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Meat Demand in the US During and After the Great Recession

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Abstract

Combining depth, length and breadth, the Great Recession is the worst economic downturn that the US economy has suffered since the Great Depression. Among other things, the recession reduced household income, caused significant changes in food prices and increased consumer uncertainties. These changes can potentially affect demand for such important food products as meat. Barten's generalized demand model is used to study the demand for meat products during and after the recession. Structural change is observed in the demand for meat products in all the markets considered. The instability in the demand for the meat products is not general, but rather isolated in a subset of some demand variables. Expenditure and own-price and cross-price elasticities of demand during the recession are estimated and compared to those after the recession.

Key Words: *Great Recession, Meat Demand, Barten's Model, Structural Change*

1.0 Introduction

Meat is an important food ingredient in the United States. Red meat and poultry products account for about 4% of consumers' disposable income, and about 30% of their food budget (Tonsor, Mintert and Schroeder, 2010). The importance of meat is also reflected in per capita consumption. Over the past two decades, for instance, per capita meat (red meat and poultry) consumption increased generally until 2007 where it began to fall slightly (figure 1). Over the same period of time, average per capita meat consumption was about 180 lbs. per year compared to 15 lbs. per year for fish.

Owing to the significance of meat in the American food basket, meat demand in the country has long and widely been studied. Early works by Working (1955), Nerlove and Addison (1958), Tomek and Chocrane (1962) concentrated on differentiating between short and long-run meat demand elasticities. Following these, studies in the late 1980s (Eales and Unnevehr, 1988; Dahlgram, 1987; Moschini and Meilke, 1989) pay particular attention to structural change and/or consumption patterns of meat demand, and observed mainly that structural change in meat demand occurred in the mid-1970s with consumers shifting from beef to chicken. In the past two decades, the meat demand literature has mainly investigated how meat demand is affected by food safety and health information (Brown and Schrader, 1990; Schrader, 1990; Capps and Schmitz, 1991; Marsh, Flake and Patterson, 1999; Schroeder and Mintert, 2004; Piggott and Marsh, 2004; Tonsor, Mintert and Schroeder, 2010); meat source, seasonal and regional variation (Olowolayemo, Martin and Raymond, 1993; Mutundo and Henneberry, 2007); household socio-demographic characteristics (Gao and Spreen, 1994); and advertising (Brester and Schroeder, 1996; Kinnucan et al., 1997).

An aspect of meat demand that is yet to be explored is the nature of meat demand during and after a recession. Recessions and their subsequent recovery processes are usually associated with significant changes in household income and/or wealth, prices and consumer uncertainties to which prudent households respond by adjusting purchases. These adjustments shape the demand for such important food products as meat.

The US economy has suffered from thirteen recessions since the Great Depression. Combining depth, length and breadth, the Great Recession – the December, 2007 to June, 2009 recession - is the worst among them (Hurd and Rohwedder, 2010). Over the eighteen months that the Great Recession lasted, output fell by 4.1%, the highest of all post-war economic downturns, and unemployment rate increased from 5.0% in December 2007 to 9.5% in July 2009 (Taylor et al. 2010). Among other things, the high level of unemployment, affected household income and wealth.

From 2007 to 2009, median and mean household income fell by 4.2% and 2.8% respectively (US Census Bureau). Mean and median household income continued to fall after end of the recession – from 2009 to 2011, median and mean household income fell by 4.1% and 2.2% respectively. According to Perri and Steinberg (2012), median and mean net worth fell by 38.8% and 14.7% respectively between 2007 and 2010. The decline in the real median and mean family income was widespread across demographic groups, albeit unequally and in different ways. In addition to the fall in income and wealth of households, food prices especially increased substantially early on in the recession and peaked in 2008, and started declining slightly in the first quarter of 2009. That notwithstanding, the annual growth rate of food prices was almost 3.8% between 2007 and 2009 (Kumcu and Kaufman, 2011).

Consumer confidence, as measured by the University of Michigan's Index of Consumer Sentiments (ICS), also dropped significantly, in aggregate terms, over the course of the recession (figure 2) suggesting an increase in the level of consumer uncertainty. Between the last quarter of 2007 and the second quarter of 2009, the ICS dropped by 12%. The decline in consumer confidence occurred (unequally) across income, racial and age groups (Petev and Pistaferri, 2011). For instance, the ICS among the top and bottom income quartiles drop by 50 and 20 points respectively between the first quarter of 2007 and the last quarter of 2008. Just like household income, consumer confidence continued to dwindle after the recession. From the second quarter of 2009 to the last quarter of 2011, amidst some fluctuations, the ICS fell by about 5%.

The triple squeeze of lower income, higher food prices and lower consumer confidence over the course of the recession put a downward pressure on food expenditure. Real aggregate per capita food expenditure fell by 5.5% from 2007 to 2008. Over the same period, real household food expenditure fell by at least 10% in all the regions of the US except in the Northeast where it fell by about 3% (figure 3). Annual reductions in real food-away-from-home expenditure appear to be responsible for the decline in household food expenditure across the various regions of the country. Between 2006 and 2010, real food-away-from-home expenditure decreased by at least 17% in the Midwest, South and West, and about 8% in the Northeast. Real food-at-home expenditure however decreased only slightly in some of the regions and increased in others. Notwithstanding the continual fall in household income and consumer confidence after the recession, (aggregate) per capita real food expenditure increased by 2.8% between 2009 and 2011 (figure 4).

In view of the changes in the consumers' income, food prices and consumers' uncertainties which eventually shaped food expenditure, there is the possibility of consumers switching between the numerous meat products during and after the recession. Against this background, the following questions become important.

1. Has there been a structural change in the demand for meat products in the US during and after the great recession?
2. If structural change occurred, is the instability general or isolated to some subset of demand variables?
3. How do meat demand elasticities during the recession compare to those after the recession?

2.0 Data and Methodology

2.1 Data

The study uses weekly scanner data on 12 aggregated meat products purchased during (January, 2008 to June 2009) and after (July 2009 to January 2011) the great recession in 19 US markets. The aggregated meat products include high and low quality beef; high and low quality chicken; high and low quality pork; high and low quality turkey; fixed weight breakfast, lunch and dinner meats; and other meat products. Table 1 shows the components of the various aggregate meat products. The markets considered cuts across the various regions of the US. They include Denver, Las Vegas, Los Angeles and San Francisco in the West; Chicago, Columbus, Detroit and Indianapolis in the Mid-West; Dallas, Houston and Phoenix in the South-West; Atlanta, Charlotte, Jacksonville and Miami in the South-East; and Baltimore, Boston, Philadelphia, and New York in the North-East.

