Sample Project

MBA 6212

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Executive Summary

In the following paper we collect data that we believe is relevant to estimating pork consumption in the United States. We define our goals and objectives regarding proving a relationship between the data and U.S. pork consumption. Existing literature is used to guide us through the analytical process and to show a need this study. Analytical and empirical frameworks are outlined and the data set explained. Hypothesis are made as we move toward processing the data. In these hypotheses, we assume that pork is a normal good and that beef is a substitute good for pork.

We then use multiple regression analysis to formulate a demand estimation equation for U.S. pork consumption. The results of our analytical analysis are interpreted and their statistical significance is verified. These results show that our hypotheses were correct. We further analyze the data using elasticities of demand in order to more accurately determine the degree to which our independent variables affect our dependent variable.

Using the elasticities of demand, we are able to more accurately show the effects a change in one independent variable has on the dependent variable, U.S. pork consumption. We then make recommendations regarding how, by using elasticities of demand, price of pork can be adjusted to counteract changes elsewhere in the demand equation.

Introduction

In this case study we researched historical data regarding consumption of a primary good X, pork, pricing of good X (P_X), pricing of an alternative good Y, beef (P_Y), and average household income (M) in an attempt to derive a demand equation sufficient to forecast the demand of the primary good within the United States.

Our primary objective was to find data relevant to the demand of pork, and successfully derive a demand equation that would allow us to accurately forecast quantities demanded of pork. In order to achieve this, it was imperative to first find data and prove it to be statistically significant in influencing the demand for our primary good. Subsequent goals included:

- determining if our alternative good is a compliment or substitute for our primary good
- evaluating whether our primary good is a normal or inferior good
- studying the price elasticity of demand, income elasticity of demand, and cross-price elasticity of demand in order to determine the effects that price of our primary good, income, and price of our alternative good, have on quantities demanded of our primary good.

Review of Existing Literature

Our textbook, ***"Managerial Economics: Economic Tools for Today's Decision Makers"*** served as a great source regarding how to approach estimating demand of a good, X. In Chapter 5 we learned that regression analysis is an efficient tool in estimating demand. The type of regression we use is the time series model. Good data must be collected in order to avoid GIGO. Using regression analysis, we are able to estimate our dependent variable, which is demand of our primary good, by using the linear correlation of our independent, or explanatory variables. The textbook tells us that we are able to make some hypotheses regarding the coefficients our analysis will produce. Later in the paper we will state these hypotheses and in conclusion we will test them.

The USDA reported in 2005, in a report titled, ***"Factors Affecting U.S. Pork Consumption,"*** that pork is the most consumed meat in the world and the third most consumed meat in the United States. Though this was reported, the "USDA – Economic Research Service" did not include in its report an equation for estimating pork consumption in the United States. This allowed us the opportunity to analyze data in order to construct such an equation. We will do so below.

Analytical and Empirical Frameworks

Our primary analytical framework was built using a regression analysis model. We expect this model to successfully link our causal pathways, i.e. prove that the price of good X, price of good Y, and household income all have an effect on demand for good X. Further, we hypothesize that our coefficients will be as follows. For price of good X (P_X) we expect a negative (inverse) coefficient. For the price of good Y (P_Y), we expect that this is a substitute good and therefore would have a positive coefficient. For average household income (M), we expect that good X is a normal good which indicates that the coefficient of M should be positive.

We also use other tools, such as elasticities of demand for pork, in order to more accurately determine the effect that a change in a single independent variable has on pork consumption in the U.S. We are then able to empirically evaluate how those elasticities can be applied in order to counteract a change in quantity demanded of pork resulting from a change in one of the independent variables.

Though there are many other factors to consider, such as global imports and exports, we consider all other factors to be constant for the purposes of this study. We expect that further research done beyond our current study, especially any done for practical application, would take into account any other pertinent factors. This is to say that we will, for the purposes of this exercise, only evaluate US consumption of pork, US pork pricing, US beef pricing, and US average household income for the time periods we have selected.

Data Set Description

Our data set consists of per capita pork consumption data, per pound pork pricing data, per pound beef pricing data, and household income data for the years 1970 through 2012. This gives us a very good time-series data set with a total of forty-three yearly observations.

