EMPIRICAL ESTIMATION OF PER CAPITA BEEF DEMAND IN THE

REPUBLIC OF ARMENIA

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ABSTRACT

To identify the factors influencing the average per capita beef consumption in Armenia, a double-log variant of a linear regression model was estimated using quarterly time-series data on quantity, prices, and income. The results of estimation showed that the average real price of beef, the average real price of pork, the average real price of poultry, and the average real per capita monetary income were statistically significant determinants of the average per capita beef consumption in Armenia.

Kew words: per capita beef consumption, real price of beef, real price of pork, real price of poultry, real per capita monetary income.

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INTRODUCTION

Agriculture is one of the main factors influencing the development and growth of a country's economy. This is especially true for developing countries, were agriculture plays a vital role as the main source of food and fiber as well as government revenue. Today, agriculture refers not only to the crop and livestock production, but also to the processing, marketing and distribution of agricultural products. During the Soviet Union era, these activities were entirely planned and conducted under the supervision of planning boards in Armenia. After the privatization, the means of production were transferred to private owners and market economy replaced the planned economy. The privatization of land was a necessary condition for developing market economy. However, the very process of the privatization was carried out in an uncontrolled manner, which was bound to have negative implications on further development of agriculture and economy as a whole. Aggregate-level data on Gross Domestic Product (GDP) and agricultural output available from the National Statistical Service of the Republic of Armenia (NSSRA) help to shed light on the current state of Armenia's agriculture.

According to Figure 1, over the period from 2000 through 2012, agricultural output has increased at the annual rate of 8% (NSSRA, 2013a). In addition, along with GDP, which exhibited an obvious upward trend, agricultural output displayed an overall slightly increasing trend over the time period from 2000 through 2012. Currently, agricultural output makes up about 21% of total GDP in Armenia (NSSRA, 2013a).

Figure 1. GDP and agricultural output of the Republic of Armenia for yearly periods from 2000 through 2012
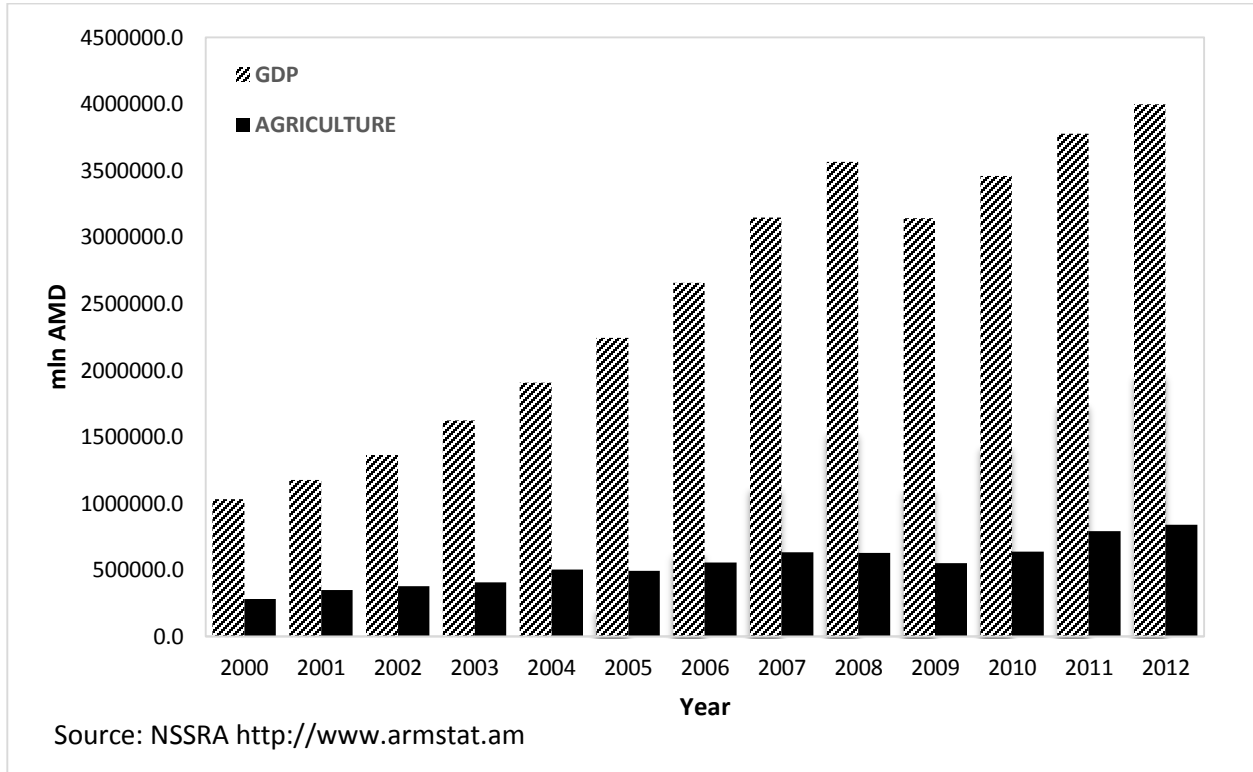
In 2012, output share of plant growing comprised about 61% of total agricultural output, with the annual growth rate of 9% for the time period from 2000 through 2012 (see Figure 2 below). For the same time period, the annual growth rate for animal husbandry output share was only 6% (NSSRA, 2013a). Also, according to Figure 2, both animal husbandry and plant growing output displayed an overall increasing trend for the time period from 2000 through 2012.

Figure 2. Animal husbandry and plant growing output of the Republic of Armenia for yearly periods from 2000 through 2012

Source: NSSRA http://www.armstat.am
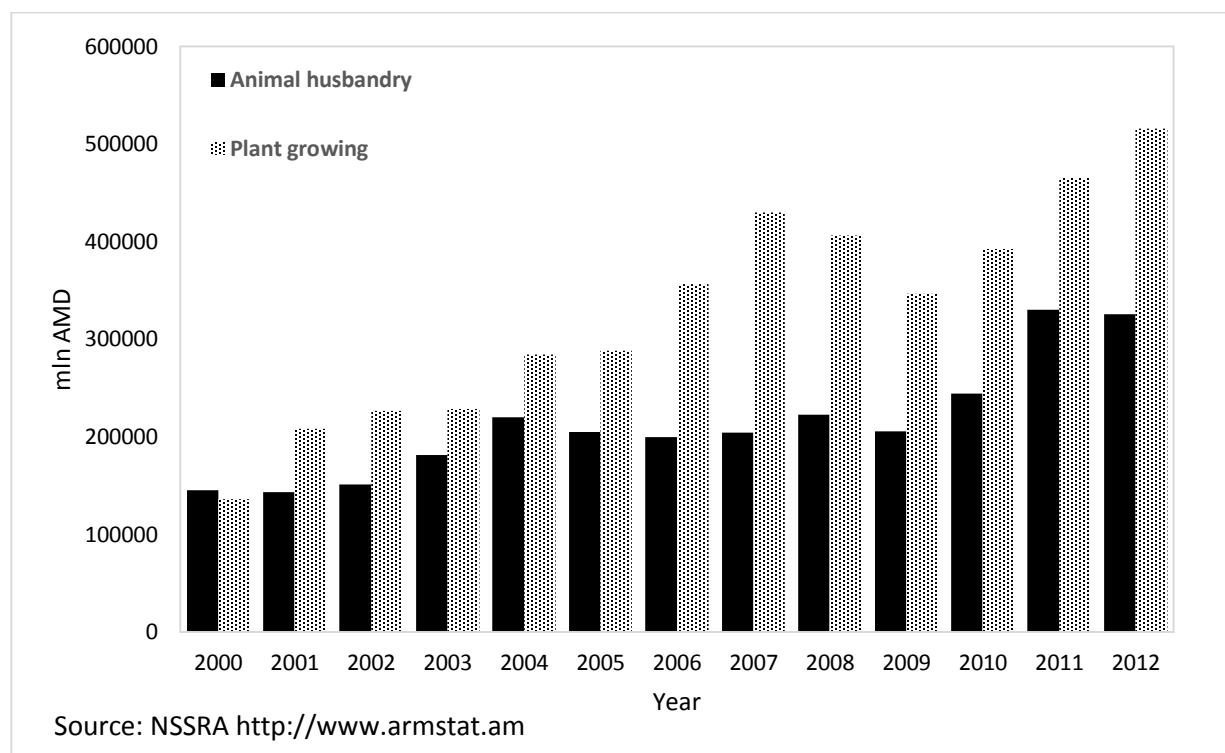
Overview of Plant Growing