The aggregated meat quantities were converted to per capita basis using weekly population estimates. The weekly population estimates used in the conversion were derived from estimates of the markets' population (from 2005 through 2009) obtained from Information Resources, Incorporated. Graphs of the estimates are available upon request. Population trend regressions estimated for all the 19 markets and appear satisfactory for 13 of the markets, but inadequate for 6 markets. The 6 markets were therefore fit with quadratic trends. The linear and quadratic regression results were then used to predict weekly population numbers for the 13 and the 6 markets, respectively.

2.2 Methodology

The first step in the analyses is to determine whether or not there has a structural change in the demand for meat in any of the markets during and after the recession. If structural change did occur, the second step would be to identify whether the instability in demand is general or isolated in some subset of the coefficients. Finally, demand elasticities during and after the recession are estimated and compared in the markets where structural change has occurred. Since all of the steps in the analyses require the estimation of demand model(s), the model used in the estimation will now be described.

Barten's general demand model is employed in the demand estimation for each of the markets.

The general model nests the four differential demand systems – Rotterdam, Central Bureau of Statistics (CBS), Almost Ideal Demand System (AIDS) and National Bureau of Research (NBR)– and thus ensures that the data is analyzed with the most appropriate differential demand model as suggested by the data. Barten's general demand model is given by equation (1):

$$w_i d \ln q_i = \theta_i d \ln Q + \eta_1 w_i d \ln Q + \sum_j \theta_{ij} d \ln P_j + \eta_2 \sum_j w_i (\delta_{ij} - w_j) d \ln P_j \quad (1)$$

Where

q_i is the quantity of meat product i

$d \ln Q = \sum_j w_j d \ln q_j$ (Divisia volume index)

$d \ln P = \sum_j w_j d \ln p_j$ (Divisia price index); p_j is the price of meat product j .

$w_i = p_i q_i / x$ (Budget shares); x is total meat expenditure

δ_{ij} is the Kronecker delta

η_1 and η_2 are nesting parameters.

The necessary demand restrictions - Adding up ($\sum_i \theta_i = 1 - \eta_1$ and $\sum_i \theta_{ij} = 0$), homogeneity ($\sum_j \theta_{ij} = 0$) and symmetry ($\theta_{ij} = \theta_{ji}$) - are imposed. Adding up is imposed by simply omitting one demand equation from the system and using the given formulas to estimate the parameters of the omitted demand equation. The demand equation for low quality turkey is the omitted equation in this study.

The values taken by η_1 and η_2 determine the compatibility of the data with the four nested differential demand systems: Rotterdam ($\eta_1 = \eta_2 = 0$); CBS ($\eta_1 = 1, \eta_2 = 0$); NBR ($\eta_1 = 0, \eta_2 = -1$); and AIDS ($\eta_1 = 1, \eta_2 = -1$). The compatibility of the data from each market with the four nested systems is tested.

Structural change in demand can be captured through the use of Chow test (Chow, 1960); Smooth Transition Autoregressive models (Holt and Craig, 2003); Smooth Transition

Regressions (Holt and Balagtas, 2009) etc. This study uses a method that allows for not only the identification of structural change that may have occurred, but also the determination of the nature (whether general or isolated) of the instability in demand. The method is as follows: A dummy variable (1 = during recession, 0 = after recession) and its product with each of the right hand side variables are defined and added to each demand equation in the system, and an F test subsequently performed to test whether or not the coefficients of the new variables are jointly equal to zero. If the F test is significant, the coefficients responsible for the instability in demand would be revealed.

If structural change occurred in any of the markets, expenditure elasticities, and compensated own- and cross-price elasticities are computed from the estimated coefficients during and after the recession with the equations (2) and (3):

$$\text{Expenditure elasticity, } e_i = \frac{\theta_i}{w_i} + \eta_1 \quad (2)$$

$$\text{Compensated price elasticity, } e_{ij}^* = \frac{\theta_{ij}}{w_i} + \eta_2 (\delta_{ij} - w_j) \quad (3)$$

3.0 Results

3.1 Differences in Mean of Variables

Table 2 presents the means of meat expenditure, per capita consumption and prices of the aggregate meat products during and after the recession in three markets: Indianapolis, Chicago and Detroit. Meat expenditure increased significantly after the recession in the markets. The consumption of some of the meat products changed significantly after the recession while others did not changed much. In Indianapolis, the consumption of meat products such as high quality high chicken, pork and turkey, and low quality beef and chicken increased significantly after the

recession, but the consumption of other meat products like high quality beef, low quality pork and turkey and the fixed weight meats did not change significantly. The consumption of some meat products such as fixed weight lunch meats in Chicago and low quality chicken in Detroit declined significantly after the recession. The change in the consumption of some of the products in the markets appears to have been influenced by changes in their prices. In Detroit for instance, the significant increase in the consumption of high quality chicken, high quality pork and low quality beef after the recession is probably due to the decline in their prices after the recession. This is not true of Indianapolis, however, where 9 meat prices increased (7 significantly) and consumption increased for 9 meats (5 significantly).

3.2 Structural Change

The results of the test for structural change in meat demand are reported in table 3. The significant F-statistics reveal that there was a structural change in the demand for the meat products in all the markets but Atlanta, Boston, Los Angeles, New York City, Philadelphia and San Francisco. The significant differences in meat expenditure and meat prices between the periods during and after the recession might be responsible for the structural change. The methodology used to capture the structural change reveal that the instability in meat demand in Indianapolis, Chicago and Detroit is not general, but rather isolated to a subset of variables. In all the three markets, meat expenditure and the prices of high quality beef, low quality chicken, high quality pork, low quality pork and other meat products are partly responsible for the instability in demand. The other variables responsible for the instability in demand in the markets include the prices of low quality beef, high quality chicken and high quality chicken in Detroit; prices of low quality beef, high quality chicken, fixed weight lunch and dinner meats and low

quality turkey in Chicago; and the prices of fixed weight breakfast and lunch meats, and high quality turkey in Indianapolis.