The data regarding pork and beef was collected from USDA (see sources). Per capita pork consumption, in pounds, was based on US retail volumes and was imported as yearly data (Exhibit A). US pork and beef pricing data was imported in monthly increments and was priced in cents per pound. The data was converted to a yearly-average pricing in dollars (Exhibit B). Yearly household income data was gathered from the US Census Bureau and was imported as dollar amounts. The data was then converted to income in thousands of dollars (Exhibit C). The converted data was then organized in a single data table (Exhibit D) in order to run regression analysis. Regression results can be seen below (Exhibit E). All data is copied directly from sources but rounding has been done, sometimes to the nearest whole number and sometimes to the nearest tenth or hundredth.

Results and Discussion

Demand Equation:

We begin with the template equation that we are trying to fill or build.

$QD_X = a - b(P_X) + c(P_Y) + d(M)$

where

a = some number

b = coefficient of US pork price

c = coefficient of US beef price

d = coefficient of US household income

Using a multiple linear regression model (Exhibit E), we can estimate the demand equation as follows:

$QD_X = 60.69 - 15.7(P_X) + 3.54(P_Y) + 0.32(M)$

where

QD_X = US per capita pork consumption

P_X = US average price per pound of pork

P_Y = US average price per pound of beef

M = US household income

Interpret Results:

To interpret this data, we will discuss the meaning of the coefficients we found using regression analysis.

First, the coefficient of P_X negative (-15.56) which means that there is an inverse relationship between the price of pork and the consumption of pork. This is expected given the law of demand. To further explain, if all other factors are held constant and the price of pork increases by 10¢, then the quantity demanded of pork would decrease by 1.567 pounds. Conversely, if the price of pork decreased by 10¢, then the quantity demanded of pork would increase by 1.567 pounds.

The coefficient of P_Y is positive (3.54) and therefore, if all other factors are held constant, the quantity demanded of pork would move in the same direction as the price of beef. So when holding constant the price of pork and household income, if the price of beef were to increase by

$1, then the quantity demanded of pork would increase by 3.54 pounds. Again the alternate is true when holding all other factors constant. If the price of beef decreases by $1, then the quantity demanded of pork would decrease by 3.54 pounds.

Regarding income, there is a positive (0.32) coefficient. This tells us two things. First, that when holding constant all other variables, when income increases the quantity demanded of pork also increases and that when income decreases the quantity demanded of pork also decreases. That is to say that if average household income went up by $1,000, then the per capita quantity demanded of pork would increase by 0.32 pounds. Secondly, because of the positive relationship between income and the quantity demanded of pork, we can deduce that pork is a normal good.

Verify Significance:

Let's now determine if our regression results are valid by using "the rule of 2" which states, "If the absolute value of the t-statistic is greater than 2, we conclude that the estimated coefficient is statistically significant at the .05 level." That means that we would be 95% confident that our independent variables are statistically significant in estimating our dependent variable. For data regarding the below analysis please refer to (Exhibit E).

Because $| -15.7 | > 2$ then the estimated coefficient $b = -15.7$ is significant at the .05 level. Therefore, we can be 95% confident that the price variable has an impact on the quantity demanded of coach seats.

Because $| 3.54 | > 2$ then the estimated coefficient $c = 3.54$ is significant at the .05 level. Therefore, we can be 95% confident that the competitor's price variable has an impact on the quantity demanded of coach seats.

Because $| 0.32 | > 2$ then the estimated coefficient $d = 0.32$ is significant at the .05 level. Therefore, we can be 95% confident that the income variable has an impact on the quantity demanded of coach seats.

As can be seen above, and in (Exhibit E), all values in our "t Stat" column have an absolute value greater than 2. This means that we are 95% confident that each of these variables has an impact on US per capita pork consumption. We therefore determine that our variables are statistically significant in estimating US per capita pork consumption.

Reduced Demand Equation:

$QD_X = 60.69 - 15.7(P_X) + 3.54(P_Y) + 0.32(M)$

Now we are going to find the reduced demand equation by holding P_Y and M constant at 2012 levels and solving for QD_X as a function of P_X. In 2012 P_Y=4.99 and M=71, so...

$QD_X = 60.69 - 15.7(P_X) + 3.54(4.99) + 0.32(71) = 60.69 - 15.7(P_X) + 17.66 + 22.72$

$QD_X = 101.07 - 15.7(P_X)$ → We estimate the equation at $QD_X = 101 - 15.7(P_X)$

In order to verify our demand estimation equation is reasonably accurate when predicting quantity demanded, let's plug in the price of pork for 2012 and see if we produce a quantity demanded similar to 2012 actual consumption. Our price of pork for 2012 is 3.47, so P_X=3.47, and our actual consumption is 45.

