

The Food Market in the Slovak Republic in Context of Nutritional Recommendations

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Abstract: *The aim of the paper is to find out how the selected demand determinants positively influence changes in actual consumption of foods in Slovak republic, i.e. how individual economic determinants, such as price and income, affect the efforts to adhere the principles of healthy diet of Slovak consumers. For the price and income effects quantification Marshall's demand functions were estimated. The higher impact of consumers income, than price, on the demand was revealed by the analyses realization. The estimates of logit model pointed to a highest positive change probability due to change of consumer income and own foods prices by pork (0.98) and beef (0.96).*

Key words: Demand · Food Market · Consumption · Nutritional Recommendations

JEL classification: D03

1 Introduction

The Slovak goods and services market has overcome many changes over the last decades. Changes occurred also in the food market. The consumer foodstuff expenditures increased together with economic growth and its share on total expenditures decreased gradually in the Slovak republic. Consumers started to prefer quality before quantity with the consumers choice growth. This trend is undoubtedly a contribution of “The Quality Food Labeling” project. In this paper the fact to what extent the Slovak consumers were trying to apply the principles of healthy diet and which economic determinants could affect them in this endeavor was considered. Many domestic and foreign scientists are oriented to the food demand development, its determinants and the nutrition valuable foodstuff consumption. Vrtíková (2016) said, food consumption has been recently subject to several changes and this trend is continuing. More significant changes in volume and consumption structure of each food group occurred. The changes of food consumption were caused by many factors. Zhao (2016) considered lifestyle, purchase experience, health consciousness, income level, price and shopping convenience as significant demand determinants. Price, health and income are the major factors.

2 Methods

For selected demand determinants, in line with economic theory and the results of our recent research (Zentková, Hošková, 2010), the food price and the net income of the consumers was considered. For these reasons, we have been dealing with the Marshall's demand functions.

The positive change in the real food consumption in SR means the yearonyear development of actual food consumption towards the recommended consumption. For those foodstuffs whose actual consumption is higher than recommended, we considered consumption reduction as positive change. On the contrary, the positive change in foodstuffs consumption whose actual dose haven't reached the recommended, we understand its increase. The Slovak Republic Public Health Service quantified recommended consumption true the recommended nutritional doses of food (RND). This created the basic precondition of healthy diet. The RND is expressed as annual consumption of an average consumer in kilograms.⁵² For the analyses, foods whose consumption has long been different from RND, milk, card cheese, pork, beef and poultry, sugar, eggs and potatoes have been selected.

Based on available data the analyses were conducted for the period 1998-2016. The Statistical Office of The Slovak Republic and Eurostat were the data source. Before the main analyses, the demand functions estimation for chosen food products were necessary. Those provided the market situation information's.

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⁵²http://www.uvzsr.sk/index.php?option=com_content&view=article&id=1014:odporuane-vyivove-davky-pre-obyvatestvo-vnslovenskej-republike&catid=66:vyiva-a-bezpenos-potravin&Itemid=72

The Marshallian demand for x -th chosen food product is the function of the price of the x -th food product and the net income of consumers.

$$q_{dx} = f(p_x, i) \quad (1)$$

The general linear model

$$y = a + \beta_1 * x_1 + \beta_2 * x_2 \quad (2)$$

The linear model of Marshallian demand has the following form:

$$q_{dx} = a + b_1 * p_x + b_2 * i \quad (3)$$

where:

q_{dx} - demand for the x -th food product in the kilograms and habitants per year
 a, b_i - estimated constant of location and regression coefficients $i = 1, 2$
 p_x - purchase price of the x -th food product in EUR *kg⁻¹
 i - average income of habitants in EUR *year⁻¹

The general power model:

$$y = a \cdot x_1^{\beta_1} \cdot x_2^{\beta_2} \quad (4)$$

The power model of Marshallian demand has the following form:

$$q_{dx} = a \cdot p_x^{b_1} \cdot i^{b_2} \quad (5)$$

where:

ditto (3)