Plant growing has always been the dominant branch in Armenia's agriculture. In fact, Armenia has always been famous worldwide for its fruits (apricot, peach, and pomegranate). Good climatic conditions, pure water and fertile soil combined with good agricultural management yielded high-quality crop products in Armenia. However, after privatization, agricultural land was distributed to households with an average land lot area of 1.1 hectares (NSSRA, 2013a). Along with market economy, came many challenges that farmers had to face.

Small capacities of production and lack of cooperation makes mechanization of the production difficult, and generates additional costs associated with the purchase of quality seeds, fertilizers and chemicals. The direct result of this is that quality of the production drops and

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makes the crop production not profitable for local farmers. Nowadays, almost 30% of arable lands of Armenia are not being cultivated (NSSRA, 2013a).

The crop production is mainly done in an open field subject to significant seasonality which makes the realization of product difficult. During the production season farmers end up selling their output at relatively low prices to processing companies, or losing it because of bad storage conditions, whereas during off-season, the prices for crop products grow significantly. However, there are favorable weather conditions to develop plant growing in Armenia. It has vertical climatic zones distributed from 390-4,000 meter above the sea level, which, in case of good management and small to moderate investment, permit the production of various crops in open fields in different parts of the country, thus reducing seasonality in production. Also, the amount of sunlight during a year and high-quality water create favorable conditions for efficient greenhouse production, which permits more efficient production on per unit basis and contributes to the reduction in seasonality present in agricultural production.

Overview of Beef Industry

Although animal husbandry output is nearly twice as less as that of plant growing, the field is still considered one of the most important ones in Armenia. According to food balance of Armenia, in 2012, 29% of the average per capita yearly consumption of agricultural goods consist of animal husbandry products, out of which 86% come from cattle breeding (NSSRA, 2012b). Unlike plant growing, which requires valleys, flat areas and fertile land for crop production, animal husbandry is mainly done in mountainous regions, where pastures are abundant.

The main products from cattle breeding are milk and beef. Although after slaughter skin, bones and blood are also processed and used in different industries. Each year, on average, 571 thousand tons of milk is produced in Armenia, 99% of which is produced by households. Caucasian Brown breed of cattle makes 98% of the overall heads raised in the country with an average annual milk yield of 1,975 kg (NSSRA, 2013a). This is a dairy-beef breed that is excellently adapted to local climatic conditions and fully uses the mountainous pastures. However, even in case of proper feeding and best maintenance, the maximum annual yield of milk of Caucasian Brown is 4,000-4,500 kg (Avetisyan, 2010). To boost cattle breeding production in Armenia the Ministry of Agriculture has initiated significant reforms in animal husbandry, which will give opportunity to make it efficient in Armenia. For that purpose, high productivity breeds are being imported into Armenia from European countries. As of today, 1,332 heads of cattle of various breeds have been imported and given to 28 commercial organizations (Ministry of Agriculture of RA, 2013). Considering the ability to adapt to local climatic conditions, three main breeds are imported, Simmental and Swiss, which have high productivity for both meat and milk, and Holstein, which is famous for high milk yield. Due to imported breeds, milk production in Armenia has grown significantly. Relative to 2012, in 2013, milk production increased by 2.8%, which is the highest indicator among the Commonwealth of Independent States (CIS) countries (Ministry of Agriculture of RA, 2013).

Milk is processed by both households and commercial organizations. The largest proportion of produced milk is consumed fresh and processed for cheese and curd production, while the rest goes into production of yogurt, sour cream, kefir and ice cream (NSSRA, 2012b). Both households and commercial organizations are largely engaged in beef production.

In 2012, of all meat types produced in Armenia, 64% was beef, 13% was pork, 12% was mutton, and 11% was poultry (NSSRA, 2013a). Beef production has always been a traditional agricultural activity for Armenian households. On average, each year about 395 thousand tons of beef are produced, with the annual growth rate of 5.2% for time periods from 2000 through 2012 (NSSRA, 2013a). Figure 3 shows the average per capita beef production and consumption in Armenia from 2000 through 2012.