3.3 Comparison of Elasticities

The dummy variable used in testing for structural change was defined as 1 for “during recession” and 0 for “after recession”. The presence of structural change in all the markets therefore suggests that the dataset for each market has to be divided into two - during recession and after recession - and separate models run for each half. The models were run for Indianapolis, Chicago and Detroit. Tests of the parameter restrictions rejected the nested models for the three markets (table 4). The elasticities derived from the models are discussed below.²

3.3.1 Expenditure elasticities

Table 5 presents the expenditure elasticities for the three markets during and after the recession. All the meat products were normal goods in both periods. In all the three markets, the demand for some meat products became relatively more expenditure elastic after the recession while demand for others become less elastic. In Indianapolis, the demand for high and low quality beef and high quality chicken, and fixed weights lunch and dinner meats are more expenditure elastic after the recession than during the recession. The demand for the rest of the meat products however became less expenditure elastic after the recession. In Chicago, the demand for high and low quality beef, high quality chicken, fixed weights lunch and dinner meats, low quality pork and high quality turkey are more expenditure elastic after the recession. The demand for fixed weight dinner meats, high quality pork, low quality turkey, and high and low quality beef and chicken become more expenditure elastic after the recession in Detroit. The demand for “other meat product” is the most expenditure elastic meat product in Indianapolis during and after the

² The model parameters are not reported, but are available upon request..

recession. The demand for “other meat products” is also the most expenditure elastic in Chicago during the recession. After the recession however, “other meat products” is the least expenditure elastic in Detroit. In all the three markets, high quality beef is more expenditure elastic than low quality beef during and after the recession. The converse is true for pork and turkey – low quality pork and turkey are more expenditure elastic than high quality pork during and after the recession in all the three markets.

3.3.2 Own price elasticities

The own price elasticities for the various meat products are reported in table 6. All the own price elasticities are negative during and after the recession (except for low quality pork in Chicago). Like with the expenditure elasticities, some of the meat products are more elastic after than during the recession while the reverse is true for other meat products. In Indianapolis for instance, the demand for high and low quality chicken, high quality pork and low quality turkey are less price elastic after the recession while the demand for others are more elastic. In Chicago, the demand for high and low quality chicken, fixed weight breakfast meats and low quality pork is less elastic after the recession than during the recession. The meat products that became less price elastic after the recession in Detroit include high and low quality beef and pork, fixed weight lunch meats, “other meat products,” low quality pork and high quality turkey. The demand for high quality beef is more price elastic than low quality beef in all the three markets both during and after the recession. For chicken however, low quality chicken is more price elastic than high quality chicken during and after the recession in Chicago and Detroit.

The most price elastic meat products during the recession are “other meat products” and low quality turkey in Indianapolis; low quality chicken and high quality turkey in Chicago; and low quality beef and turkey in Detroit. These meat products were still highly price elastic after the

recession except high quality chicken in Chicago which turned out to be one of the least price elastic products.

3.3.3 Cross Price Elasticity

The cross price elasticities between the meat products during and after the recession for the three markets are presented in tables 7 to 12. Most meats are substitutes, for example 96 out of 132 cross-price elasticities are positive in Chicago during the recession. There has been a substantial change in the relationship between products after the recession. In Chicago (tables 7 and 8) for instance, high quality beef became a stronger substitute for low quality beef and vice versa after the recession and low quality beef became a strong substitute for “other meat products” and high quality pork. In Indianapolis (tables 9 and 10), high quality beef became a strong substitute for low quality beef and high and low quality chicken after the recession; and fixed weight lunch meats became strong substitutes for pork and turkey products; and “other meat products” became substitutes for pork products and high quality chicken. In Detroit (tables 11 and 12), fixed weight dinner meats became strong substitutes for low quality chicken and fixed weight breakfast and lunch meat products after the recession. These and the other strong substitutability observed after the recession barely occurred during the recession.

Similarly, the substitutability between some of the meat products during the recession was lost after the recession. In Detroit for instance, the strong substitutability between high quality beef and fixed weight breakfast meats during the recession is lost after the recession. Substitutability between some of the meat products during the recession were maintained after the recession. For instance, in Indianapolis, low quality beef remained a strong substitute for fixed weight lunch and dinner meats and high quality pork during and after the recession. Thus, the relationship

between the meat products during and after the recession depended on the products and the markets in question.

4.0 Conclusion

Combining depth, length and breadth, the Great Recession is considered to be the worst recession that has plagued the US economy since the Great Depression. Among other things, the recession significantly affected household income, prices of consumer products and increased consumers' uncertainties. Such changes are likely to have affected the demand for such important food products as meat. Using market level data, this study investigated whether or not there was a structural change in the demand for meat products during and after the recession, and also identified the possible sources of the structural change. The study further estimated and compared expenditure and own-price and cross price elasticities during and after the recession. It was observed that structural change in demand occurred in most the markets considered, and the instability in demand is not general, but rather isolated in some subsets of variables. All the meat products were normal goods during and after the recession. The demand for some of the meat products became more expenditure elastic after the recession while the demand for others became less elastic. Similarly, the demand for some of the meat products became more price elastic after the recession while the demand for other became less elastic. The relationship between some of the products, as measured by cross-price elasticities, during the recession changed after the recession, with some meat products becoming strong substitutes and others becoming weak substitutes. The relationship between some of the meat products did not however change much.

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6.0 Figures

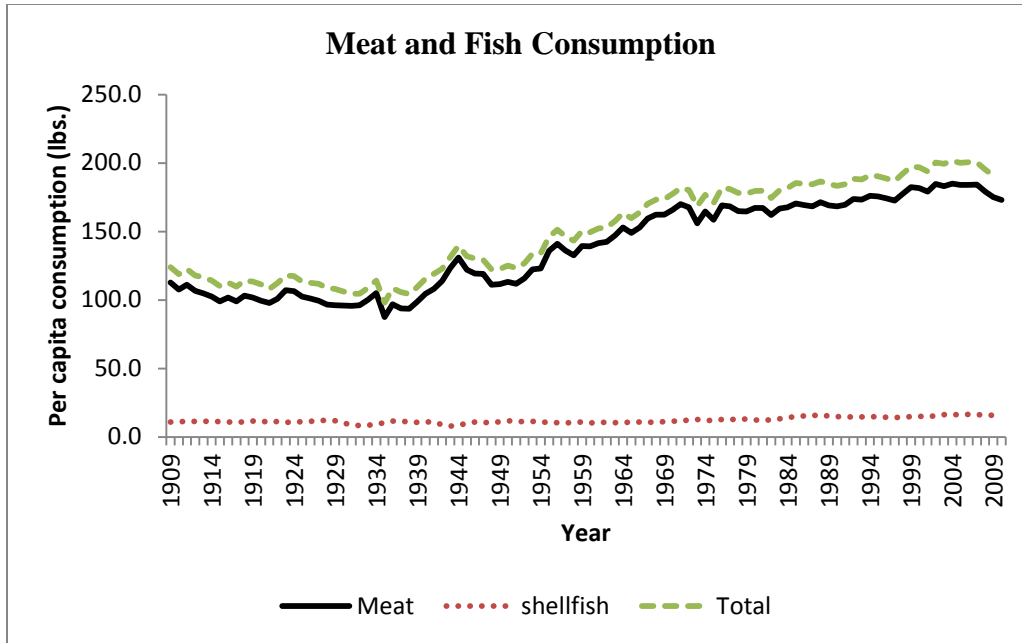


Figure 1: Trend in Per capita Meat and Fish Consumption in the US, 1909 to 2010

Source of data: Economic Research Service, US Department of Agriculture.