The general exponential model

$$y = a \cdot \beta_1^{x_1} \cdot \beta_2^{x_2} \quad (6)$$

The exponential model of Marshallian demand has the following form:

$$q_{dx} = a \cdot b_1^{p_x} \cdot b_2^i \quad (7)$$

where:

ditto (3)

For the quantification of sensitivity are estimated the price, income elasticities.

$$Epd = \frac{\% \Delta Qdx}{\% \Delta Px}, \quad (8)$$

where:

Epd – price elasticity of demand

$\% \Delta Qdx$ - percentage change in quantity of demand of chosen food product

$\% \Delta Px$ –percentage change in price of chosen food product

$$Eid = \frac{\% \Delta Qdx}{\% \Delta I}, \quad (9)$$

where:

Eid – income elasticity of demand

$\% \Delta Qdx$ - percentage change in demand for chosen food product

$\% \Delta I$ - percentage change in income of consumer

For the impact detection of selected demand determinants on the positive change in actual foodstuffs consumption in Slovak republic the logistic regression model was used.⁵³

General logit

$$\ln \frac{p}{(1-p)} = a + \beta_1 * x_1 + \beta_2 * x_2 \quad (10)$$

⁵³<https://books.google.sk/books?id=n9a86Nb9EZ8C&pg=RA1-PA45&lp=RA1-PA45&dq=logistick%C3%A1+regresia&source=bl&ots=10aoN7znrQ&sig=6NjffhOMRH9zSkDBvKebuco_rG8&hl=sk&sa=X&ved=0ahUKewjq7JKbrc3XAhUHPRoKHdqZByUQ6AEIQzAE#v=onepage&q=logistick%C3%A1%20regresia&f=false>

where:

β_i – parameters

X_i – conditions

ODP logit

$$\ln \frac{p}{(1-p)} = a + b_1 * p_x + b_2 * i \quad (11)$$

where:

a, p_x , i - ditto (3)

b_i -beta estimates

The year on year trend

The quantified changes in observed food consumption towards to RND or away RND were the logistic regression inputs:

- (1) Towards to RND,
- (0) Away from RND.

3 Research results

Milk, cheese card, beef and potatoes are among the foods with insufficient consumption between average Slovak consumers. The maximal consumed volume of above mentioned foods did not meet RND during the observed period (Table 1). For this reason, the average consumed volume is very deep under the recommended. Neither the development of consumption trend was negative. The most significant change in consumption was observed in beef. At the monitored period beginning (1998), the annual beef consumption was 11.8 kg per person (beef consumption decreased by 10kg between 1990 and 1998). At the end of monitored period, the annual beef consumption was 4.9kg per person. The beef consumption decline was caused by confidence loss of Slovak consumers due to numerous HACCP reports. Milk and potatoes consumption declined by 40% in the monitored period. On the one hand, decreasing milk consumption could be caused by reduced adults milk consumption due to increasing lactose intolerance. On the other hand, reduced milk consumption could be caused also by increased fermented milk products and curd consumption.

Pork, sugar, poultry and eggs consumption was higher than RND during the reference period. The minimal consumption readings of eggs and poultry were approaching the RND. However, average sugar and pork consumption were well above RND, their consumption decreased during the period under review. Poultry consumption was slightly fluctuating because of consumers beef and pork substitution.

