programs EViews 6.0 and SHAZAM 10.0, created by Quantitative Micro Software and Shazam, respectively.

CHAPTER IV

RESULTS

Consumer demand responses to the promotion program carried out by the U.S. Meat Export Federation (USMEF) are most appropriately estimated by the application of the Generalized Least Squares (GLS) Parks Model on pooled time-series cross-sectional data. The dependent variable is sales quantity of U.S. beef value cuts, while independent variables are U.S. beef value cut prices and promotion expenditures incurred by USMEF. Twelve monthly observations from March, 2006 through February, 2007 are analyzed in the model. When the data are pooled, all the observations from each beef value cut are stacked on top of each other. In this thesis, the time-series and cross-sectional data set begins with observations corresponding to the Petit Tender, the second cross-section is the California Steak and the final cross-section in the set is the Texas Fillet.

Estimating the coefficients as a pooled set, rather than individually, assumes that each explanatory variable affects each beef value cut by the same magnitude. It is assumed that the coefficients for price and advertising variables would be the same value for each cut, if estimated separately rather than collectively in the pooled estimation. Statistical tests were conducted to ensure that the Parks Model is the appropriate method for estimation. When estimated as separate equations, the coefficients on both the price and advertising variables were found not to be statistically different than when estimated as a system in the GLS pooled regression, utilizing the Parks Model. Therefore, the Petit Tender, the California Steak and the Texas Fillet all respond to prices and advertising in

the same manner according to estimation results. This statistical test verifies the appropriateness of the pooled estimation. The estimated coefficients and standard errors of the beef value cut demand analysis are shown in Table 4.1.

Table 4.1 The Estimated Coefficients and Standard Errors of U.S. Beef Value Cut Demand Relationship

Variable	Estimated Coefficient	Estimated Standard Error	T-Ratio	P-Value
Intercept	15.279	1.230	12.42	0.000
Log Price	-5.1943	0.8516	-6.100	0.000
Square Root Advertising	0.0034136	0.001435	2.379	0.023

The coefficient of determination, Buse R^2 , is 0.5300, which means that the estimated model accurately describes 53 percent of the variability in quantity sold of the U.S. beef value cuts. Therefore, over 50 percent of the variability in U.S. beef value cuts quantity sold is accounted for by changes in advertising and value cut prices. The selected level of significance for the F-tests and the t-tests is 0.05. The F-test was statistically significant; therefore, the changes in U.S. beef value cut sales quantities explained by the set of explanatory variables in the model are considered to be statistically different from zero. The t-tests on the intercept, advertising coefficient, and price coefficient were all significantly different from zero, which verifies that each of the exogenous variables independently effects quantity of U.S. beef value cuts sold as estimated in the model. The variance/covariance matrix estimated for the pooled sample

shows the degree of contemporaneous correlation that exists between the cross-sections and is shown in Table 4.2.

Table 4.2 Degree of Correlation Among the Meat Cuts

	Petit Tender	California Steak	Texas Fillet
Petit Tender	0.97051	0.42499	-0.092082
California Steak	0.42499	1.0800	0.15576
Texas Fillet	-0.092082	0.15576	0.20407

The above variance/covariance matrix shows the degree of correlation among the meat cuts, and shows the values of each σ in the Ω matrix mentioned in Chapter III. Although the three cuts are each explained by the estimated coefficients in the same way, the covariance shows the similarity in the behavior of the residuals between the cross-sections. The higher the covariance is between two cuts, the more similar the behavior of the residuals of the two cross-sections. The Petit Tender and California Steak are the most highly correlated, with a covariance of 0.42499, followed by the California Steak and Texas Fillet with a covariance of 0.15576 and the least correlation that exists among the cross-section is between the Petit Tender and the Texas Fillet, with a covariance of -0.092082. This shows that the residuals of the Petit Tender and California Steak behave the most similarly when looking at the residuals between the cross-sections.

The autocorrelation coefficient for each cross-sectional data set describes the magnitude of the autocorrelation that exists within each cut. When autocorrelation exists within a cross-section of the pooled sample, the error term associated with each observation depends on past error values within the same cross-section. This is represented by the general equation: $\varepsilon_{it} = \rho_i \varepsilon_{i,t-1} + u_{it}$. The autocorrelation that exists within each set of the pooled sample varies from one cross-section to another. The degree of autocorrelation is represented by ρ_i . The value ρ_i estimated for each cross-sectional unit is shown in Table 4.3. The higher the autocorrelation coefficient is for each cut, the greater the dependency of the residuals on past error values. The highest degree of autocorrelation exists within the California Steak cross-section with an autocorrelation coefficient of 0.69800, followed by the Petit Tender at -0.082599 and then the Texas Steak with an autocorrelation coefficient of 0.0071192. Essentially, no autocorrelation pattern of order 1 is evident for Petit Tender and Texas Fillet. That is not the case for California Steak.

