The influence of the Slovak household income differentiation on food expenditures – the Engel's expenditures functions estimation

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Abstract: The economy of the Slovak Republic, as a part of the European economic area, is significantly determined by the world globalization process. One of the aspects, which globalization brings, is the social differentiation deepening between countries as well as across the particular countries. This phenomenon occurs in the Slovak Republic also as a consequence of the increasing households' income differentiation. It is logical to assume that the household's members who live in the different living conditions behave differently in the commodity and service market due to different preferences. The purpose of this article is to quantify the influence of the household income differentiation on their behaviour in the food market. This market is divided into five separated food market groups according to the Healthy Eating Pyramid. The share of the particular food groups' expenditures in the total household food expenditures is used as a representative of the household food purchase preferences. The results of the analysis did not confirm the assumption about the significant influence of the household income differentiation on the purchases of the particular food groups. The estimation of the Engel's expenditure functions and the food expenditures elasticities with respect to the income changes are used for quantification of the impact of the household income differentiation on the particular food groups' expenditures. The food expenditures elasticities referred to the income changes verified differences among the household behaviour in the food market. The food expenditures of the households with a higher income are less elastic regarding the income changes than the food expenditures of the households with a lower income.

Key words: food expenditures, food groups, Engel's expenditure function, household income groups

The world globalization generally brings many positive aspects for the economic development, on one hand, but the economic development is – as a consequence of globalization – significantly regionally differentiated, on the other hand, Hermann (2003). In other words, the increasing economic growth rate of the developed countries deepens the differences in the living standard of their inhabitants (Hermann 2003).

Slovak households also show the features of polarization due to the household income differentiation that influences the food consumption (Krížová 2007).

Based on the above mentioned results, the quantification of the households' income differentiation plays an important role in their behaviour in the food market. Park et al. (1996) analyzed according to household poverty status twelve food commodity groups. Parameter estimates were used to obtain subsistence expenditures, own-price elasticities, expenditure elasticities, and income elasticities. Own-price elasticities were similar between the income groups for most commodities. However, income elasticities were consistently higher for the lower-income group. Worsley et al. (2003) deals with the relationships between an index of per capita income and the intake of a variety of individual foods as well as groups of food for men and women in different age groups in Australia. Their research results expose, that both men and women in low income households had less varied diets than those in higher-income households. Men in the middle-income group had significantly less varied intakes of fish, snacks, and spreads than men in the high-income group. Women in the low-income group had less varied diets than females in the higher-income groups, except for fish and fruit. Syrovátka (2003) examined the impact of the Czech household income differentiation on the food expenditures using the Engel's expenditure functions. His research results confirmed the negative correlation between the level of the household incomes and the level of expenditures spent on such kind of food groups as fish and fish products, fruit and fruit products, fats and oils. The positive correlation between the level of household incomes and the level of expenditures occurred in food groups such as potatoes and vegetables, milk, cheese and eggs, meat and meat products, sugar, cocoa, coffee, tea and other foodstuffs.

The research of Wong et al. (1984) deals with the relationship between household income, expense and consumption of food in Mexico. The results of the research study show a direct relationship between household income level and expense and consumption of the foods. The income-elasticity of the demand of basic foods was lower than that estimated for high-protein foods, and there was a marked tendency to increase consumption of high-protein foods as family income increased.

According to the research results of Hupková and Bielik (2010) 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 an indispensable good. The poultry demand is income elastic and its consumption is continuously increasing.

MATERIAL AND METHODS

The goal of the article is to quantify the influence of the households' income differentiation on their behaviour in the food market. For the analysis, the data of the household food expenditures were used during the years 2000–2008. The food market is divided into five separated food groups markets according to the Healthy Eating Pyramid (Figure 1) and the households are divided into four income groups according to the level of the average net income per 1 household member per year.

All monetary data input used in the analysis are measured in the Slovak currency which was valid till the end of the year 2008. The output of the analysis, measured in monetary units, is conversed to Euro by using the conversion rate (1 € = 30.1260 SKK) set by the ECOFIN 8th July.

For the reason of the inflationary influence elimination, the nominal values of all monetary variables are transformed into the real values by using the following formula:

$$rvi = \frac{nvi}{CPI} \times 100 \qquad (1)$$

where:
rv_m = real value of m-th variable
nv_m = nominal value of m-th variable
CPI = consumer price index (year 2000 = 100%)

The first part of our article deals with the analysis of the particular food expenditures share in the total household food expenditures. There are examined the development trends of the food expenditures distribution into the particular food groups by using the trend regression models.

The general trend function for the share of expenditures on k-th foodstuffs group in the total expenditures of j-th households income group is:

$$se_{kj} = f(t) \qquad k = 1, 2, ..., 5 \quad j = \overline{1,4} \qquad (2)$$

where:
se_{kj} = share of expenditures of k-th foodstuffs group in the total expenditures of j-th households income group in percentage
t = order of year in time series, $t = 1, 2, ..., 9$

– *Empirical linear* trend regression equation for the share of expenditures of k-th food group in the total expenditures of j-th households income group is:

$$se_{kj} = a + b \times t \qquad (3)$$

where:
se_{kj}, t = ditto (2)
a = estimation of intercept
b = regression coefficient

– *Empirical power* trend regression equation for the share of expenditures of k-th foodstuffs group in the total expenditures of j-th households income group is:

$$se_{kj} = a \times tb \qquad (4)$$

where:
se_{kj}, t = ditto (2)
a, b = ditto (3)

– *Empirical exponential* trend regression equation for the share of expenditures of k-th foodstuffs group in the total expenditures of j-th households income group is:

$$se_{kj} = a \times b^t \qquad (5)$$

where:
se_{kj}, t = ditto (2)
a, b = ditto (3)

– *Empirical second degree polynom* trend regression equation for the share of expenditures of k-th foodstuffs group in the total expenditures of j-th household's income group is:

$$se_{kj} = a + b_1 \times t + b_2 \times t^2 \qquad (6)$$

where:
se_{kj}, t = ditto (2)
a = ditto (3)
b_1, b_2 = regression coefficients

The second part of the article deals with the quantification of the impact of the average real households' income on the particular foodstuffs group expenditures by using the regression analysis for the estimation of the Engel's expenditure functions and computing of income elasticities of the food expenditures.