Figure 3. The average per capita beef production and consumption in the Republic of Armenia for yearly periods from 2000 through 2012
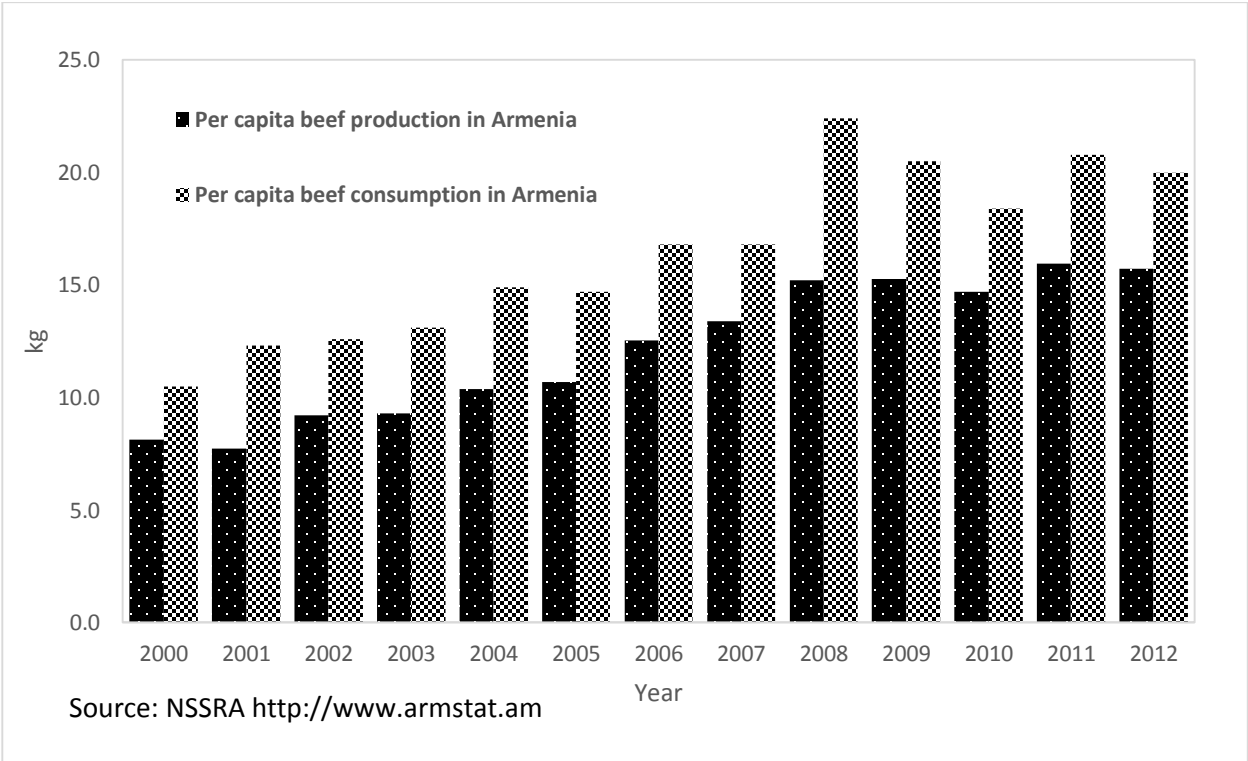
The average per capita beef production exhibited an overall increasing trend over the observed period, and an increasing trend is observed for the average per capita beef consumption up until 2008, after which it went down. The annual growth rate of the average per capita beef consumption from 2000 to 2012 was 5.7%, whereas the annual growth rate of the average per capita beef production for the same period was 6.6%, meaning that the average per capita production of beef grew faster than the consumption.

Along with domestically produced beef, Armenia also imports beef. Figure 4 displays the major countries that Armenia imports beef from. According to Figure 4, beef is imported mainly from India and Brazil (NSSRA, 2012b; Food and Agriculture Organization, 2010).

Figure 4. Main importers of the Republic of Armenia in 2010

Source: Food and Agriculture Organization of the United Nations http://faostat3.fao.org/
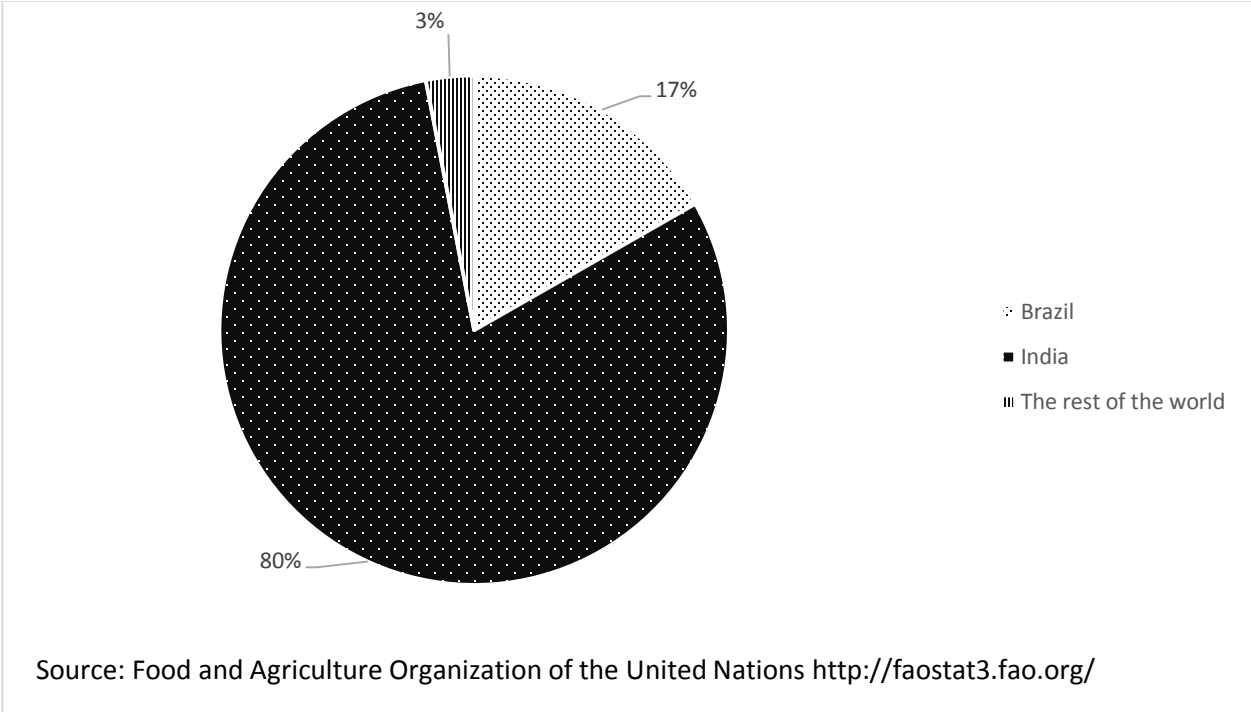
Though a significant amount of beef is imported each year, it is mainly used by processing companies. Despite the fact that domestically produced beef is relatively more expensive, consumers still prefer domestically produced beef, because they believe that local producers do not use hormones simulating growth of animals, thus perceiving domestically produced beef to be healthier. The local production also has better taste characteristics than the imported analogues (EV Consulting, 2009).

Background of the Problem

Low productivity of cattle makes animal husbandry inefficient and economically not profitable activity for Armenian farmers. Although a number of actions towards increasing the productivity of local breeds have been taken by the Ministry of Agriculture, the majority of farmers still face problems associated with low production volumes and quality. In addition, low prices of imported beef reduce demand for domestically produced beef and create dependence on foreign supplies. Proper organization of beef production significantly depends on the accurate estimation of beef demand.

Statement of the Problem

To the best of our knowledge, no empirical estimation of beef demand in Armenia has been done so far. Related studies used descriptive approach to portray the dynamics and overall situation in the beef industry of Armenia. An empirical estimation of beef demand will help understand the factors affecting beef consumption and better meet beef demand in Armenia.

Research Question

The primary research question of this study is:

What are the factors impacting the average per capita beef demand in Armenia?

Objectives of the Study

The objectives of this paper include:

1. To empirically identify statistically significant determinants of the average per capita beef demand in Armenia; and

2. To estimate the own-price, cross-price, and income elasticities of beef.

Significance of the Study

The findings of this research will be of importance to the policymakers and other interested parties in assisting them with their decision-making process regarding beef demand in Armenia. In particular, the findings of this study will help them identify the drivers of beef demand that the interested parties will have to focus on in designing beef development strategies. These results can also be used in planning cattle production, since production decisions take into account demand considerations. Since the beef industry provides input for other industries, the latter can use the results of this study to adjust their production plans accordingly. In addition, the information on elasticities obtained from this study will help beef producers with their pricing strategies in the short-run given their total-revenue maximizing behavior.