Table 1 Descriptive Statistics of consumption selected food products in kg* consumer⁻¹*year⁻¹ (1998-2016)

	RND in kg* con ⁻¹ *year ⁻¹	Minimum	Maximum	Mean	Std. Deviation	Variance
Milk	91	44.40	74.40	55.45	9.43	88.95
Cardcheese	3.2	1.90	2.60	2.13	0.21	0.04
Poultry	15	14.10	22.30	18.56	2.26	5.11
Pork	22.2	28.00	36.90	32.26	2.10	4.41
Beef	17.4	3.60	11.80	6.02	2.29	5.24
Eggs	11.2	11.10	15.60	12.44	0.92	0.85
Potatoes	80.6	46.90	75.20	58.23	9.90	98.09
Sugar	22.1	26.60	34.80	30.95	2.45	6.03

Source: authors calculations

3.1 Marshall's demand functions

In order quantify the impact of the food price and the net income of the consumer on the demand of the SR consumers, selected Marshall's demand functions are estimated. Table 2 gives an overview of the individual coefficients estimates, baseline tests and calculated elasticities. Models that described the impact of price and net income on demand best are presented. Statistically significant are Marshall's demand for milk, pork, beef and potatoes. The consumers income has been proven to be a significant determinant of the demand for these foods. Considering the negative correlation of the

regression coefficient in demonstrable models, we can assume that milk, beef and potatoes are considered by Slovak consumers to be inferior. However, the results of our research in 2010 (Zentková, Hošková, 2010) have shown that aggregated food groups behave as superior goods. This indicates that, although demand for, for example liquid milk declines with an increase in intake, demand for an aggregated food group milk and dairy products is growing with increasing intake. According to the quantification of income elasticities, the 1% increase in income has the biggest impact on demand for beef, which reduced by 0.74%, less dramatically by 0.50% reduced demand for milk and potatoes.

The coefficients of price and income elasticities of the reliable models shows that food consumption is more responsive to change in income than to change in price, except for pork. If the pork price increases by one percent, the demanded amount will be reduced by 0.54 percent with the confidence of 99%. The pork demand is non-elastic ($EPD = b_2 = -0.54$).

Table 2 Estimated Marshallian demand of selected food products

Food product	Model	adj.R ²	A	b ₁ (I)	b ₂ (P)	EID	EPD
Milk***	Power	0.9225	3145.1559**	-0.4986**	-0.0256	-0.50	-0.03
Card cheese	Linear	0.2486	1.9118**	0.0002	-0.6150	0.37	-0.27
Poultry	Linear	0.0614	30.1055**	-0.0002	-4.5733	-0.04	-0.58
Pork***	Power	0.5232	421.3156**	-0.2204**	-0.5418**	-0.22	-0.54
Beef***	Power	0.8685	6242.7420**	-0.7405*	-0.5757	-0.74	-0.57
Eggs	Power	0.1783	997.9334**	-0.1698*	0.0793	-0.16	0.08
Potatoes***	Power	0.8764	3353.0950**	-0.5020**	-0.0296	-0.50	-0.03
Sugar	Power	0.0498	21.3166**	0.0442	-0.0981	0.04	-0.10

Source: authors calculations, * $\alpha=0,05$, ** $\alpha=0,01$, *** model suitable to variables relationship description
EPD – price elasticity of demand, EID – income elasticity of demand

3.2 Logit models

The probability of selected foods consumption change towards RND were estimated. Estimated logit models and their parameters significance overview were provided in Table 3. The interpreted facts can be distorted to some extent due to statistically not significant model parameters. According to our analyses, the consumption positive change likelihood is higher for beef ($p = 0.96$, logit = 3.14) and pork ($p = 0.98$, logit = 3.8). If the beef price increases by one Euro per kilogram, the positive consumption change logarithm can be reduced by 0.23. According to estimated Marshall demand function, beef demanded quantity is decreasing with price increase. This is negative in terms of RND. An annual increase in consumer income by one Euro, can cause an increase in the chance logarithm by 0.001. If the pork price increases by one Euro per kilogram, the positive consumption chance logarithm can increase by 0.008. One Euro income increase can reduce the chance logarithm by 0.0001.