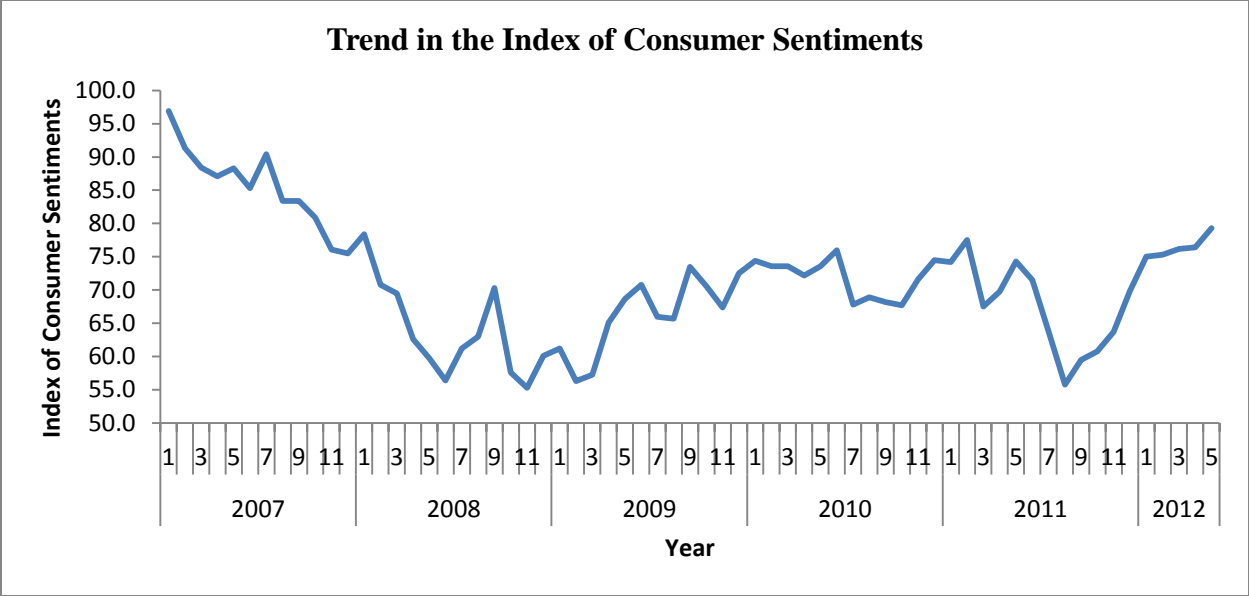


Figure 2: Trend in University of Michigan’s Index of Consumer Sentiments

Source of data: Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

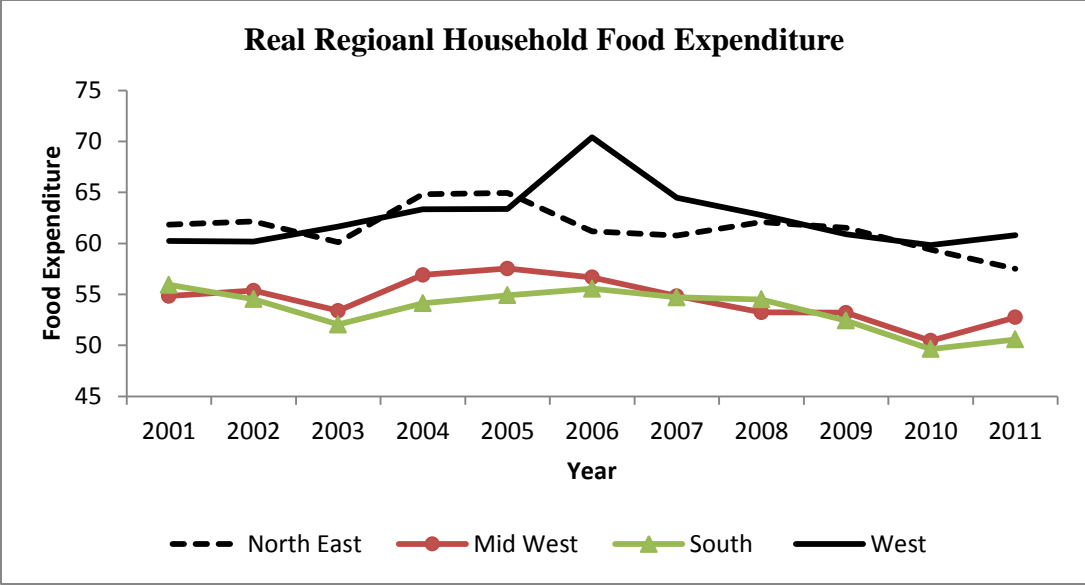


Figure 3: Trend in Real Regional Household Food Expenditure in the US

Source of data: Consumer Expenditure Survey, Bureau of Labor Statistics.

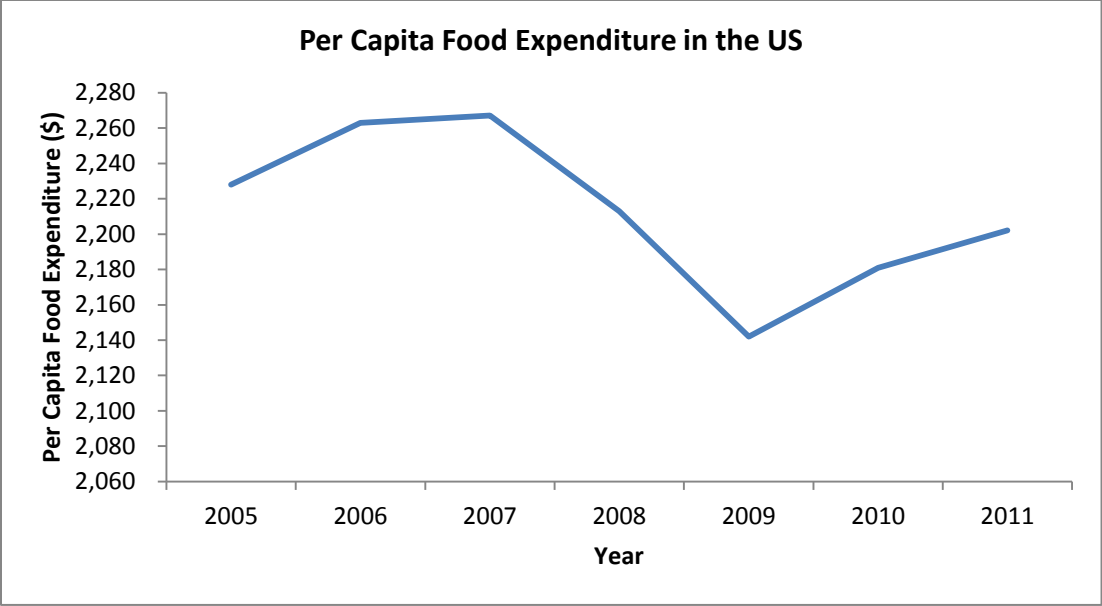


Figure 4: Trend in Per Capita Food Expenditure in the US

Source of data: Economic Research Services, US Census Bureau and the Bureau of Labor Statistics