$QD_X = 101 - 15.7(P_X) = 101 - 15.7(3.47) = 101 - 54.48 = 46.52$

This clearly shows that our estimated 2012 quantity demanded, at QD_X=46.52, is very close to the actual 2012 consumption of 45.

Disclaimer Regarding Data:

We realize that this is per capita and that when the difference is multiplied by the overall population of 300+ million consumers it could drastically change overall quantity demanded. However, we have taken much liberty when rounding numbers and understand that a better equation for estimating demand could be produced for real world application by rounding less and using whole consumption, rather than per capita, data. Regardless, we feel that these results are accurate enough to demonstrate application of the statistical concepts learned in this class.

Graph of Demand Curve:

In order to graph our demand, we need to find two points on the demand curve. We do this by solving our reduced demand equation for QD_X when P_X=0 and solving for P_X when QD_X=0.

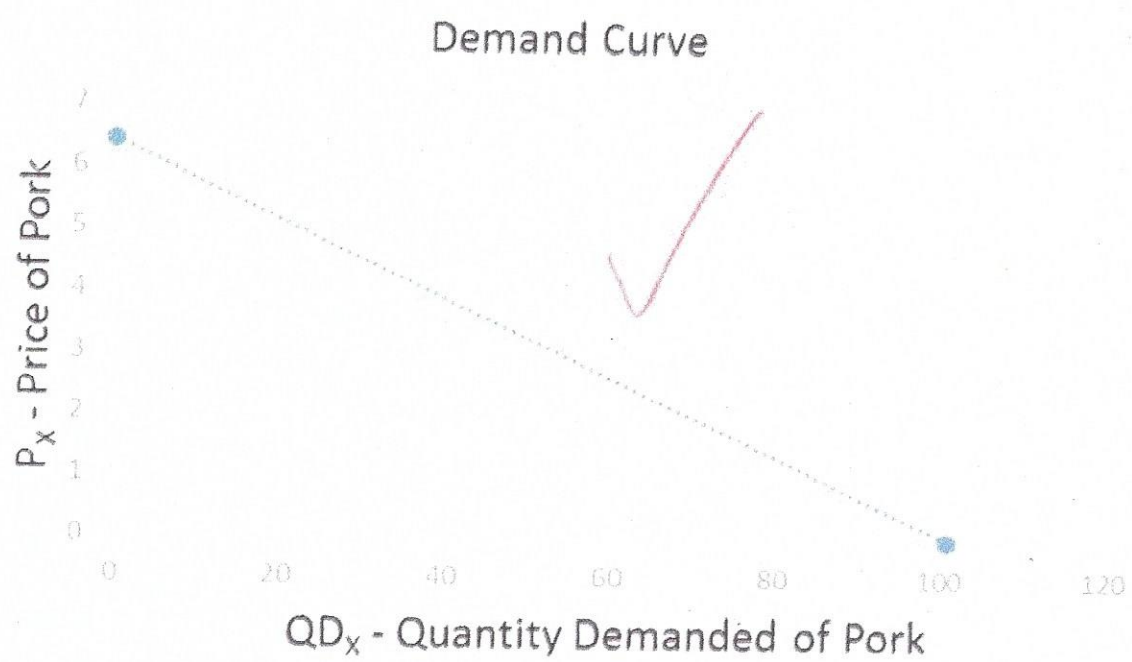
$QD_X = 101 - 15.7(P_X)$

$QD_X = 101 - 15.7(0) = 101 - 0 = 101$

$0 = 101 - 15.7(P_X)$ → $15.7(P_X) = 101$ → $P_X = 6.433$

We find that when P_X=0, QD_X=101 and when QD_X=0, P_X=6.433. Now we graph those two points in order to produce a visual representation of our demand curve, as shown below in **Figure 1**.

(Figure 1)



Elasticities of Demand:

We will now evaluate elasticities of demand for US pork consumption by holding constant two of three independent variables while changing a single independent variable. During this process we will observe the effective changes on our dependent variable, QD_X, resulting from the respective changes in our independent variables, P_X, P_Y and M, in order to determine elasticities and to further evaluate our demand situation. We will start by using our reduced demand equation to evaluate the Price Elasticity of Demand for pork using the point and arc methods. We will then calculate and evaluate income elasticity of demand and cross-price elasticity of demand.