Organization of the Paper

The next section presents literature review on previous research and governmental programs initiated in the beef industry in Armenia. Then, the data used in the estimation are described followed by the discussion of the empirical specification of the model. In the following section, the estimation results are presented and interpreted. The final section presents summary, conclusions, and recommendations for future research.

LITERATURE REVIEW

In 2007, the government of the Republic of Armenia has signed "The cattle breeding development program of RA" (The number of decision N 336-A) directed to the development of cattle breeding in Armenia. The main objective of the program was to support the establishment of new selection centers and improve the productivity of the main breed of Armenia, "Caucasian Brown," by 2015. Particularly the program aimed to:

- expand the volumes of artificial insemination of cattle;
- identify high productivity cattle from different herds, and support their reproduction;
- support households to acquire internationally developed high productivity breeds; and
- promote inter-tribal breeding, aiming to maintain the gene of local breeds.

From the perspective of beef production, the accomplishment of this project would result in a significant increase in productivity of cattle breeding in Armenia. Referring to the "Cattle breeding development program of RA", the Ministry of Agriculture, recorded that, as of 2012, 1,332 heads of tribal calves were purchased and distributed to 28 commercial organizations engaged in beef and milk production (Ministry of Agriculture of RA, 2013).

Following 2013 report of the Ministry of Agriculture of the Republic of Armenia, according to the annual indicators from 2011 through 2013, there was a significant growth in the number of cattle heads bred in Armenia. In 2011 the growth rate of the number of cattle heads bred in Armenia was 0.1% compared to the previous year, whereas in 2012 the same indicator has increased to 4.8%, and in 2013 to 10.3% (NSSRA, 2013a).

Evaluating the efficiency of the program, a new project "The development of artificial insemination program in the Republic of Armenia" was presented to the government for discussion, to support the reproduction of high productivity breeds during the period of 2013-2020.

The latest research discussing beef industry of Armenia was "Industry Insights (Meat Market)" conducted by EV consulting in 2009 (EV consulting, 2009). It was a descriptive research concerning Armenia's meat industry. The study provided background information of meat industry of Armenia, particularly discussing consumer specifics, pricing patterns of beef, long-term development prospects, as well as the impact of 2009 economic crisis on meat market of Armenia. According to this research, the most consumed meat in Armenia was beef constituting 42% of total consumption, followed by poultry, pork and mutton constituting 35%, 16%, and 7%, respectively. The research revealed the perception that domestically produced and imported meats were significantly different among consumers as far as the healthfulness was concerned. Although locally produced beef is considered more healthy and tasty, a large proportion of consumers still can afford only low-priced imported beef. Concerning the economic crisis, the research by EV consulting revealed that meat consumption at the end of 2009 had downward trend, but the effect was not crucial.

The previous research adds to our understanding of the beef industry and the dynamics present in that industry. Our study is different from the previous research in that it uses an empirical approach in studying beef demand in Armenia instead of a descriptive approach.

DATA

Quarterly time-series data ranging from 1995:1 through 2012:4 were used in the analysis. The dataset included information on quantity of beef consumed, price of beef, prices of substitutes, income, and an artificially created trend variable. All of the data (except the trend variable) were obtained from two sources:

- National Statistical Service of the Republic of Armenia, which is the main body responsible for collection of statistical data in Armenia; and

- Food and Agriculture Organization (FAO), which provides one of the largest international datasets on agriculture.

Most of the original raw data were available on annual basis, which is why quarterly interpolations of them were ultimately used in the analysis. From 1995 through 2000, the average per capita beef consumption data were extracted from FAO's website, while from 2001 through 2012, these data came from statistical publications of NSSRA. Price data related to various meat types were entirely available from the NSSRA. In particular, from 1995 through 2000, these data were available on annual basis from statistical yearbooks of "Prices and Tariffs". From 2001 through 2012 the price data were also available on quarterly basis in statistical publications of "Food Security and Poverty". The average per capita monetary income data were extracted from statistical yearbooks of NSSRA. From 1995 through 2000 income information was obtained from "Main Socio-Economic Indicators of Living Standards of Population" section of statistical yearbooks, and from 2001 through 2012 these data were obtained from "Consumption of Monetary Income, Consumption Expenditures of Households and Their Structure" section of statistical yearbooks. Because per capita monetary income data from 2001 through 2012 were given on monthly basis, they were eventually converted to quarterly data. This income variable

was expected to capture the impact of per capita personal disposable income, since the data on the latter were unavailable. In addition, since the dataset extended over numerous years, the inflationary impact on price and income levels over the study period was removed by adjusting them for inflation (real prices and real income) using consumer price index with 2005 as base year. Table 1 depicts summary statistics on the variables used in this study, which is discussed in the following series of graphical illustrations of each variable versus time.

Table 1. Summary statistics of the variables used in the estimation of per capita beef demand

	Units	Obs	Mean	Std. Dev.	Minimum	Maximum
Average per capita beef consumption	kg	72	15.4	3.8	10.4	22.4
Average real price of beef	AMD/kg	72	1,411.3	176.5	1,188.5	1,919.7
Average real price of pork	AMD/kg	72	1,764.9	322.3	1,214.1	2,566.4
Average real price of poultry	AMD/kg	72	1,234.8	174.9	989.6	1,878.9
Average real per capita monetary income	AMD	72	212,769.2	54 221.3	132,309.8	315,534.6

The Average per Capita Beef Consumption

Figure 5 represents the average per capita beef consumption pattern in Armenia for quarterly periods from 1995 through 2012. According to Figure 5, the average per capita beef consumption in Armenia displayed an overall increasing trend over the studied period. There were no obvious breaks that would suggest a structural change in beef consumption. A significant increase was recorded in 2007, which again decreased the next year. For the period of 1995 through 2012, the average of average per capita consumption of beef was 15.4 kg, with standard deviation of 3.8. Within the study period, the constant growth rate of the average per capita beef consumption was estimated to be 1.04%.