7.0 Tables

Table 1: Components of the Aggregate Meat Products

Aggregate Meat	Components
High quality beef (Beef_H)*	Loin, rib, flank
Low quality beef (Beef_L)	Brisket, chuck, miscellaneous, plate, ribs, round, shank, variety, ground beef, ground chuck, ground round, ground sirloin
High quality chicken (Chicken_H)	Breasts, other processed, thighs, wings, fajitas/stir fry kabobs
Low quality chicken (Chicken_L)	Backs & necks, combo packs, Cornish game hens, giblets, ground, legs, variety, whole bird
Fixed weight breakfast meats (FW_B)	Fixed weight breakfast meats
Fixed weight dinner meats (FW_D)	Frankfurters, dinner sausage, frozen/refrigerated poultry, frozen meat
Fixed weight lunch meats (FW_L)	Fixed weight lunch meats
Other meats (Other)	Lamb, lunch meats, sausage, smoked ham, specialty, veal
High quality pork (Pork_H)	Loin
Low quality pork (Pork_L)	Bacon, ground, leg, misc., ribs, shoulder, variety
High quality turkey (Turkey_H)	Ground turkey
Low quality turkey (Turkey_L)	Backs/necks/tails, breast, combo packs, giblets, legs, stir fry/fajitas/kabobs, thighs, variety, whole bird

* *The names in brackets are the names of the aggregate meat products used in subsequent tables.*

Table 2: Means of Per Capita Consumption and Prices of Meat Products During and After the Recession in Selected Markets

	Indianapolis			Chicago			Detroit		
	During R ^a	After R ^b	Difference ^c	During R	After R	Difference	During R	After R	Difference
Quantities (lb)									
Beef_H	0.046	0.046	-0.001	0.038	0.038	0.001	0.034	0.036	0.003
Beef_L	0.311	0.330	0.019***	0.138	0.143	0.005	0.218	0.236	0.017***
Chicken_H	0.120	0.127	0.008*	0.084	0.092	0.008***	0.095	0.107	0.012***
Chicken_L	0.060	0.070	0.009***	0.057	0.056	-0.001	0.062	0.058	-0.004**
FW_B	0.090	0.091	0.001	0.051	0.052	0.001	0.071	0.073	0.002
FW_L	0.126	0.126	0.000	0.063	0.059	-0.004***	0.073	0.075	0.003*
FW_D	0.143	0.139	-0.004	0.117	0.116	-0.002	0.117	0.116	-0.001
Other	0.056	0.061	0.005	0.039	0.044	0.005	0.044	0.047	0.003
Pork_H	0.082	0.093	0.011**	0.043	0.044	0.001	0.049	0.058	0.009***
Pork_L	0.079	0.077	-0.002	0.028	0.028	0.000	0.050	0.050	0.000
Turkey_H	0.007	0.008	0.001***	0.013	0.014	0.002***	0.018	0.020	0.002***
Turkey_L	0.034	0.055	0.021	0.031	0.043	0.013	0.042	0.067	0.024
Prices (\$)									
Beef_H	6.351	6.725	0.374***	7.014	7.005	-0.009	7.022	6.926	-0.096
Beef_L	2.520	2.524	0.005	3.183	3.096	-0.086**	2.767	2.668	-0.099***
Chicken_H	2.194	2.130	-0.063**	3.164	3.021	-0.143***	2.715	2.367	-0.348***
Chicken_L	1.205	1.167	-0.039***	1.376	1.367	-0.008	1.272	1.238	-0.033**
FW_B	2.806	2.964	0.158***	3.235	3.365	0.130***	2.971	3.054	0.083***
FW_L	2.154	2.205	0.051**	2.728	2.785	0.057**	2.619	2.649	0.029*
FW_D	3.039	3.122	0.082*	3.713	3.731	0.018	3.583	3.593	0.010
Other	2.018	2.311	0.293***	3.039	2.909	-0.130	2.634	2.735	0.102
Pork_H	2.719	2.575	-0.145***	3.403	3.235	-0.168*	3.102	2.858	-0.244***
Pork_L	1.951	1.992	0.041	2.439	2.366	-0.072	2.143	2.201	0.058
Turkey_H	2.938	3.013	0.075**	3.170	3.199	0.029	2.791	2.827	0.036
Turkey_L	1.501	1.650	0.149***	2.307	2.192	-0.115	2.046	1.901	-0.145**
Meat Exp. (\$)	2.895	3.063	0.168**	2.226	2.267	0.041*	2.445	2.548	0.102***

***, ** and * imply significant at 1%, 5% and 10% levels respectively.

a. During R = During the recession. b. After R = After the recession c. Difference = After R – During R

Table 3: Results of the Test for Structural Change in Meat Demand

Market	F statistic
Atlanta	0.875
Baltimore	1.361***
Boston	1.002
Charlotte	1.396***
Chicago	1.253**
Columbus	1.353***
Dallas	1.598***
Denver	1.279**
Detroit	1.682***
Houston	1.607***
Indianapolis	1.294**
Jacksonville	2.015***
Las Vegas	1.194*
Los Angeles	1.021
Miami	1.892***
New York	1.011
Philadelphia	1.139
Phoenix	2.080***
San Francisco	1.791

*** implies significant at 1% level

Table 4: Results of Nesting Parameter Tests

		Indianapolis		Chicago		Detroit	
		η_1	η_2	η_1	η_2	η_1	η_2
During Recession	= 0	3.136***	-1.909***	2.768***	-0.175	2.799***	-2.704***
	= 1 or -1	2.136***	-0.909***	1.768***	0.825***	1.799***	-1.704***
After Recession	= 0	2.035***	-1.909***	2.783***	-0.685***	2.421***	-2.972***
	= 1 or -1	1.035***	-0.909***	1.783***	0.315*	1.421***	-2.972***