Table 4.3 Autocorrelation Coefficient for Each Beef Value Cut Cross-Section

U.S. Beef Value Cut	Autocorrelation Coefficient
Petit Tender	-0.082599
California Steak	0.69800
Texas Fillet	0.0071192

The estimated coefficient for the price variable is the own price elasticity because the double logarithmic mathematical form was used in the model specification. The own price elasticity for the value cuts is -5.1943, which means that a one percent increase in the price of the U.S. beef value cuts results in a 5.1943 percent decrease in quantity of U.S. beef value cuts quantity demanded. The own-price elasticity is negative, which means that the U.S. beef value cuts show price-elastic characteristics and findings consistent with *a priori* reasoning. The magnitude of the own-price elasticity of the value cuts is large compared to the own-price elasticity for beef in the U.S. which consistently lies between -.6 and -.8. This is not of a concern because foreign markets typically have higher own-price elasticity measurements for imported goods because there is greater substitutability for lower cost domestic goods. The own-price elasticity measurement for U.S. beef is an overall average, while this study calculated own-price elasticity for the U.S. beef value cuts in Guatemala City, which are specialty products. It is not surprising that the own-price elasticity measurement for the U.S. beef value cuts in Guatemala City is of a greater absolute value than the average own-price elasticity of U.S. beef in the United States.

The advertising elasticity was calculated separately since the square root of advertising was used in the model specification. The value of the advertising elasticity estimated at the sample means is 0.1375. For a 1% change in advertising, a corresponding 0.1375% increase in quantity of U.S. beef value cuts is sold. This means that overall, a \$1 promotion expenditure increases U.S. beef value cut sales by 0.051136 pounds. If \$1 was spent each month on advertising for one full year, 0.613629

additional pounds of the beef value cuts would be sold as a result of advertising. This is the approximate equivalent of one individual cut of the Petit Tender (8 ounces per cut), or two individual cuts of either the California Steak (4 ounces per cut) or the Texas Fillet (4 ounces per cut) per year. Although the elasticity of advertising is small relative to the price elasticity of the U.S. beef value cuts, results are consistent with *a priori* reasoning. Demand studies typically show much more sensitive responses to changes in prices than to changes in advertising (Funk et al. 1977).

The overall cost spent on the USMEF promotion for one year was \$77,878.85. The additional revenue as a result of the USMEF promotion was \$8,543.92 for the Petit Tender, \$19,209.05 for the California Steak and \$27,444.59 for the Texas Steak. The overall additional revenue of the U.S. beef value cuts resulting from the USMEF promotion was \$55,197.56. If the objective was to increase export demand, the USMEF promotion program as a whole was successful in that demand for the U.S. beef value cuts was increased as a result of the promotion efforts. The demand curve for the U.S. beef value cuts increased, and was shifted to the right as a result of the promotion. Although demand was increased, this fact alone does not explain whether or not the promotion program was cost effective. For the program to be cost effective, the Benefit Cost Ratio (BCR) should be greater than or equal to one. The BCR is a measure of the accumulated additional revenue generated as a result of the promotion versus the cumulative cost of the promotion program. Any BCR measurement that is less than one shows that the program costs more than the value of the additional revenue generated as a result of the promotion activities. In this case, the BCR is equal to 0.708762, which

shows that the cost incurred was greater than the additional revenue generated. The promotion program as a whole cost \$22,681.29 more than the revenue generated from March 2006 through March 2007.

Although the cost incurred by USMEF for the promotion program was greater than the additional revenue generated, the promotion was successful in increasing the demand for U.S. beef. The U.S. value cuts are new products in Guatemala, so it is reasonable that the BCR is less than one during the initial stages of new product availability in the Guatemala HRI sector. With further promotion efforts and increased consumer awareness of the U.S. beef value cuts, it is hypothesized that consumption of the value cuts increase and additional revenue generated as a result of the promotion will outweigh the cost of the promotion activities. Further analysis of future promotion activities is discussed in the following Conclusions and Implications Chapter.

CHAPTER V

CONCLUSIONS AND IMPLICATIONS

Opportunities for increased U.S. agricultural exports to Central America have expanded with the implementation of the Central America-Dominican Republic Free Trade Agreement (CAFTA-DR). U.S. high quality beef may have especially strong potential since all tariffs have been immediately eliminated. The U.S. Meat Export Federation (USMEF) has identified Guatemala as the target market for increased U.S. beef exports to Central America. In an effort to increase shipments of U.S. beef to Guatemala, a promotion program was implemented in 2006 to launch the introduction of three new U.S. beef value cuts. The value cuts were introduced in Guatemala City's Hotel Restaurant and Institutional (HRI) sector in cooperation with the Guatemalan HRI supplier Alimentos Campeón. The value cuts promoted include the Petit Tender, California Steak and Texas Fillet.