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Figure 5. The average per capita beef consumption in the Republic of Armenia for quarterly periods from 1995 through 2012

The Average per Capita Beef Consumption

Source: NSSRA http://www.armstat.am
Food and Agriculture Organization of the United Nations http://faostat3.fao.org/
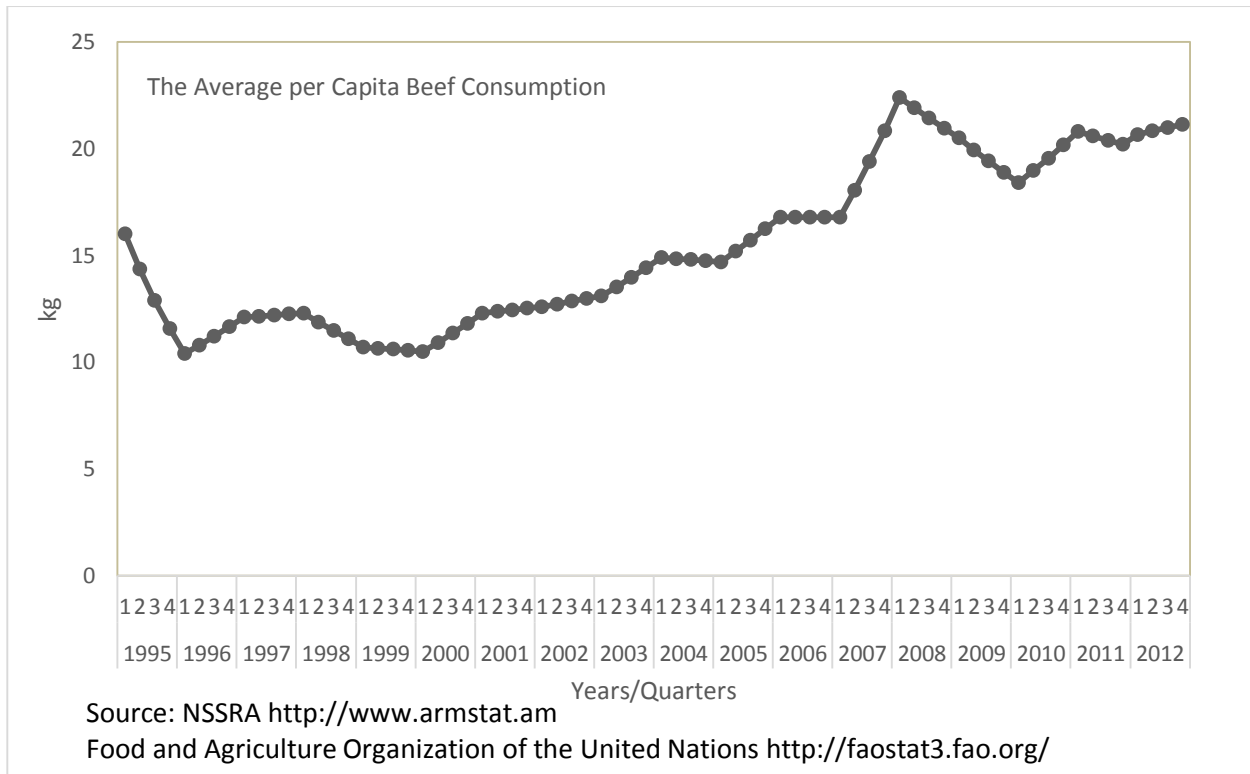
The Average Real Price of Beef

The average of average real price of beef per kilogram was 1,411.3 Armenian Drams (AMD), with standard deviation of 176.5. Figure 6 portrays the pattern of the average real price of beef for quarterly periods from 1995 through 2012. According to Figure 6, the average real price of beef mostly remained constant at its average only to trend up after 2009. The average annual growth rate of the average real price of beef was 2.4%, which is the lowest price growth rate compared to other meat types.

Figure 6. The average per kilogram real price of beef in the Republic of Armenia for quarterly periods from 1995 through 2012

Source. NSSRA http://www.armstat.am
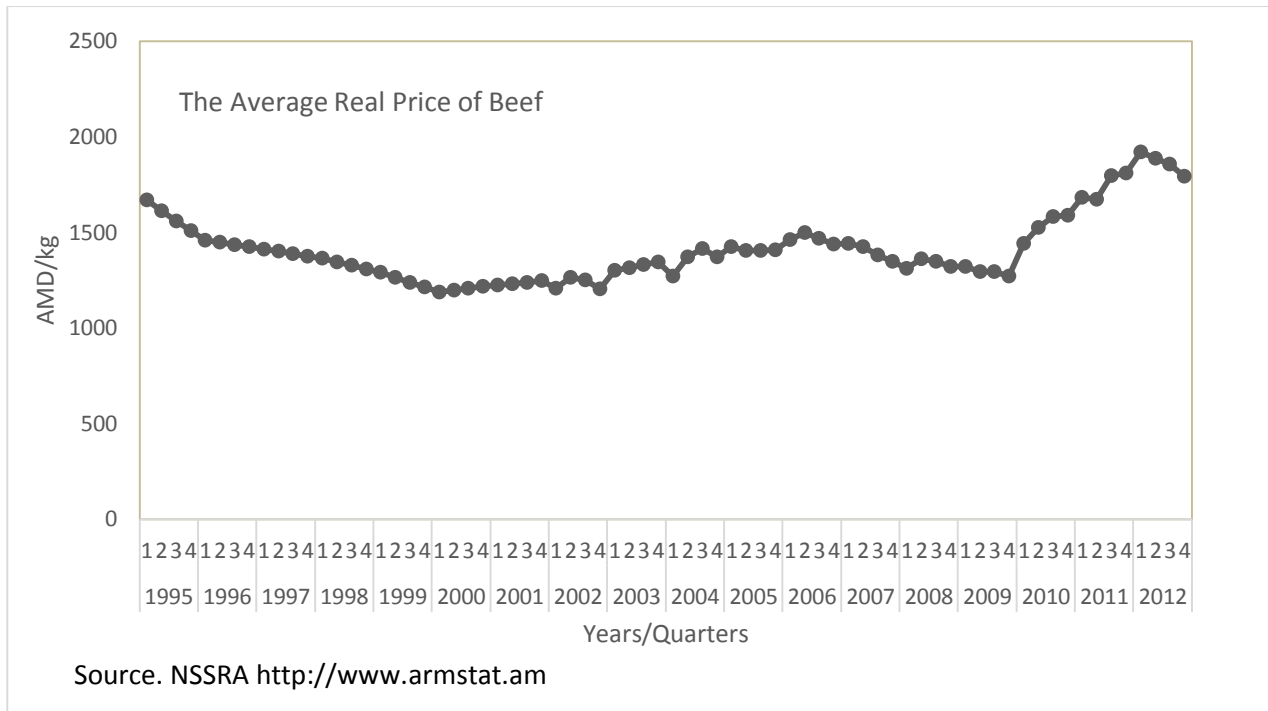
The Average Real Price of Pork

From all types of meat produced in Armenia, pork has always been the most expensive one. The average of average real price of pork per kilogram for the entire study period was 1,764.9 AMD, with standard deviation of 322. Figure 7 presents the pattern of the average real price of pork for quarterly periods from 1995 through 2012. According to Figure 7, the average real price of pork data exhibited a cyclical pattern, repeating itself each 3-4 years, which is probably due to hog production cycle. However, over the study period, the average real price of pork increased by annual growth rate of 2.9%. The highest average real price of pork was observed in the fourth quarter of 2009, which may be attributed to the financial crisis that took place around that time.

