The Economic Effects of New Product Beef Promotion in Guatemala

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ABSTRACT

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 an important product affected by the agreement, and the United States Meat Export Federation (USMEF) invested in a new product promotion program to increase exports of U.S. beef to Guatemala. Consumer responsiveness and the 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.

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 duty-free, quota free access to most 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 costly with the elimination of the import tariff, it is still true that beef products of local origin continue to have a competitive price advantage over U.S. beef cuts. For this 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 is of the USDA quality grade Choice. The cuts were selected on the basis of price competitiveness while maintaining high quality attributes. The selected cuts are also more price competitive than other US meats including the tenderloin, New York Strip 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. A private firm 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, taste tests 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.

Objectives

The objective of the study is to understand the behavior of Guatemalan consumers and their responsiveness 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 trade liberalization resulting from CAFTA-DR. By analyzing the strengths, weaknesses and impacts of the USMEF promotion of U.S. branded beef, U.S. 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 other economic analysis had been conducted to identify the statistical evidence of the effectiveness of the promotion campaign. It is hoped that this can serve as useful for the study of the responsiveness of foreign HRI consumers to U.S. branded beef promotions.

This study will 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 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 promotion expenditures has been provided by USMEF, while prices were provided by the private firm.

Emphasis is given to promotion expenditures and changes in sales quantities as the measures used to analyze Guatemalan consumer response during the 14 month time period investigated. Costs of resources utilized in the promotion are compared to corresponding changes in sales quantities and sales revenue to determine the effectiveness of the promotion. The study will conclude with 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.

REVIEW OF LITERATURE

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 for this study 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 work. Richards, Van Ispelen and Kagan (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. 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 method to explain the consumer demand responses in Guatemala City.

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 quantitative 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). 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 the promotion in Guatemala City.

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 permits 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 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 the private firm. 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 in U.S.

Dollars, along with 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 of U.S. beef value cuts, reported in pounds, 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. 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.

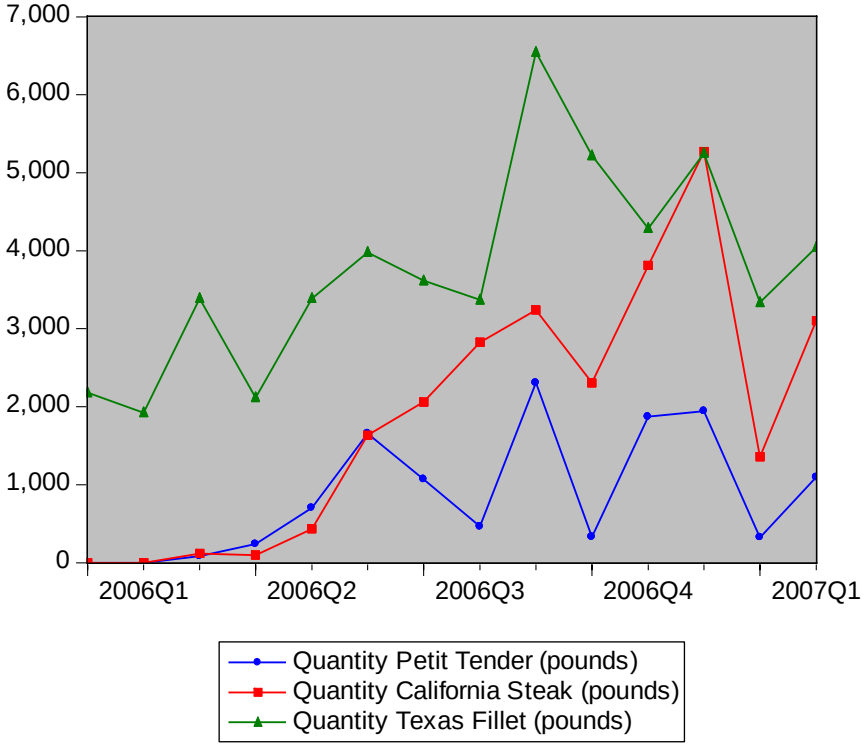

Figure 3.1 Monthly Beef Value Cut Quantities

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.

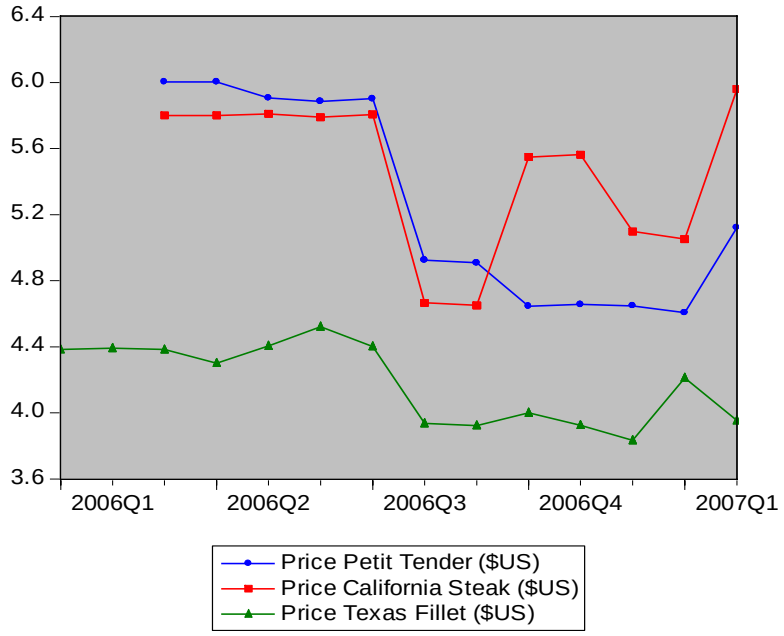

Figure 3.2 Monthly Beef Value Cut Prices per Pound

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 promotion activities were divided into different communication media. The various activities utilized by USMEF include newspaper advertising, mini-billboards, television communication, banners, taste tests, 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 as well.