Point Price Elasticity of Demand:

Reduced Demand Equation – $QD_X = 101 - 15.7(P_X)$ …so… $\Delta QD_X / \Delta P_X = -15.7$

When $P_X=3.47$, $QD_X=46.52$

Point PED = $(\Delta QD_X / \Delta P_X) * (P_X / QD_X) = -15.7 * (3.47 / 46.52) = -15.7 * 0.075$

Point PED = -1.17

Because | Point PED | > 1, we can determine that demand for good X is price elastic at $P_X=3.47$.

Arc Price Elasticity of Demand:

$\epsilon_P^X = (\Delta QD_X / \Delta P_X) * ((P_X^1 + P_X^2) / (QD_X^1 + QD_X^2))$

Let's imagine that we are now considering raising the price of pork in order to increase our total revenues. Before making the price change, we'd like to know if our revenues will actually increase when we increase price. To evaluate this, we'll use the arc formula when determining the price elasticity of demand. In order to do so we need to solve for two points on the demand curve. In the section above titled "Reduced Demand Equation" we solved for QD_X using the P_X value for 2012, obtained from **Exhibit D**. We found that when PX=3.47, then QD_X=46.52. Now we will solve for QD_X if PX were to increase by $1. This gives us a relatively large area on the demand curve in which to decide what, if any, is a good amount to increase price.

$QD_X = 101 - 15.7(P_X) = 101 - 15.7(3.47) = 101 - 54.48 = 46.52$

2012: When P_X=3.47, QD_X=46.52

$QD_X = 101 - 15.7(P_X) = 101 - 15.7(4.47) = 101 - 70.18 = 30.82$

Estimated: When P_X=4.47, QD_X=30.82

Now we can solve for price elasticity of demand between our two points on the demand curve.

$\epsilon_P^X = ((30.82 - 46.52) / (4.47 - 3.47)) * ((4.47 + 3.47) / (30.82 + 46.52))$

$\epsilon_P^X = ((-15.7) / (1)) * ((7.94) / (77.34)) = (-15.7 * 7.94) / (1 * 77.34) = -124.66 / 77.34$

$\epsilon_P^X = \mathbf{-1.61}$

The interpretation of this number is that for every 10% increase in price, between these two points on the demand curve, you will see a 16.1% decrease in per capita pork consumption. Because $| \epsilon_P^X | > 1$, demand for good X is price elastic between P_X=3.47 and P_X=4.47. So, we can determine that we would not raise price to increase total revenue. However, because we are not yet at unitary price elasticity at P_X=3.47, we could lower price to increase total revenue. This would be very good to know in a situation in which we had an excess amount of pork available for market. We could then lower price to increase both quantity demanded and total revenue.

Income Elasticity of Demand:

In order to determine if our good is normal, inferior, or income neutral, we must calculate the income elasticity of demand. To do so, we will use our demand estimation equation and hold constant all factors other than income. For this purpose, we suppose P_X and P_Y will remain constant at 2012 values of P_X=3.47 and P_Y=4.99. Let's first solve for 2012 income of 71 (M=71).

$QD_X = 60.69 - 15.7(3.47) + 3.54(4.99) + 0.32(71) = 60.69 - 54.48 + 17.66 + 22.72 = 46.59$

When M=71, QD_X=46.59

Now let's evaluate QD_X when household income increases by $5,000. Because income is in thousands of dollars, M would increase by 5 resulting in M=76.

$QD_X = 60.69 - 15.7(3.47) + 3.54(4.99) + 0.32(76) = 60.69 - 54.48 + 17.66 + 24.32 = 48.19$

When M=76, QD_X=48.19

Now we can use our calculations to solve for income elasticity of demand.

$\epsilon_M^X = (\Delta QD_X / \Delta M_X) * ((M_X^1 + M_X^2) / (QD_X^1 + QD_X^2))$

$\epsilon_M^X = ((48.19 - 46.59) / (76 - 71)) * ((76 + 71) / (48.19 - 46.59))$

$\epsilon_M^X = ((1.6) / (5)) * ((147) / (94.78)) = (1.6 * 147) / (5 * 94.78) = 235.2 / 473.9$

$\epsilon_M^X = \mathbf{0.496}$

The interpretation of this number is that for every 10% increase in income, QD_X will increase by 4.96% if all other factors remain constant. Because $\epsilon_M^X > 0$, good X is a normal good. Because $1 > \epsilon_M^X > 0$ (ϵ_M^X is less than 1), good X is a necessity. We can therefore determine that quantity demanded of good X will move in the same direction as any change in income, but will not be affected as drastically as a luxury good would be affected by the same change.