Figure 7. The average per kilogram real price of pork in the Republic of Armenia for quarterly periods from 1995 through 2012

Source: NSSRA http://www.armstat.am

The Average Real Price of Poultry

Of all types of meat produced in Armenia, poultry was the cheapest one. For the entire study period, the average of average real price of poultry per kilogram was 1,234.8 AMD, with standard deviation of 174.9. Figure 8 captures the pattern of the average real price of poultry for quarterly periods from 1995 through 2012. As shown in Figure 8, unlike the prices of other meat types, the average real price of poultry exhibited an overall decreasing trend with annual growth rate of -5.8%.
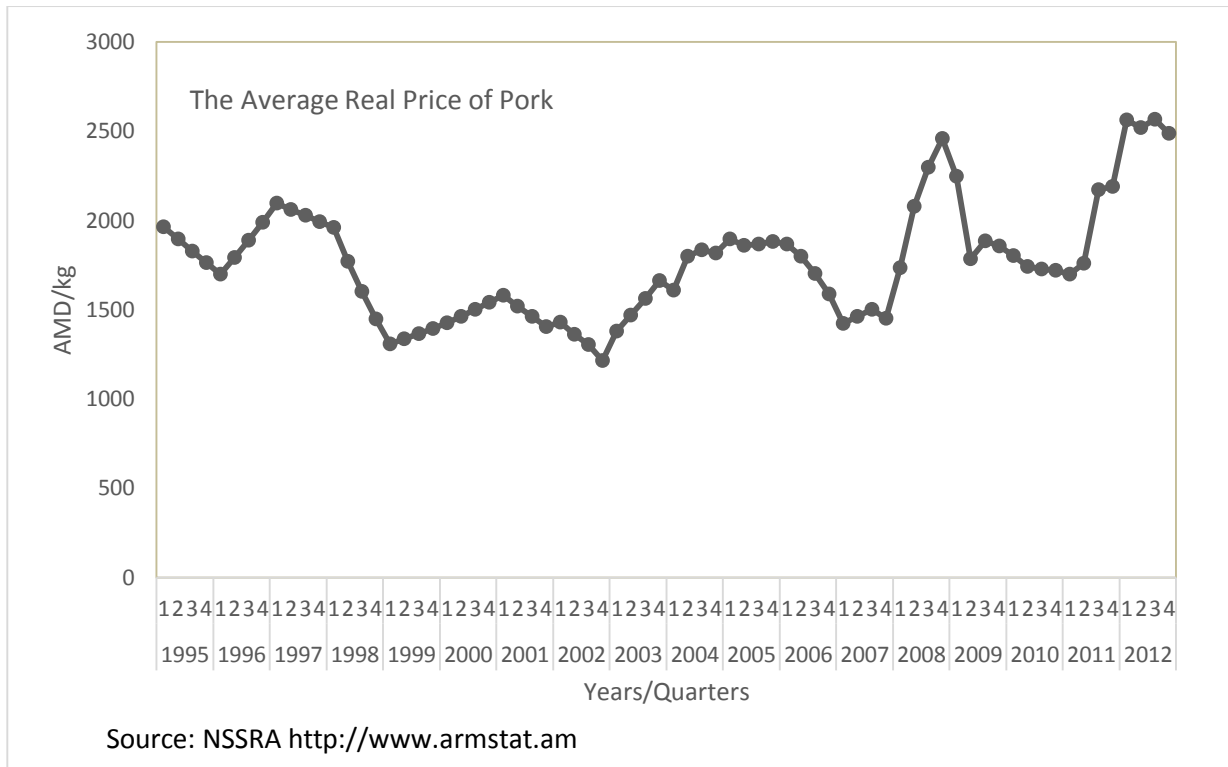
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Figure 8. The average per kilogram real price of poultry in the Republic of Armenia for quarterly periods from 1995 through 2012

Source: NSSRA http://www.armstat.am
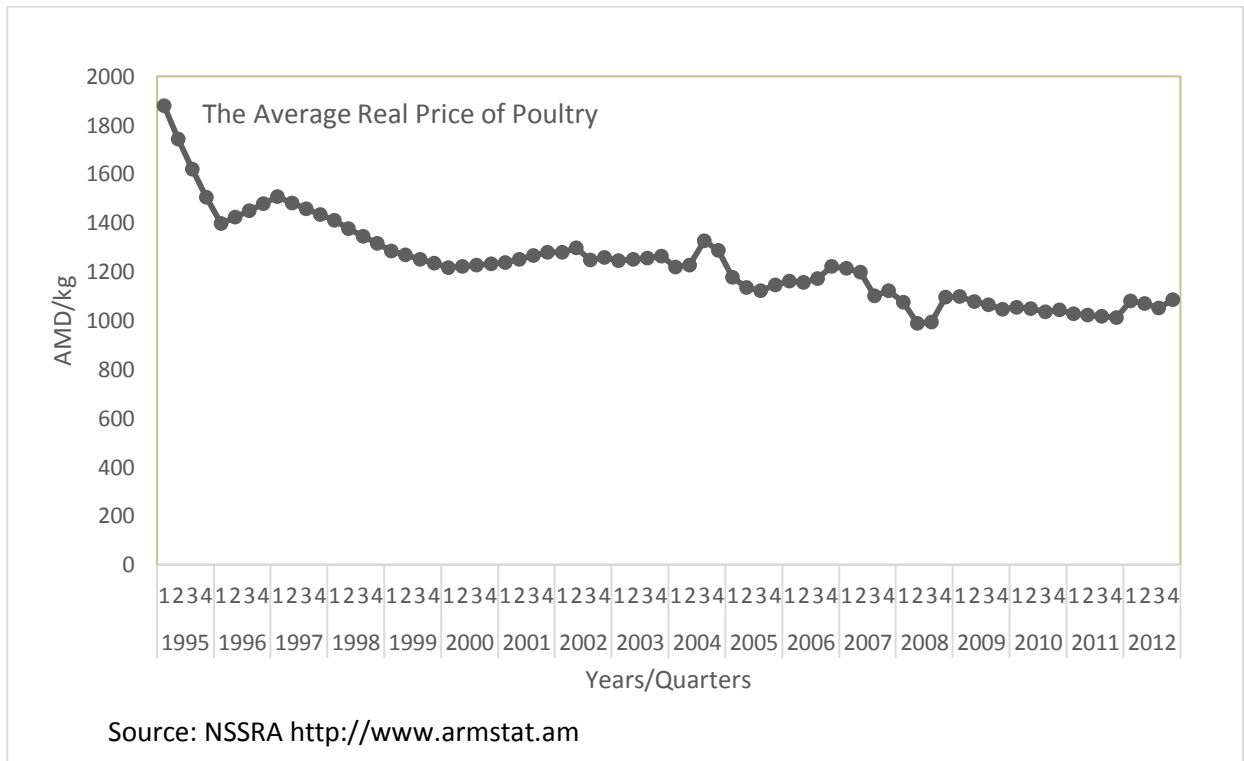
The Average Real per Capita Monetary Income

Over the study period, the average of average real per capita monetary income was 212,769.2 AMD, with standard deviation of 54,221.3. As depicted in Figure 9, the average real per capita monetary income displayed an overall increasing trend with the annual growth rate of 10.2% for the entire study period. The highest average per capita monetary income of 315,534.6 AMD was recorded in the fourth quarter of 2011.