***, * implies 1% and 10% levels of significance respectively.

Table 5: Expenditure Elasticities During and After the Recession

	During Recession			After Recession		
	Indianapolis	Chicago	Detroit	Indianapolis	Chicago	Detroit
Beef_H	1.046*** (0.126)	0.940*** (0.146)	1.171*** (0.159)	1.084*** (0.106)	1.169*** (0.135)	1.231*** (0.101)
Beef_L	0.894*** (0.067)	0.836*** (0.115)	0.960*** (0.091)	0.956*** (0.069)	0.872*** (0.064)	1.030*** (0.067)
Chicken_H	0.675*** (0.116)	0.896*** (0.147)	0.942*** (0.170)	1.092*** (0.115)	0.966*** (0.085)	1.067*** (0.097)
Chicken_L	0.985*** (0.066)	0.946*** (0.225)	0.725*** (0.089)	0.723*** (0.087)	0.715*** (0.174)	1.135*** (0.070)
FW_B	0.810*** (0.075)	0.641*** (0.082)	0.814*** (0.086)	0.801*** (0.070)	0.620*** (0.069)	0.798*** (0.078)
FW_L	0.737*** (0.074)	0.515*** (0.067)	0.837*** (0.057)	0.791*** (0.055)	0.801*** (0.049)	0.802*** (0.053)
FW_D	0.946*** (0.066)	1.052*** (0.072)	0.924*** (0.071)	1.085*** (0.057)	1.096*** (0.053)	0.943*** (0.046)
Other	2.411*** (0.603)	2.346*** (0.491)	1.892*** (0.376)	1.382*** (0.555)	1.249*** (0.303)	0.569* (0.313)
Pork_H	1.170*** (0.119)	0.713*** (0.265)	0.746*** (0.148)	0.913*** (0.092)	0.632*** (0.157)	0.962*** (0.121)
Pork_L	1.370*** (0.153)	1.154*** (0.426)	1.634*** (0.176)	1.370*** (0.118)	2.003*** (0.198)	1.351*** (0.190)
Turkey_H	0.856*** (0.102)	0.799*** (0.099)	0.905*** (0.092)	0.628*** (0.091)	0.833*** (0.089)	0.883*** (0.101)
Turkey_L	1.936*** (0.874)	3.296*** (0.545)	1.138*** (0.464)	1.166*** (1.324)	2.081*** (0.447)	1.358*** (0.528)

*** and * imply significant at 1% and 10% levels respectively

Table 6: Own Price Elasticities During and After the Recession

	During Recession			After Recession		
	Indianapolis	Chicago	Detroit	Indianapolis	Chicago	Detroit
Beef_L	-1.425*** (0.203)	-0.928*** (0.198)	-2.723*** (0.158)	-1.885*** (0.215)	-0.941*** (0.203)	-2.144*** (0.129)
Beef_H	-1.234*** (0.091)	-0.706*** (0.178)	-1.386*** (0.147)	-1.332*** (0.085)	-0.921*** (0.116)	-1.071*** (0.081)
Chicken_H	-1.756*** (0.128)	-1.026*** (0.117)	-1.088*** (0.136)	-1.726*** (0.124)	-0.553*** (0.097)	-1.640*** (0.125)
Chicken_L	-2.079*** (0.111)	-1.488*** (0.248)	-1.853*** (0.092)	-1.639*** (0.225)	-0.655** (0.281)	-2.461*** (0.129)
FW_B	-1.472*** (0.161)	-0.947*** (0.181)	-1.238*** (0.153)	-1.552*** (0.205)	-0.844*** (0.226)	-1.554*** (0.133)
FW_L	-1.314*** (0.117)	-0.871*** (0.117)	-1.144*** (0.127)	-1.328*** (0.110)	-0.889*** (0.147)	-1.139*** (0.132)
FW_D	-0.983*** (0.082)	-0.606*** (0.122)	-0.778*** 0.099	-1.449*** (0.120)	-0.646*** (0.120)	-1.042*** (0.093)
Other	-3.175*** (0.455)	-1.170*** (0.428)	-2.266*** (0.221)	-3.359*** (0.537)	-1.897*** (0.316)	-2.254*** (0.176)
Pork_H	-2.281*** (0.124)	-0.443** (0.177)	-1.454*** (0.166)	-1.789*** (0.098)	-0.651*** (0.128)	-1.915*** (0.119)
Pork_L	-1.498*** (0.177)	-0.846*** 0.298	-1.722*** (0.105)	-1.940*** (0.133)	0.343* (0.199)	-1.511*** (0.133)
Turkey_H	-1.293*** (0.098)	-1.474*** (0.075)	-2.019*** (0.122)	-1.347*** (0.154)	-1.825*** (0.103)	-1.814*** (0.142)
Turkey_L	-3.153*** (0.660)	-1.204*** (0.381)	-2.520*** (0.307)	-2.894*** (0.992)	-1.362*** (0.374)	-2.935*** (0.281)

*** and * imply significant at 1% and 10% levels respectively

Table 7: Price Elasticities in Chicago During the Recession

	Beef_H	Beef_L	Chicken_H	Chicken_L	FW_B	FW_L	FW_D	Other	Pork_H	Pork_L	Turkey_H	Turkey_L
Beef_H	-0.928'''	0.101	0.149	-0.032	0.179'''	0.051	0.269'	-0.092	0.142	-0.024	-0.026'''	0.210''
Beef_L	0.060	-0.706'''	0.239'''	0.118''	0.005	0.102''	0.001	0.089	0.022	-0.026	0.038''	0.059
Chicken_H	0.145	0.391'''	-1.026'''	0.041	0.145'''	-0.007	0.142	0.261''	-0.135'	0.025	0.002	0.016
Chicken_L	-0.110	0.672''	0.144	-1.488'''	0.162'''	-0.035'''	0.313	0.285	-0.103	-0.142	0.032	0.270
FW_B	0.279'''	0.013	0.232'''	0.074	-0.947'''	0.148	0.107	-0.056	0.021	0.010	0.072'	0.048'''
FW_L	0.080	0.266''	-0.012	-0.016	0.147	-0.871'''	0.028	0.175'''	-0.024	0.068	0.085''	0.074
FW_D	0.165'	0.001	0.089	0.056	0.042	0.011	-0.606'''	0.105'	0.083'	-0.018	0.017	0.055
Other	-0.222	0.363	0.651''	0.203	-0.087	0.272'''	0.417'	-1.170'''	0.306	-0.038	0.104'''	-0.798'''
Pork_H	0.262	0.068	-0.256'	-0.056	0.024	-0.029	0.249'	0.232	-0.443''	-0.163	-0.034'	0.144
Pork_L	-0.091	-0.167	0.097	-0.159	0.023	0.167	-0.110	-0.060	-0.337	0.846'''	0.069'	-0.278
Turkey_H	-0.160	0.397''	0.014	0.058	0.285'	0.337''	0.168	0.264'''	-0.114'	0.112'	-1.474'''	0.112'''
Turkey_L	0.949'	0.446	0.075	0.359	0.140	0.213	0.402	-1.487'''	0.354	-0.330	0.082	-1.204'''