Table 3 Estimated logit models of selected food products

Milk($p=0,15$)		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	I	0.001	0.001	1.242	1	0.265	1.001
	Pm	-11.090	9.339	1.410	1	0.235	0.000
	Constant	2.047	3.411	0.360	1	0.548	7.746
Curd cheese($p=0,51$)		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	I	-0.001	0.002	0.471	1	0.492	0.999
	Pcch	9.222	8.507	1.175	1	0.278	10112.748
	Constant	-4.966	3.414	2.115	1	0.146	0.007
Poultry($p=0,17$)		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	I	0.0001	0.001	0.747	1	0.388	1.000
	Pp	4.999	3.685	1.840	1	0.175	148.253
	Constant	-13.786	8.337	2.734	1	0.098	0.000
Pork($p=0,98$)		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	I	-0.001	0.001	1.579	1	0.209	0.999

	Ppr	0.008	2.122	0.000	1	0.997	1.008
	Constant	4.129	11.321	0.133	1	0.715	62.114
Beef(p=0,96)		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	I	0.001	0.002	0.751	1	0.386	1.001
	Pb	-0.234	1.713	0.019	1	0.891	0.791
	Constant	-4.773	5.378	0.788	1	0.375	0.008
Eggs(p=0,35)		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	I	-0.001	0.001	1.336	1	0.248	0.999
	Peg	25.132	27.637	0.827	1	0.363	821693286 88.027
	Constant	-0.033	2.186	0.000	1	0.988	0.967
Potatoes(p=0,10)		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	I	0.0001	0.001	0.015	1	0.901	1.000
	Ppo	5.860	8.203	0.510	1	0.475	350.698
	Constant	-4.584	3.121	2.157	1	0.142	0.010
Suggar(p=0,58)		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	I	0.0001	0.000	0.000	1	0.989	1.000
	Ps	-0.039	3.085	0.000	1	0.990	0.961
	Constant	0.330	2.960	0.012	1	0.911	1.391

Source: authors calculations

4 Discussion and Conclusions

According to estimated Marshall's demand curves, actual food consumption of an average Slovak consumer is greater affected by income change than by food price increase. This points to the Slovak population gradual living standard trend increase. With increasing revenues consumers are less prone to change their decision due to price change and the preferences emphasis is increasing. The pork and beef positive consumption change probability is most influenced by economic determinants.

Stranieri (2017) investigated the determinants behind the purchase of healthy convenience food products. Results confirmed positive relations with consumer food shopping habits, food-related environmental behavior, gender, income and knowledge. Aftab (2017) evaluated the welfare cost resulted from an increase in food prices in the three most populous countries of south Asia the results indicate that cereals (wheat, rice) are relatively price inelastic. However, protein-rich food items like chicken and mutton are relatively more income elastic where consumer welfare declines in all countries mainly for cereals and milk, as these food items are relatively less elastic to price fluctuations.

Hoffer (2017) identified how consumption of 12 goods-alcohol, cigarettes, fast food, items sold at vending machines, purchases of food away from home, cookies, cakes, chips, candy, donuts, bacon, and carbonated soft drinks - varies across the income distribution by calculating their income-expenditure elasticities. - Income had the greatest effect on expenditures for alcohol (0.314), food away from home (0.295), and fast food (0.284). Percentage of a household's discretionary budget spent on the studied goods falls substantially as income gets larger. Policies targeting the consumption of such goods will disproportionately impact lower income households. Weatherspoon (2017) assessed the role income, prices, policy, agricultural production, and market access play on how rural households purchase different food groups. Households in Rwanda are price and expenditure responsive, but prices have more impact on food group purchases. Crop production resulted in reduced household market procurement for its associated food group but had mixed effects on the purchases of all other food groups. The study of Taillie (2017) examines trends in the prevalence of price promotions among packaged food and beverage purchases, differences in prevalence by household income, and the association between price promotions and the nutritional profile of purchases. Higher-income households had greater proportions of purchases with price promotions than lower-income households. While total price-promoted packaged food purchases had higher mean energy, total sugar, and saturated fat densities than purchases with no price promotions, absolute differences were small. No clear associations emerged between presence of price promotions and nutritional quality of purchases.

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