Estimating Demand Elasticities of Meat Demand in Slovakia

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Abstract. *This article focuses on assessing consumer beliefs, attitude and behaviour towards meat. The aim is to obtain estimates of price and income elasticity of meat demand in Slovakia. This report analyses pork, poultry and beef meat consumption in Slovakia according to the individual households' social categories. The Household Budget Survey of the Slovak Statistical Office was used for period 1993-2007. The data consists of yearly observations of beef, pork and poultry consumption, average annual consumer prices of beef, pork and poultry meat and net income per capita.*

Knowing the values of demand elasticities for food is widely used to correct policy formation and analysing trade patterns all over the world, but especially in developing countries where food expenses represent relatively large shares of consumer budgets.

Keywords: meat consumption, price elasticity, income elasticity, individual households' categories, fixed effect

Introduction

Reliable estimates of the reaction of the supply and demand for agricultural commodities to prices and other factors are fundamental to accurate economic forecasting and policy decision making. For example, own-price elasticities of demand indicate the extent to which buyers vary their purchases as the price of the product rises and falls. These variations are measured as movements along the demand curve. Cross-elasticities of demand provide a framework for understanding the interactions in food and fibre choice decisions by consumers. These are reflected in shifts in the location of demand curves. This understanding is necessary for the accurate analysis of the response of consumers to changes in prices and availabilities of products due to changes in their external environment.

These information are significant factors implemented into the producers decisions making not only in the agricultural sector.

Panel data of individual households provide an ideal data source to study changes in the market as well as investigating changing food consumption patterns. The availability of such panels has motivated considerable research on new methods for analyzing panel data, and the benefits from the resulting analyses have led to an increased use of customer panels.

Each consumer is allowed to have a unique parameter called a fixed effect in the utility specification. This parameter either increases or decreases a consumer's preference for an alternative from some base level. This approach captures the essence of heterogeneity by permitting preferences to be truly heterogeneous. In addition to this operational superiority, this method has a major substantive advantage over the previous two methods: the estimated values of the fixed effects may be used to analyze the underlying consumer segments. (Papatla, 1996)

In many cases, fixed effect models can be used to control for spatial components. This can be done, for example, by incorporating either household level effects into a demand equation, using panel data, or village level effects, using a cross-sectional demand survey. (Case, 1991)

Considerable research has analyzed the hypothesis of structural change in meat demand, including Braschler (1983), Chalfant and Alston (1988). The evidence from these studies is mixed, given the variety of methods and data employed. Previous studies have generally illustrated structural change in meat demand in terms of its effects on estimated elasticities. While this conveys information on whether demand reacts differently to variations in prices and expenditure levels due to structural change, it says

nothing of the effects of structural change on quantity demanded with prices and expenditure level held constant. According to the research of Moschini and Meilke (1989) the demands for beef and pork are much more elastic than chicken and fish. Notably, beef was the only superior good. The cross-price elasticities show more complementarily relationships than expected, with ten of the twelve cross-price elasticities having a negative sign.

Fraser, Moosa (2002) determined for the UK meat demand elasticity coefficients. According their results compensated cross-price elasticity estimates show that all meat types – beef, pork, and poultry are net substitutes with some marked differences between specifications. There are also differences between the expenditure elasticity estimates that are particularly pronounced for beef and chicken. For beef, the expenditure elasticity estimates fall when moving to the stochastic trend and seasonality models but for all other meats they increase. Although, all the models yield sensible elasticity estimates, the different specifications do impact the magnitude of the elasticity estimates.

The article is organized as follows. Section 1 contains a discussion of fixed effect methodology applying. Section 2 deals with the meat consumption development in Slovakia. The key issue is solved in the third section – meat demand modelling and calculating demand elasticities.

Methodology

In the estimation process the fixed effect specification of the panel data is used. Fixed effect specification is preferred in case of omitted variable problems in the regressions, by means of capturing idiosyncratic factors that might affected the demand and meat consumption. The White period robust coefficient variance estimator was applied to accommodate arbitrary serial correlation and time-varying variances in the disturbances.

The fixed effect model assumes that individual specific time invariant effects should be treated as the intercept term of the regression. This presents opportunities for a number of transformations of the data, which eliminate this effect. Essentially, any transformation that rids the model of the fixed effect produces a fixed effect estimator (Baltagi, 2001).

By far the most extensively discussed and used fixed effects estimator is the least squares dummy variable estimator, also referred to as the within estimator (Greene, 2000, Hsiao, 1986)

The fixed effects estimation method is regarded as ridden with problems in theoretical literature. The least squares dummy variable approach has been widely criticized. Less importantly, the LSDV approach presents a loss in the degrees of freedom, due to the large number of parameters being estimated, which may or may not be a problem in practice, depending on the number of observations available (Wooldridge, J. M., 2002).