''', '', and ' represent significant at 1%, 5% and 10% levels respectively

Table 8: Price Elasticities in Chicago After the Recession

	Beef_H	Beef_L	Chicken_H	Chicken_L	FW_B	FW_L	FW_D	Other	Pork_H	Pork_L	Turkey_H	Turkey_L
Beef_H	-0.941'''	0.531'''	0.168'	0.020	0.029	0.128'''	0.169	-0.205'	-0.026	-0.146''	0.089'''	0.184''
Beef_L	0.316'''	-0.921'''	-0.090	-0.009	0.082	0.017	0.111	0.247'''	0.159'''	-0.032	0.004	0.116'
Chicken_H	0.163'	-0.148	-0.553'''	0.086	-0.025	-0.001	-0.047	0.188''	0.001	0.088'	0.010	0.237'''
Chicken_L	0.068	-0.052	0.300	-0.655''	0.224	0.228	0.152	0.351'	-0.114	-0.312''	-0.044	-0.147
FW_B	0.045	0.214	-0.040	0.103	-0.844'''	-0.009	0.268	-0.032	0.096	0.140''	0.156'''	-0.098
FW_L	0.200'''	0.045	-0.002	0.105	-0.009	-0.889'''	0.329'''	0.159'''	-0.003	-0.031	0.012	0.084'
FW_D	0.104	0.115	-0.029	0.027	0.105	0.129'''	-0.646'''	0.176'''	-0.007	0.029	0.024	-0.027
Other	-0.496'	1.009'''	0.469''	0.251'	-0.049	0.247'''	0.696'''	-1.897'''	0.127	0.069	0.145'''	-0.569'''
Pork_H	-0.049	0.494'''	0.001	-0.062	0.113	-0.003	-0.020	0.097	-0.651'''	0.048	-0.037	0.068
Pork_L	-0.557''	-0.206	0.346'	-0.350''	0.342''	-0.075	0.180	0.109	0.100	0.343'	-0.031	-0.203
Turkey_H	0.548'''	0.042	0.061	-0.080	0.617'''	0.049	0.237	0.368'''	-0.122	-0.050	-1.825'''	0.155''
Turkey_L	0.833''	0.879'	1.101'''	-0.195	-0.285	0.245'	-0.197	-1.059'''	0.168	-0.241	0.114'	-1.362'''

''', '', and ' represent significant at 1%, 5% and 10% levels respectively

Table 9: Price Elasticities in Indianapolis During the Recession

	Beef_H	Beef_L	Chicken_H	Chicken_L	FW_B	FW_L	FW_D	Other	Pork_H	Pork_L	Turkey_H	Turkey_L
Beef_H	-1.425'''	0.140	0.172	0.016	0.287'''	0.165'	0.175	0.305'''	-0.043	0.039	0.024''	0.144
Beef_L	0.052	-1.234'''	0.222'''	0.064'''	0.156'''	0.163'''	0.136'''	0.152'''	0.212'''	0.066'	0.015'''	-0.003
Chicken_H	0.194	0.678'''	-1.756'''	0.109'''	0.160'	0.072	-0.049	0.221'''	0.164'	0.094	-0.007	0.122
Chicken_L	0.063	0.677'	0.375'''	-2.079'''	0.218	0.138	0.079	0.055	0.112'	0.252'''	0.053	0.056
FW_B	0.327'''	0.483'''	0.161'	0.064	-1.472'''	-0.059	0.355'''	-0.015	0.036	0.087	-0.024	0.060
FW_L	0.179'	0.478'''	0.069	0.038	-0.056	-1.314'''	0.274'''	0.088	0.189'''	-0.041	0.022'	0.073
FW_D	0.122	0.256'''	-0.030	0.014	0.216'''	0.176'''	-0.983'''	0.097'	0.181'''	-0.098'	-0.001	0.050
Other	0.806'''	1.089'''	0.519'''	0.038	-0.035	0.215	0.370''	-3.175'''	0.214	0.113	0.020	-0.173
Pork_H	-0.057	0.761'''	0.192'	0.038'	0.041	0.230'''	0.344'''	0.107	-2.281'''	0.456'''	0.019'	0.148'
Pork_L	0.077	0.350'	0.164	0.128'''	0.150	-0.074	-0.279'	0.084	0.680'''	-1.498'''	0.002	0.216'
Turkey_H	0.318''	0.536'''	-0.084	0.181	-0.283	0.275'	-0.026	0.099	0.190''	0.011	-1.293'''	0.075
Turkey_L	0.740	-0.042	0.559	0.074	0.269	0.347	0.373	-0.336	0.576'	0.564'	0.029	-3.153'''

''' , '' , and ' represent significant at 1%, 5% and 10% levels respectively

Table 10: Price Elasticities in Indianapolis After the Recession

	Beef_H	Beef_L	Chicken_H	Chicken_L	FW_B	FW_L	FW_D	Other	Pork_H	Pork_L	Turkey_H	Turkey_L
Beef_H	-1.885'''	0.589'''	0.332'''	0.083''	0.291'''	-0.086	0.402'''	0.158	-0.038	0.150'	-0.010	0.013
Beef_L	0.217'''	-1.332'''	0.086''	0.012	0.069	0.164'''	0.236'''	0.253'''	0.234'''	-0.013	0.022'''	0.054
Chicken_H	0.374'''	0.261''	-1.726'''	0.136'''	0.230'''	0.083	0.270'''	0.141	0.079	0.139''	-0.007	0.020
Chicken_L	0.323''	0.124	0.467'''	-1.639'''	0.035	-0.097	0.420''	-0.095'	0.228''	0.126	-0.027	0.135
FW_B	0.331'''	0.214	0.232'''	0.010	-1.552'''	0.195'	0.229'	-0.134	0.175''	0.217'''	0.011	0.070
FW_L	-0.093	0.481'''	0.080	-0.027	0.186'	-1.328'''	0.253'''	0.080	0.125'	0.115'	0.040'''	0.090''
FW_D	0.280'''	0.444'''	0.167'''	0.075''	0.140'	0.162'''	-1.449'''	0.053	0.029	-0.021	0.001	0.120'''
Other	0.417	1.810'''	0.331	-0.065	-0.310'	0.195	0.200	-3.359'''	0.330'	0.446'''	0.035''	-0.029
Pork_H	-0.050	0.837'''	0.093	0.078''	0.203''	0.153'''	0.055	0.165'	-1.789'''	0.282'''	0.010	-0.038
Pork_L	0.296	-0.069	0.244''	0.064	0.375'''	0.209'''	-0.060	0.332'''	0.421'''	-1.940'''	-0.015	0.142
Turkey_H	-0.128	0.792'''	-0.082	-0.092	0.131	0.487'''	0.022	0.177''	0.105	-0.101	-1.347'''	0.035
Turkey_L	0.067	0.748	0.090	0.179''	0.315	0.426''	0.887'''	-0.056	-0.148	0.371	0.014	-2.894'''