Figure 9. The average real per capita monetary income in the Republic of Armenia for quarterly periods from 1995 through 2012
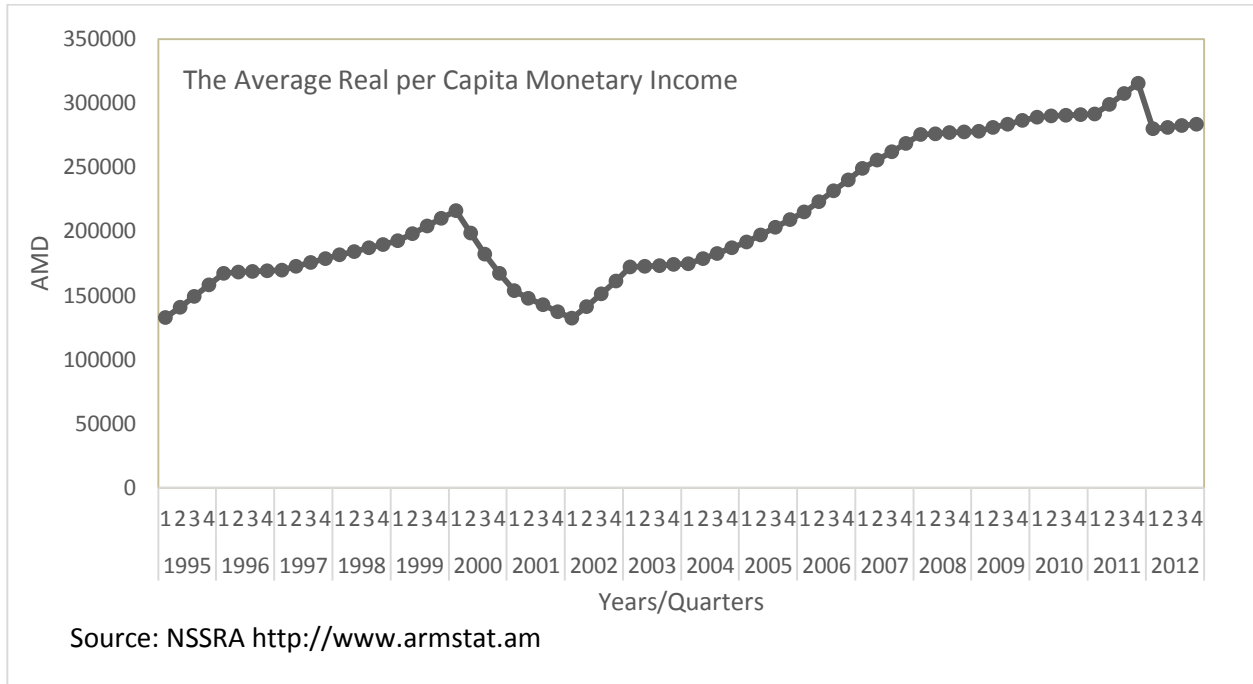
A negative sign on the parameter estimate associated with the variable of the average real price of beef was expected because of the law of demand. A positive sign was anticipated on the parameter estimates associated with the average real prices of competing meat types, since the latter are considered to be substitutes for beef. Beef was hypothesized to be a normal good, which is why a positive sign was anticipated on the parameter estimate of the average real per capita monetary income.

EMPIRICAL SPECIFICATION

The following structural beef demand equation in the linear double-log form was estimated:

$$(1)\ ln\_quantity\_beef_t = \beta_0 + \beta_{1*}ln\_real\_price\_beef_t + \beta_{2*}ln\_real\_price\_pork_t +$$

$$+\beta_{3*}ln\_real\_price\_poultry_t + \beta_{4*}ln\_real\_money\_income_t + \beta_{5*}trend_t + u_t,[1]$$

where $ln\_quantity\_beef_t$ is the natural logarithm of the average per capita beef consumption in time period t;

$ln\_real\_price\_beef_t$ is the natural logarithm of the average real price of beef in time period t;

$ln\_real\_price\_pork_t$ is the natural logarithm of the average real price of pork in time period t;

$ln\_real\_price\_poultry_t$ is the natural logarithm of the average real price of poultry in time period t;

$ln\_real\_money\_income_t$ is the natural logarithm of the average real per capita income in time period t;

$trend_t$ is an artificially created variable that takes on 1 for the first observation and increases chronologically thereafter;

u_t is the random error term, and βs are the parameters to be estimated.

STATA10 statistical software package was used to estimate the model in (1). In addition, it needs to be mentioned that the model was checked and corrected for multicollinearity and serial correlation.

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[1] Equation (1) was first estimated with mutton price included as an independent variable. However, due to multicollinearity problem, as well as the wrong sign on the parameter estimate associated with price of mutton, it was dropped from the final model. Also, seasonality was tested for with a joint F-test of seasonal dummy variables, however, no evidence of statistically significant seasonality was found.

The Problem of Multicollinearity

One of the diagnostic issues that needs to be addressed is related to possible multicollinearity present in the data. If multicollinearity is present in the data the confidence intervals are much wider as a result of which the probability of making Type II error (failure to reject a false null hypothesis) increases. To address this issue, the data were checked for the presence of multicollinearity using a set of criteria. The measures used for checking for multicollinearity are presented in Table 2.

Table 2. Multicollinearity diagnostics table

	VIF	SQRT VIF	Tolerance	R-squared
ln of the average real price of beef	6.04	2.46	0.1657	0.8343
ln of the average real price of pork	1.94	1.39	0.5156	0.4844
ln of the average real price of mutton	6.65	2.58	0.1503	0.8497
ln of the average real price of poultry	12.08	3.48	0.0828	0.9172
ln of the average real per capita monetary income	5.00	2.24	0.2002	0.7998
2nd quarter seasonality dummy variable	1.51	1.23	0.6611	0.3389
3rd quarter seasonality dummy variable	1.52	1.23	0.6582	0.3418
4th quarter seasonality dummy variable	1.51	1.23	0.6610	0.3390
Trend variable	10.87	3.30	0.0920	0.9080
	Eigenvalue		**Conditional Index**	
1	7.5609		1.0000	
2	1.0003		2.7493	
3	1.0000		2.7497	
4	0.2379		5.6372	
5	0.2000		6.1492	
6	0.0004		130.7299	
7	0.0002		176.5127	
8	0.0001		238.9755	
9	0.0000		471.9186	
10	0.0000		750.3399	
Condition number	750.3399			

According to the rule of thumb, if the Variance Inflation Factor (VIF) is higher than 10 for a variable, then that variable was said to be highly collinear (Kleinbaum, Lawrence, Kupper, Muller, 1988). According to the results in Table 2, the average real price of poultry and the trend variables have VIFs higher than 10, indicative of multicollinearity issue. Moreover, the condition number is 750.3399, which falls between 100 and 1,000, pointing out to the presence of multicollinearity problem. To remedy the problem of multicollinearity, the pair-wise correlation coefficients were calculated. These correlation coefficients are presented in Table 3.