More importantly, the fixed effects approach rids the regression of all fixed effects, regardless if they are contained as unobservable within the intercept term, or as observables in the matrix of regressors. Thus the effects of individual specific regressors, such as sex or place of birth, on the dependent variable cannot be estimated under the fixed effects approach (Baltagi, 2001).

The dependent variable is chosen to represent per capita consumption of beef, pork and poultry meat. The coefficients are estimated with OLS method.

The meat demand equation was specified as follows:

$$ln\,(Y_i) = \beta_0 + \beta_1 * ln\,(P_B) + \beta_2 * ln\,(P_{PK}) + \beta_3 * ln\,(P_{PL}) + \beta_4 * ln\,(I) + \beta_5 * (t) + \beta_6 * (d_1) + ln\,\varepsilon$$

Variables used in the econometric model:

Variable	Explanation
Y_i	per capita meat consumption for i (i = beef, pork, poultry)
P_B	real price of beef meat, (Sk/kg)
P_{PK}	real price of pork meat, (Sk/kg)
P_{PL}	real price of poultry meat, (Sk/kg)
I	real income per capita
t	trend

d_1	dummy variable that measures the impact of BSE. The variable takes the value 1 if the BSE was observed in the Slovak Republic and 0 otherwise

Results

In recent years is paid increasing attention to the question of structural change in the demand for meat products, especially beef. Declining per capita consumption of red meat and increasing consumption of pork and poultry meat reflects on consumer preferences changes not only in Slovakia.

The past ten years in the countries of former Eastern Block were connected with dramatic changes as a consequence of the transformation. The decline in purchasing power of the population and reduction in consumer subsidies had resulted in significant drop in meat consumption in the early 1990s. In the year 1991 occurred in Slovakia the price liberalization which affected 85% prices.

Decreasing domestic beef meat production affects increase of consumer prices what indicates declining consumption by stagnated purchasing power. Contrariwise poultry consumption keeps growing trend. Consumption of fishes is not suitable in the long term.

Although food consumption usually follows a rather steady pattern, the animal diseases that occurred during recent years have strongly affected the meat consumption. BSE, foot and mouth disease and swine fever have had a severe impact on food markets in the EU causing demand for meat to decrease rapidly. These facts are of high importance for the analysis.

The determinants and effects of changes in meat consumption patterns are income and the related effects of out of home consumption and growing convenience, prices (especially for poultry), health consciousness and to a lesser extent environmental consciousness. The change in demographic structure is a wide field and comprises change of age structure, change of household size and marital structures, migration from rural to urban areas and many other variables.

The aggregate average consumption of beef meat per year during the years 1993 – 2007 in Slovakia was 52 549 tons. Through an analysed period decreased the average beef meat consumption by 45 540 tons (57 %). A considerable participation of this fact has occurrence of disease BSE in Europe 2000/2001 and later in the Slovakia.

Beef consumption is projected to stagnate or slightly decline over the medium term as the potential increase fuelled by rising income level would be broadly offset by the sustained price increase for beef observed since enlargement of the EU and by the low consumer preference for beef meat. Beef market prices have increased substantially in the new Member States of EU upon enlargement, with increases ranging between 10 and 30 %. It is expected that the tight market within the EU could result in firm prices throughout the projection period.

During the analysed period the poultry meat consumption increased by 45 366 tons, which presents increase by 71 per cent. The poultry meat consumption has a long term increasing course and in spite of this fact it still didn't reach level of average consumption of EU 15. We suppose that the annual rise of poultry meat consumption in Slovakia will continue. Pork meat consumption will be more stable with a slight decrease.

The outlook for pork meat consumption is in general positive since pork meat is likely to continue to be favoured by Slovak consumers, although evidently less than poultry. After the gradual decrease observed, per capita pork consumption is projected to increase or to maintain relative stable level.

The future trend for poultry production remains relatively positive with respect to other meats, strong consumer preference and increased use in food preparations should continue to play in favour of poultry. Per capita poultry consumption is projected to increase because of benefits from a growing consumer preference.

Another issue solved in research is demand modelling with aim to estimate the elasticity coefficients for beef, pork, poultry meat demand in Slovakia. The simple linear demand model was applied. Most of the estimated coefficients are significant. (table 1)

Table 1. Estimation results. Dependent variable ln (Yi)

	Beef	**Pork**	**Poultry**
CONSTANT	197.9543***	22.4283	-34.3893*
ln (P_B)	-0.4707***	0.3385***	0.1508***
ln (P_{PK})	0.7886***	-0.9778***	0.0793
ln (P_{PL})	0.0324	0.0937	-1.0038***
ln (I)	0.8919***	0.3823	0.7106***
d_1	-0.1037***	-0.0109	0.0161
d_2	-0.3581***	0.0326	0.0863***
adjusted R-squared	0.9018	0.8706	0.9561

Source: authors` calculations
* significant at α=0.1
** significant at α=0.05
*** significant at α=0.01

The significant variables that affect beef meat consumption are own beef meat price, pork meat price, income, trend and occurrence of BSE disease. The beef meat demand is inelastic with respect to own price. As expected, the pork meat is a substitute for beef meat. According to model results price of poultry meat has no effect on beef consumption. Based on income elasticity coefficient, beef meat is a normal good for an average household in Slovakia.