''' , '' , and ' represent significant at 1%, 5% and 10% levels respectively

Table 11: Price Elasticities Detroit During the Recession

	Beef_H	Beef_L	Chicken_H	Chicken_L	FW_B	FW_L	FW_D	Other	Pork_H	Pork_L	Turkey_H	Turkey_L
Beef_H	-2.723 ^{'''}	0.914 ^{'''}	0.204 [']	0.118 ^{'''}	0.268 ^{'''}	0.235 ^{'''}	0.268 ^{''}	0.208 ^{''}	0.269 ^{'''}	0.016	0.089 ^{'''}	0.135
Beef_L	0.351 ^{'''}	-1.386 ^{'''}	0.090	0.072 ^{'''}	0.246 ^{'''}	0.077 ^{''}	0.075	0.170 ^{'''}	0.024	0.119 ^{'''}	0.043 ^{'''}	0.119 ^{''}
Chicken_H	0.191 [']	0.220	-1.088 ^{'''}	0.088 ^{'''}	-0.066	0.061 [']	0.172 ^{'''}	0.052	0.194 ^{'''}	0.044	0.007	0.124
Chicken_L	0.371 ^{'''}	0.592 ^{'''}	0.297 ^{'''}	-1.853 ^{'''}	0.415 ^{'''}	0.118	-0.101	-0.062	0.087	0.098 [']	-0.078	0.117
FW_B	0.294 ^{'''}	0.701 ^{'''}	-0.077	0.145 ^{'''}	-1.238 ^{'''}	-0.039	0.009	-0.012	-0.011	0.089 [']	0.113 ^{''}	0.026
FW_L	0.285 ^{'''}	0.243 ^{''}	0.078 ^{'''}	0.045	-0.043	-1.144 ^{'''}	0.124	0.085 ^{''}	0.161 ^{'''}	0.021	0.063	0.082 [']
FW_D	0.153 ^{''}	0.111	0.104 [']	-0.018	0.005	0.059	-0.778 ^{'''}	0.127 ^{'''}	0.094 [']	0.059 [']	0.011	0.073
Other	0.478 ^{''}	1.014 ^{'''}	0.128	-0.045	-0.025	0.161 ^{''}	0.511	-2.266 ^{'''}	0.017	0.138	0.073 ^{''}	-0.184
Pork_H	0.409 ^{'''}	0.094	0.314 ^{'''}	0.042	-0.016	0.202 ^{'''}	0.251 [']	0.011	-1.454 ^{'''}	0.141 ^{''}	0.040	-0.036
Pork_L	0.036	0.707 ^{'''}	0.108	0.071 [']	0.186 ^{''}	0.040	0.234 [']	0.138	0.213 [']	-1.722 ^{'''}	-0.009	-0.002
Turkey_H	0.395 ^{'''}	0.496 ^{'''}	0.034	-0.110	0.459 ^{''}	0.231	0.086	0.141 ^{''}	0.117	-0.018	-2.019 ^{'''}	0.188 ^{'''}
Turkey_L	0.441	1.011 ^{''}	0.434	0.122	0.077	0.221 ^{''}	0.418	-0.263	-0.078	-0.002	0.139 ^{'''}	-2.520 ^{'''}

''', '', and ' represent significant at 1%, 5% and 10% levels respectively

Table 12: Price Elasticities in Detroit After the Recession

	Beef_H	Beef_L	Chicken_H	Chicken_L	FW_B	FW_L	FW_D	Other	Pork_H	Pork_L	Turkey_H	Turkey_L
Beef_H	-2.144 ^{'''}	0.663 ^{'''}	0.152 [']	0.080 ^{'''}	0.102	0.076 [']	0.423 ^{'''}	0.073	0.195 ^{'''}	0.118 ^{''}	0.040 [']	0.224 ^{'''}
Beef_L	0.255 ^{'''}	-1.071 ^{'''}	0.158 ^{'''}	0.031 ^{''}	0.116 ^{'''}	0.084 ^{'''}	0.072	0.154 ^{'''}	0.078 ^{''}	-0.027	0.055 ^{'''}	0.096 ^{'''}
Chicken_H	0.143 [']	0.385 ^{'''}	-1.640 ^{'''}	0.150 ^{'''}	0.240 ^{'''}	0.187 ^{'''}	0.001	0.141 ^{''}	0.235 ^{'''}	0.002	-0.013	0.169 ^{'''}
Chicken_L	0.252 ^{'''}	0.252 [']	0.503 ^{'''}	-2.461 ^{'''}	0.815 ^{'''}	-0.128	0.449 ^{'''}	0.084	0.005	0.189 ^{'''}	0.046	-0.005
FW_B	0.112	0.332 ^{'''}	0.280 ^{'''}	0.284 ^{'''}	-1.554 ^{'''}	0.097	0.311 ^{'''}	-0.036	-0.027	0.090 ^{''}	0.130 ^{'''}	-0.019
FW_L	0.092 [']	0.265 ^{'''}	0.241 ^{'''}	-0.049	0.107	-1.139 ^{'''}	0.267 ^{'''}	0.080 ^{''}	0.055	0.008	0.028	0.045
FW_D	0.242 ^{'''}	0.108	0.000	0.082 ^{'''}	0.162 ^{'''}	0.126 ^{'''}	-1.042 ^{'''}	0.061 ^{''}	0.172 ^{'''}	0.032	0.025	0.031
Other	0.166	0.915 ^{'''}	0.344 ^{''}	0.061	-0.075	0.152 ^{''}	0.246 ^{''}	-2.254 ^{'''}	0.113	0.311 ^{'''}	0.042	-0.022
Pork_H	0.296 ^{'''}	0.308 ^{''}	0.381 ^{'''}	0.002	-0.038	0.069	0.458 ^{'''}	0.075	-1.915 ^{'''}	0.266 ^{'''}	-0.010	0.106
Pork_L	0.270 ^{''}	-0.163	0.006	0.138 ^{'''}	0.188 ^{''}	0.015	0.127	0.311 ^{'''}	0.400 ^{'''}	-1.511 ^{'''}	0.017	0.204
Turkey_H	0.178 ^{''}	0.634 ^{'''}	-0.062	0.065	0.527 ^{'''}	0.102	0.194	0.082	-0.029	0.032	-1.814 ^{'''}	0.091
Turkey_L	0.732 ^{'''}	0.818 ^{'''}	0.590 ^{'''}	-0.005	-0.057	0.122	0.180	-0.031	0.228	0.291 ^{''}	0.067	-2.935 ^{'''}

''', '', and ' represent significant at 1%, 5% and 10% levels respectively