Cross-Price Elasticity of Demand:

We now shift our focus to cross-price elasticity of demand for good X in relation to the price of good Y in order to determine what, if any, effect the price of good Y has on the quantity demanded of good X. In order to determine the cross-price elasticity of demand for good X, Y, we need to hold all other factors constant while we have a change in the price of good Y (P_Y). Let's start by again taking a look at our demand estimation equation. We'll hold constant P_X and M at 2012 values and change P_Y to observe the relationship between PY and QD_X. First we solve for QD_X with P_Y set at 2012 values, or P_Y=4.99.

$QD_X = 60.69 - 15.7(3.47) + 3.54(4.99) + 0.32(71) = 60.69 - 54.48 + 17.66 + 22.72 = 46.59$

Now let's evaluate QD_X when the cost of good Y increases by \$1, or P_Y=5.99.

$QD_X = 60.69 - 15.7(3.47) + 3.54(5.99) + 0.32(71) = 60.69 - 54.48 + 21.2 + 22.72 = 50.13$

We can now we can use our calculations to solve for income elasticity of demand.

$\epsilon_{X,Y} = (\Delta QD_X / \Delta P_Y) * ((P_Y^1 + P_Y^2) / (QD_X^1 + QD_X^2))$

$\epsilon_{X,Y} = ((50.13 - 46.59) / (5.99 - 4.99)) * ((5.99 + 4.99) / (50.13 + 46.59))$

$\epsilon_{X,Y} = ((3.54) / (1)) * ((10.98) / (96.72)) = (3.54 * 10.98) / (1 * 96.72) = 38.87 / 96.72$

$\epsilon_{X,Y} = 0.4$

The interpretation of this cross-price elasticity of demand is that for every 10% increase in the price of good Y (P_Y), quantity demanded of good X (QD_X) will increase by 4%. Because $\epsilon_{X,Y} > 0$, good X and Good Y are substitutes.

Conclusion and Recommendations

Based on the analysis performed in the section above titled "Results and Discussion" we can determine that all hypotheses regarding coefficients, that were made in the section titled "Analytical and Empirical Frameworks," have been proven correct. Our coefficient for P_X is negative, our coefficient for P_Y is positive and our coefficient for M is also positive. Further, we were correct in our expectation that good X is a normal good and that good Y is a substitute good for good X.

The results have shown us that the price elasticity of demand for good X is -1.61 between PX=3.47 and PX=4.47, and that the point price elasticity at 2012's PX=3.47 is -1.17. This result shows that, for the current price on the demand curve, demand for good X is price elastic. This means that if the industry or firm would like to increase total revenues, they would need to lower price for good X.

Income elasticity for good X is 0.496. We can use these results to determine how the industry might make an adjustment should average household income decline. For example, if average household income decreased by 10%, we would see roughly a 5% decrease in quantity demanded of good X. Let's use point PED in order to see how the industry might counteract that decrease in income by increasing quantity demanded. Point PED = -1.17. So we could calculate:

% change in price * -1.17 = 5% ➔ % change in price = 5 / -1.17 ➔ % change in price = -4.27

We want a negative change in price in order to increase demand.

So, the industry could lower price by about 4.27% to offset the decrease in quantity demanded of good X when income decreases by 10%.

The same calculations can be done using cross-price elasticity of demand. For example, if the price of good Y increased by 10%, then the quantity demanded of good X would increase by 4% because these goods are substitutes and the cross-price elasticity of demand for goods X,Y is 0.4. Let's assume that the industry has a finite supply of good X and would then like to use the price of good X to decrease the quantity demanded of good X. We can then solve for the change in price we need in order to offset the increase in demand. This time we'll use the arc price elasticity of demand between P_X=3.47 and P_X=4.47, which is -1.61. This time we need to reduce quantity demanded by 4% so we calculate:

% change in price * -1.61 = -4% ➔ % change in price = -4 / -1.61 ➔ % change in price = 2.48

We want a positive change in price in order to decrease demand.