During the analysed period the beef meat demand declined by 10 per cent yearly. This trend was caused by change in consumers preferences in favour of pork meat. Occurrence of BSE disease also significantly led to decrease in beef consumption. The beef meat consumption dropped by more than 30 per cent as a result of BSE.

The pork meat demand is price inelastic with respect to own price. Pork demand is income inelastic which means that income grows faster than pork meat consumption.

For poultry meat demand significant variables are poultry meat price, beef meat price, income and occurrence of BSE disease. The poultry demand is price elastic with respect to own price. Poultry meat is substitute with beef meat. Poultry meat demand is income elastic.

Due to BSE occurrence the poultry meat consumption increased by around 9 per cent. Consumers substituted beef meat consumption mainly with poultry meat as a result of BSE. The impact of BSE on pork meat demand is not significant.

Table 2. Income elasticity estimation results

	Beef	**Pork**	**Poultry**
Workers	1.122	0.277	0.445
Businessmen	1.248	0.535	0.772
Employees	0.735	0.335	0.612
Farmers	1.926	1.592	1.215
Pensioners	1.214	0.628	0.268
Average household	0.914	0.233	1.094

Source: authors` calculations

The social household group of workers is characterized by lower level of net incomes in comparison with other studied groups. The demand for beef meat is for this household category income elastic, a value of 1.122. Contrariwise demand for pork is significantly inelastic; consumption of this sort

of meat is markedly impacted by level of workers incomes. The poultry meat demand is also inelastic. (Table 2)

Similar coefficients of income elasticity show the households of businessmen. Beef meat demand is income elastic, pork and poultry demand is inelastic. All analyzed sorts of meat represent for this household category normal goods.

Specific results were reached by coefficients of income elasticity for households of employees. The coefficient is for all studied meats lower than one and greater than zero, which means income inelastic demand. According to the incomes level has this category the highest net real incomes per capita and we assume that increase of incomes is followed by slower increase of demand.

Farmers are specific category because of the existing self supplementation with analyzed kinds of meats. The beef, pork and poultry demands are income elastic. Their change of meat consumption is greater than change of incomes. Possible reason of this fact should be the substitution of market supply by own meat production.

Beef meat demand by pensioners is income elastic, value 1.214. Contrariwise pork and poultry are inelastic. Poultry presents based on coefficient indispensable good for pensioners. Price relations for poultry are very favourable for the consumers, especially for pensioners. We can not omit an important fact that in these households does not live children, which are decreasing average meat consumption in other categories.

The average household income elasticity coefficients in Slovakia characterized beef and pork demand as income inelastic. Pork as the long term most consumed meat in Slovakia with respect to the coefficient represents the indispensable good. The poultry demand is income elastic and its consumption is continuously increasing.

Conclusions

This paper has used a fixed effects method for modelling of meat demand in Slovakia.

Rising income is expected to change the composition of food demand, especially in developing countries. Economists have proposed numerous hypotheses to explain changes in world consumer substitution of poultry in place of beef. Applied analysis has focused on such factors as lower relative poultry prices and consumer preference structures altered by health concerns.

During analysed period 1993 – 2007 was percentage share of meat expenditures of total expenditures by all household categories decreasing. Reason of this decline is the price liberalization too, which passed in the year 1991 and during it were 85% prices liberalized.

This development was partly caused by the direct income effects of transition. Income declined until the early mid-1990s, and recovered from 1995. Another part of the decrease of consumption was due to the rising prices of meat.

According to research results the most consumed meat in Slovakia is pork. Beef consumption has in recent period declined in spite of increasing poultry meat demand. A considerable participation of this fact has occurrence of disease BSE in Europe and later in Slovakia and preferences changes.

Estimation outcomes indicate a significant influence of beef meat consumption own beef meat price, pork meat price, income, trend and occurrence of BSE disease. The significant variables that affect pork consumption are own pork meat price and beef meat price. For poultry meat demand significant variables are poultry meat price, beef meat price, income and occurrence of BSE disease.

According to the elasticity estimation results we can state that beef meat demand is price and income inelastic. Pork is substitute to beef which is a normal good. Occurrence of BSE disease significantly impacts the beef consumption during analysed period.

The average household income elasticity coefficients in Slovakia characterized beef and pork demand as income inelastic. Pork as the long term most consumed meat in Slovakia with respect to the coefficient represents the indispensable good. The poultry demand is income elastic and its consumption is continuously increasing.

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