Table 3. Pair-wise correlation coefficients of independent variables

	ln of the average real price of beef	ln of the average real price of pork	ln of the average real price of mutton	ln of the average real price of poultry	ln of the average real per capita monetary income	2nd quarter seasonality dummy variable	3rd quarter seasonality dummy variable	4th quarter seasonality dummy variable	Trend variable
ln of the average real price of beef	1.00								
ln of the average real price of pork	0.67	1.00							
ln of the average real price of mutton	0.82	0.62	1.00						
ln of the average real price of poultry	-0.16	-0.17	-0.53	1.00					
Ln of the average real per capita monetary income	0.45	0.42	0.72	-0.82	1.00				
2nd quarter seasonality dummy variable	0.45	-0.02	0.72	0.01	-0.01	1.00			
3rd quarter seasonality dummy variable	0.02	0.03	0.72	-0.04	0.02	-0.33	1.00		
4th quarter seasonality dummy variable	-0.04	0.03	-0.02	-0.02	0.04	-0.33	-0.33	1.00	
Trend variable	-0.04	0.35	-0.02	-0.02	0.85	-0.01	0.01	0.04	1.00

According to table 3, the average real price of mutton and the average of real price of beef are highly correlated (0.82). Also, initial estimation results showed that the parameter estimate associated with the variable of the average of real price of mutton was negative, indicating that mutton and beef were complements. However, according to the theory beef and mutton are substitutes. Consequently, the average real price of mutton was dropped from the final estimation.

The Problem of Serial Correlation

Another problem that was addressed was related to possible serial correlation. The serial correlation was detected using Durbin-Watson d-test, the value of which was 0.3004298 in the initial estimation, implying that there is positive serial correlation in the data (Durbin and Watson, 1951).

This problem was corrected using the procedure developed by Newey and West, which allows to use Ordinary Least Squares (OLS) estimation and adjusts standard errors making them heteroscedasticity and autocorrelation consistent (HAC) (Newey and West, 1987). For the Newey-West procedure lag length of 1 was chosen. After correcting for serial correlation with the Newey-West procedure, F-test for testing for seasonality was conducted. As indicated by F-test, seasonality was not present in the data. Hence, the final model did not include seasonal dummies.

ESTIMATION RESULTS

The estimated coefficients, which are also the corresponding elasticities because of the double-log specification of the model, as well as the corresponding Newey-West standard errors, t-statistics, p-values, and 95% confidence intervals, are reported in Table 4. The level of significance chosen for this analysis was 0.05. According to the estimation results in Table 4, the probability of obtaining an F value of as much as or greater than 79.65 was equal to 0.0000 leading to the rejection of the hypothesis that together the independent variables have no effect on the average per capita beef consumption at the 5% level of significance. The coefficient of determination, R^2, was estimated by taking the square of the correlation coefficient between actual and predicted average per capita beef consumption. The estimated R^2 was equal to 0.893, meaning that 89.3% of variation in the average per capita beef consumption was explained by the model.

Table 4. Estimation results

	Coefficient	Newey-West Std. Error	t	P>|t|	95% Confidence Interval	
ln of the average real beef price	-0.226	0.145	-1.56	0.124	-0.516	0.063
ln of the average real pork price	0.237	0.108	2.19	0.032	0.021	0.454
ln of the average real poultry price	1.180	0.419	2.82	0.006	0.343	2.016
ln of the average real per capita monetary income	0.241	0.092	2.64	0.010	0.059	0.424
Trend	0.015	0.002	6.71	0.000	0.010	0.019
Constant	-9.303	3.053	-3.05	0.003	-15.398	-3.208
R-squared	0.893					
F-test	79.65					
Prob>F	0.0000					

As expected, the parameter estimate associated with the average real beef price was -0.226 and statistically significant at the 10% significance level according to the one-tail test of significance. It showed that 1% increase in the average real price of beef, on average, decreased the average per capita beef consumption by 0.226%, *ceteris paribus*. The estimated own-price elasticity of less than 1 in absolute value indicates that beef faced an inelastic demand.

As anticipated, the parameter estimate associated with the average real price of pork was 0.237 and statistically significant; implying that 1% increase in the average real price of pork on average increased the average per capita beef consumption by 0.237%, *ceteris paribus*. As expected, the parameter estimate associated with the average real price of poultry was 1.18 and statistically significant, suggesting that 1% increase in the average real price of poultry on average increased the average per capita beef consumption by 1.18%, *ceteris paribus*. The positive cross-price elasticity estimates of beef with respect to pork and poultry implies that these meat types are substitutes, as hypothesized.

The parameter estimate associated with the average real per capita monetary income was 0.241 and statistically significant; meaning that 1% increase in the average real per capita monetary income on average increased the average per capita beef consumption by 0.241%, *ceteris paribus*. Also the fact that 0.241 lies in between 0 and 1, implies that beef is a normal good, as expected.

The parameter estimate associated with Trend variable was 0.015 and statistically significant, implying that for quarterly periods from 1995 through 2012 the growth rate of per capita beef consumption was 1.5% per quarter.

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SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS FOR FUTURE RESEARCH

The purpose of this paper was to estimate the average per capita beef demand in Armenia. To that end, a double-log variant of linear regression model was estimated using quarterly time-series data. The estimation results revealed that the average real price of beef was negatively associated with the average per capita consumption of beef. The results also showed that the demand for beef for inelastic. Hence, producers had to increase the beef price in an attempt to maximize their total revenue in the short-run. The cross-price elasticities of beef with respect to pork and poultry showed that these meat types were substitutes for beef with poultry being a relatively stronger competitor for beef according to the absolute values of the parameter estimates associated with competing meat types. Hence, beef producers need to pay a close attention to the behavior of poultry industry. Income variable was found to positively affect the consumption for beef. In addition, the parameter estimate associated with income showed that beef was a normal good. The trend variable helped to statistically ascertain the presence of an upward trend in the per capita consumption of beef in Armenia.

A couple of recommendations for future research need to be mentioned. First, the current analysis did not differentiate between the consumption of domestically produced and imported beef. However, this kind of differentiation will be useful, due to the widespread perception of difference in the healthiness of domestically produced and imported beef. Second, the future study should focus on estimating a system of equations for different meat types to provide a more comprehensive picture of the meat industry.

REFERENCES

1. Avetisyan, S. 2010. *Agriculture and Food Processing in Armenia*.

2. EV consulting. 2009. "Industry Insights of Beef Market."

3. Food and Agriculture Organization of the United Nations. Statistical datasets. Available at http://faostat3.fao.org/

4. Gujarati, D. 2004. *Basic Econometrics*.

5. Kleinbaum D., Kupper L., and Muller K. 1988. *Applied Regression Analysis and Other Multivariate Methods*.

6. Ministry of Agriculture of the Republic of Armenia. 2010. "National Strategy for Sustainable Use and Development of Farm Animal Genetic Resources".

7. Ministry of Agriculture of the Republic of Armenia. 2013. "Overview of Animal Husbandry Industry of Armenia".

8. National Statistical Service of the Republic of Armenia (NSSRA a), "Statistical Yearbooks of the Republic of Armenia, 2000-2013". Available at http://www.armstat.am

9. National Statistical Service of the Republic of Armenia (NSSRA b). "Food Security and Poverty Publications 2000-2013". Available at http://www.armstat.am