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**
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**
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.

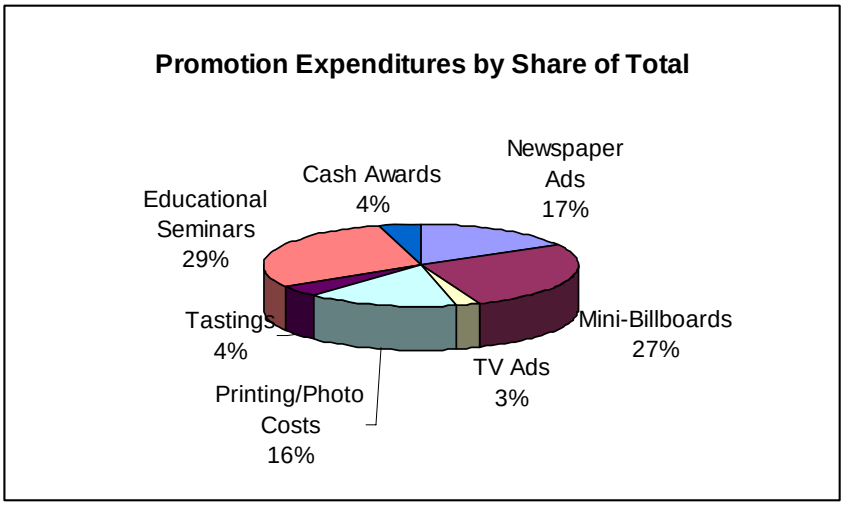

Figure 3.27 Promotion Expenditures by Share of Total
(United States Meat Export Federation, 2006)

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.

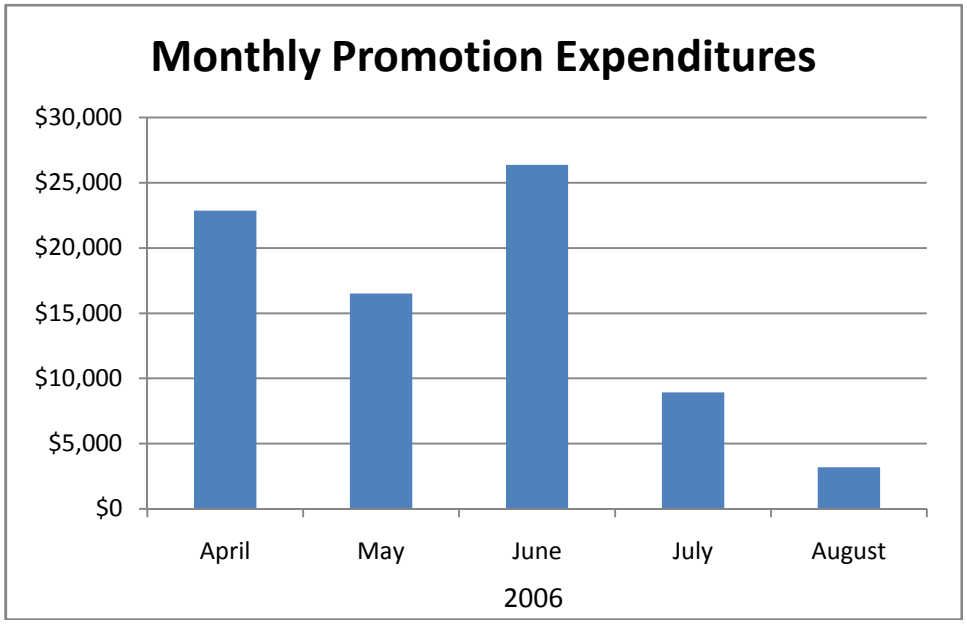

Figure 3.28 Monthly Promotion Expenditures Incurred by USMEF
(United States Meat Export Federation, 2006)

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 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.

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 were also conducted to verify 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 for 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 entire pooled data set has the same error structure. Each value cut has its own σ and its own autoregressive format. The version of the Parks Model applied here also accounts for mutual correlation that exists among the cross-sectional units (meat types) when estimating the parameters of the model. 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,

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

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

to a Generalized Least Squares (GLS) Estimation:

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

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

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

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 study, there are three cross-sectional time-wise autoregressive data series. Mutual dependence among cross sections is hypothesized and the following statistical model was estimated:

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

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
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 monthly sales quantities 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. 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 (1974) 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 work. 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 occurred during this short time-frame. The exclusion of these measurements is further supported by the work of Funk (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 was 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.

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 study, 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	0.0034136	0.001435	2.379	0.023

Advertising

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 the Empirical Model section of this paper. 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 1977).

The overall cost of MEF 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 indicates 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.

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) and should increase further as the economies in the region benefit from higher income, investment, and stronger economic growth. 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. 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 1977, Capps 1989, Brester and Schroeder 1995, Richards, VanIspelen and Kagan 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 into 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, though it is unlikely that CAFTA-DR or the MEF promotion accounted for all of this expansion in exports. 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 additional positive results.

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