This study examined demand for the U.S. beef value cuts in Guatemala City, Guatemala. Consumer responsiveness to promotion efforts and pricing was analyzed to understand changes in sales and the effectiveness of the USMEF promotion program. Pooled time-series cross-sectional data were used to estimate parameters for the Parks Model of Generalized Least Squares Regression. Coefficients for the GLS regression were estimated while taking into accounting for serial and contemporaneous correlation existing in the pooled data series. The three cross-sections include monthly observations of the Petit Tender, California Steak and Texas Fillet U.S. beef value cuts from March 2006 through February 2007. The endogenous variable is volume (quantity in pounds)

of the U.S. beef value cuts while exogenous variables include total promotion expenditures incurred by USMEF and prices of the U.S. beef value cuts, both in nominal U.S. dollars. All estimated coefficients were statistically significant and it was found that U.S. beef value cut sales are positively related to advertising and negatively related to value cut prices, which is consistent with *a priori* reasoning. The U.S. beef value cuts were found to be price elastic, with an own-price elasticity of -5.1943. The advertising elasticity of the U.S. beef value cuts is 0.1375, and although this is a smaller value relative to the own-price elasticity, similar results have been found in other consumer demand studies (Funk et al. 1977; Capps 1989; Brester and Schroeder 1995; Richards et al. 1997; and Davis 2005). This positive advertising elasticity indicates that promotion activities did increase demand; however, it was found that the promotion program was not cost effective.

The Benefit Cost Ratio of additional revenue generated as a result of the promotion compared to the expenditures of the promotion program is 0.71, indicating that the cumulative costs incurred for the promotion outweigh the cumulative revenue generated by the promotion. The overall cost of the promotion was \$77,878.85, while the additional sales revenue generated was \$55,197.56 over the twelve months of the study. In essence, USMEF spent \$22,681.29 more than was gained as a result of the promotion activities.

Although the program was not cost effective, it was successful in increasing demand for the value cuts. It is important to realize that the U.S. beef value cuts are new products that were just introduced into the marketplace and it typically takes time for a

product to penetrate the market. Given time, the benefits of the promotion could surpass the costs incurred. Demand has increased as a result of the promotion campaign, thus it may be too early to deem the effort ineffective since sales are positively correlated with advertising expenditures and are increasing as a result of the promotion. There were also important limitations to this study that deserve attention and warrant further consideration in the future when considering the overall effectiveness of the promotion campaign.

The three U.S. beef value cuts were not available to Guatemalan consumers until March, 2006. This allowed for the inclusion of only twelve monthly observations for each cut. The short timeframe, limited number of observations and the monthly aggregation of sales data did not permit the inclusion of additional explanatory variables typically found in demand studies. Although prices and advertising account for 53 percent of the sales quantity demanded of the U.S. beef value cuts, the remaining 47 percent of variability is unexplained. If a greater number of observations were available in the future either in the form of more highly disaggregated data or a longer time-series, additional explanatory variables could be incorporated into the model to account for the remaining variability in sales volume.

Seasonality and income effects could be explored with a longer timeframe and the effects of pay days could be taken into account if weekly observations were available. Prices of substitutes or complementary goods were unavailable in this study. Seasonality, income, holidays such as Holy Week, payday effects and cross-price

information could be potential demand drivers if available and included in a future model.

Although there was not a statistical difference in the responsiveness of the value cuts as a pooled sample compared to the results for the cuts estimated individually, more time and observation could potentially show differences in the behavior of the three cuts on an individual basis. Additional study in the future could find responses that differ among the cuts, which would be beneficial in understanding individual demand behavior specific to each of the value cuts. Furthermore, increased time and additional promotion could allow for the disaggregation of the individual promotion activities to evaluate the various efforts of the promotion on an individual basis. This would prove beneficial as it would allow the exploration of demand responses to specified individual advertising variables. Greater emphasis and increased concentration of the most successful types of promotion activities utilized could be possible with further knowledge of the impacts of the promotion activities on an individual basis.

Insight in to demand responses can further be achieved by examining changes in quantities throughout Guatemala City by geographic location. The city is organized by zone, and the majority of the promotion activity occurred in Zones 1, 7 and 10. The location of each HRI customer, along with the corresponding location of promotion activities could be incorporated into the model in the future if a greater number of observations are available. By incorporating a spatial dimension to the model, responsiveness according to zone could be understood and used as a management tool to determine future locations for the most effective promotion of U.S. beef.

The introduction of the Petit Tender, California Steak and Texas Fillet U.S beef value cuts had a positive beginning, with \$401,437 in sales over the 12 month study. Overall U.S. beef exports to Guatemala increased 52 percent in volume in 2006 when compared to 2005. Increased exports are expected to continue through 2007 as well, and the outlook for continued growth in exports of the U.S. beef value cuts is promising. In conclusion, this study found that the USMEF promotion in Guatemala was effective in increasing consumer demand, and continued promotion and evaluation should yield positive results.

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