So, the industry could raise price by about 2.48% to offset the increase in quantity demanded of good X when the price of good Y increases by 10%.

Recommendations regarding maximizing profits cannot be given without more data regarding the costs associated with delivering good X to market. One might think that we should maximize total revenues in this situation, but as we learned preparing for our final, higher total revenues does not always equal higher profits. For this reason, and not having information on how profit will be affected, we cannot recommend taking action designed to move price toward unitary price elasticity in order to maximize total revenues.

We do however recommend using the results of our analysis, including the long and short demand equations, and the elasticities of demand, in order to better estimate future demand and to properly react to changes regarding independent variables within the equation as we have demonstrated above.

References

USDA ERS

http://www.ers.usda.gov/datafiles/Meat_Price_Spreads/history.xls

USDA ERS

http://www.ers.usda.gov/datafiles/Food_Availabily_Per_Capita_Data_System/Food_Availability/mtpcc.xls

USDA ERS

http://www.ers.usda.gov/media/326138/ldpm13001_1_.pdf

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Appendix

Exhibit-A

Year	Pork Consumption
1970	55
1971	61
1972	55
1973	49
1974	53
1975	43
1976	45
1977	47
1978	47
1979	53
1980	57
1981	54
1982	49
1983	51
1984	51
1985	51
1986	49
1987	49
1988	52
1989	52
1990	49
1991	50
1992	52
1993	52
1994	52
1995	51
1996	48
1997	48
1998	51
1999	53
2000	51
2001	50
2002	51
2003	52
2004	51
2005	50
2006	49
2007	50
2008	49
2009	50
2010	47
2011	45
2012	45

Exhibit-B

Year	Month/Year	US Beef Retail Price in cents	US Pork Retail Price in cents	US Beef Retail Price in Dollars	US Pork Retail Price in Dollars
1970 Average		99.9	77.4	$ 1.00	$ 0.77
1971 Average		106.2	69.8	$ 1.06	$ 0.70
1972 Average		116.6	82.7	$ 1.17	$ 0.83
1973 Average		139.7	109.2	$ 1.40	$ 1.09
1974 Average		143.8	107.8	$ 1.44	$ 1.08
1975 Average		152.2	134.6	$ 1.52	$ 1.35
1976 Average		145.7	134.0	$ 1.46	$ 1.34
1977 Average		145.9	125.4	$ 1.46	$ 1.25
1978 Average		178.8	143.6	$ 1.79	$ 1.44
1979 Average		222.4	152.5	$ 2.22	$ 1.52
1980 Average		233.6	147.5	$ 2.34	$ 1.48
1981 Average		234.7	161.2	$ 2.35	$ 1.61
1982 Average		238.4	185.6	$ 2.38	$ 1.86
1983 Average		234.1	179.7	$ 2.34	$ 1.80
1984 Average		235.5	171.4	$ 2.35	$ 1.71
1985 Average		228.6	170.8	$ 2.29	$ 1.71
1986 Average		226.8	188.8	$ 2.27	$ 1.89
1987 Average		238.4	199.4	$ 2.38	$ 1.99
1988 Average		250.3	194.0	$ 2.50	$ 1.94
1989 Average		265.7	193.5	$ 2.66	$ 1.93
1990 Average		281.0	224.9	$ 2.81	$ 2.25
1991 Average		288.3	224.2	$ 2.88	$ 2.24
1992 Average		284.6	209.5	$ 2.85	$ 2.09
1993 Average		293.4	209.1	$ 2.93	$ 2.09
1994 Average		282.9	209.5	$ 2.83	$ 2.10
1995 Average		284.3	206.1	$ 2.84	$ 2.06
1996 Average		280.2	233.7	$ 2.80	$ 2.34
1997 Average		279.5	245.0	$ 2.80	$ 2.45
1998 Average		277.1	242.7	$ 2.77	$ 2.43
1999 Average		287.8	241.4	$ 2.88	$ 2.41
2000 Average		306.4	258.2	$ 3.06	$ 2.58
2001 Average		337.7	269.4	$ 3.38	$ 2.69
2002 Average		331.5	265.8	$ 3.32	$ 2.66
2003 Average		374.6	265.8	$ 3.75	$ 2.66
2004 Average		406.5	279.2	$ 4.07	$ 2.79
2005 Average		409.1	282.7	$ 4.09	$ 2.83
2006 Average		397.0	280.7	$ 3.97	$ 2.81
2007 Average		415.8	287.1	$ 4.16	$ 2.87
2008 Average		432.6	293.7	$ 4.33	$ 2.94
2009 Average		425.8	292.0	$ 4.26	$ 2.92
2010 Average		438.4	311.3	$ 4.38	$ 3.11
2011 Average		480.7	343.4	$ 4.81	$ 3.43
2012 Average		498.6	346.7	$ 4.99	$ 3.47
2013 Average		528.9	364.4	$ 5.29	$ 3.64

Exhibit-C

Year	Income	Income in Thousands
1970	10,001	10
1971	10,383	10
1972	11,286	11
1973	12,157	12
1974	13,094	13
1975	13,779	14
1976	14,922	15
1977	16,100	16
1978	17,730	18
1979	19,554	20
1980	21,063	21
1981	22,787	23
1982	24,309	24
1983	25,401	25
1984	27,464	27
1985	29,066	29
1986	30,759	31
1987	32,410	32
1988	34,017	34
1989	36,520	37
1990	37,403	37
1991	37,922	38
1992	38,840	39
1993	41,428	41
1994	43,133	43
1995	44,938	45
1996	47,123	47
1997	49,692	50
1998	51,855	52
1999	54,737	55
2000	57,135	57
2001	58,208	58
2002	57,852	58
2003	59,067	59
2004	60,466	60
2005	63,344	63
2006	66,570	67
2007	67,609	68
2008	68,424	68
2009	67,976	68
2010	67,392	67
2011	69,677	70
2012	71,274	71

Exhibit-D

Observations (Year)	Pork Consumption (pounds per Capita)	(Px) Price/lb Pork (dollars)	(Py) Price/lb Beef (dollars)	(M) Average Income per Household ($1Ks)
1970	55	0.77	1.00	10
1971	61	0.70	1.06	10
1972	55	0.83	1.17	11
1973	49	1.09	1.40	12
1974	53	1.08	1.44	13
1975	43	1.35	1.52	14
1976	45	1.34	1.46	15
1977	47	1.25	1.46	16
1978	47	1.44	1.79	18
1979	53	1.52	2.22	20
1980	57	1.48	2.34	21
1981	54	1.61	2.35	23
1982	49	1.86	2.38	24
1983	51	1.80	2.34	25
1984	51	1.71	2.35	27
1985	51	1.71	2.29	29
1986	49	1.89	2.27	31
1987	49	1.99	2.38	32
1988	52	1.94	2.50	34
1989	52	1.93	2.66	37
1990	49	2.25	2.81	37
1991	50	2.24	2.88	38
1992	52	2.09	2.85	39
1993	52	2.09	2.93	41
1994	52	2.10	2.83	43
1995	51	2.06	2.84	45
1996	48	2.34	2.80	47
1997	48	2.45	2.80	50
1998	51	2.43	2.77	52
1999	53	2.41	2.88	55
2000	51	2.58	3.06	57
2001	50	2.69	3.38	58
2002	51	2.66	3.32	58
2003	52	2.66	3.75	59
2004	51	2.79	4.07	60
2005	50	2.83	4.09	63
2006	49	2.81	3.97	67
2007	50	2.87	4.16	68
2008	49	2.94	4.33	68
2009	50	2.92	4.26	68
2010	47	3.11	4.38	67
2011	45	3.43	4.81	70
2012	45	3.47	4.99	71

Exhibit-E

Regression **Statistics**	
Multiple R	0.692563659
R Square	0.479644421
Adjusted R Square	0.439617069
Standard Error	2.44233963
Observations	43

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	214.4351136	71.47837121	11.98291655	1.05944E-05
Residual	39	232.6358918	5.965022866		
Total	42	447.0710054			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*
Intercept	60.68669129	1.876923978	32.33305771	8.92359E-30	56.8902542	64.48312837	56.8902542
(Px) Price/lb Pork (dollars)	-15.69997335	2.968975431	-5.288010533	5.02904E-06	-21.705293	-9.694653705	-21.705293
(Py) Price/lb Beef (dollars)	3.537785614	1.598217706	2.213581793	0.032774948	0.305085172	6.770486056	0.305085172
(M) Average Income per Household ($1Ks)	0.316878971	0.083163386	3.810318282	0.000480685	0.148665145	0.485092797	0.148665145