The general Engel's expenditure function for the share of expenditures of k-th foodstuffs group in the

total expenditures of j-th household's income group is formed as follows:

$$re_{kj} = e_{kj}(ri_j) \quad k = 1, 2,..., 5 \quad j = \overline{1.4} \quad (7)$$

where:

re_{kj} = average real expenditures on k-th foodstuffs group in total expenditures of j-th households income group in SKK per year

$e_{kj}(ri_j)$ = Engel's expenditure function for k-th foodstuffs group in j-th households income group

ri_j = average real income in j-th households income group in SKK per 1 household member per year

– *Empirical linear* regression equation of the Engel's expenditure function for k-th foodstuffs group in j-th households income group is:

$$re_{kj} = a + b \times ri_j \quad (8)$$

where:

re_{kj}, ri_j = ditto (7)
a = estimation of intercept
b = regression coefficient

The elasticity of expenditures on k-th foodstuffs group in j-th household's income group if the household's income changes derived from the linear Engel's expenditure function is calculated as formula as follows:

$$E_{IEkj} = \Delta r_{ij} \xrightarrow{\text{lim}} 0\left[e_{kj}(ri_j + \Delta ri_j) - e_{kj}(ri_j)\right]/\Delta ri_j \times$$

$$\times \frac{ri_j}{re_{kj}} = \frac{dre_{kj}}{dri_j} \times \frac{ri_j}{re_{kj}} = b \times \frac{ri_j}{re_{kj}} \quad (9)$$

where:

E_{IEkj} = elasticity of the expenditures on k-th foodstuffs group in j-th households income group if the households income changes

b = ditto (7)

$$ri_j = \frac{\sum_{i=1}^{n} ri_{ij}}{n} \qquad re_{kj} = \frac{\sum_{i=1}^{n} re_{ikj}}{n} \qquad n = 8 \quad (10)$$

where:

ri_{ij} = ditto (7) re_{kj}

re_{ikj} = average real expenditures on k-th foodstuffs group in j-th households income group in i-th year in SKK

– *Empirical power* regression equation of the Engel's expenditure function for k-th foodstuffs group in j-th household's income group is:

$$re_{kj} = a \times ri_j^b \quad (11)$$

Linear logarithmic transformation of the power function is:

$$\ln re_{jk} = \ln a + b \times \ln ri_j \quad (12)$$

where:

re_{kj}, ri_j = ditto (7)

a, b = ditto (8)

The elasticity of expenditures on k-th foodstuffs group in j-th households' income group if the households' income changes derived from the power Engel's expenditure function is calculated as formula as follows:

$$E_{IEkj} = \frac{dre_{kj}}{dri_j} \times \frac{ri_j}{re_{kj}} = \frac{b \times a \times ri_j^b}{ri_j} \times \frac{ri_j}{a \times ri_j^b} = b \quad (13)$$

resp.

$$E_{IEkj} = \frac{d\ln re_{kj}}{d\ln ri_j} = b \quad (14)$$

where:

E_{IEkj} = ditto (9)
b = ditto (8)

– *Empirical exponential* regression equation of the Engel's expenditure function for k-th foodstuffs group in j-th households' income group is:

$$re_{kj} = a \times b^{r_{ij}} \quad (15)$$

Linear logarithmic transformation of the exponential function is:

$$\ln re_{jk} = \ln a + \ln b \times ri_j \quad (16)$$

where:

re_{kj}, ri_j = ditto (7)
a, b = ditto (8)

Elasticity of expenditures on k-th foodstuffs group in j-th households' income group if the households' income changes derived from the exponential Engel's expenditure function is calculated as formula as follows:

$$E_{IEkj} = \frac{dre_{kj}}{dri_j} \times \frac{ri_j}{re_{kj}} = (a \times b^{r_{ij}} \times \ln b) \times \frac{ri_j}{a \times b^{r_{ij}}} = \ln b \times ri_j \quad (17)$$

resp.

$$E_{IEkj} = \frac{d\ln re_{kj}}{dri_j} \times ri_j = \ln b \times ri_j \quad (18)$$

where:

E_{IEkj}, ri_j = ditto (9)
b = ditto (8)

RESULTS

Characteristics of the Slovak household income groups

Table 1 presents the average level of the net nominal and real income per 1 household member, the nominal and real food expenditures and the share of food expenditures in the total household expenditures in the particular household income groups. Households with the lowest average net income per 1 household

Table 1. Specification of the household income groups

| Indicator | Income group | | | | | | | |
| | 1st | | 2nd | | 3rd | | 4th | |
	€	08/00	€	08/00	€	08/00	€	08/00
Net nominal income*	2 640.98	2.23	3 728.07	2.33	4 632.69	2.31	7 249.72	2.47
Net real income*	2 147.14	1.81	3 030.95	1.89	3 766.41	1.88	5 894.08	2.00
Nominal food expenditures*	667.16	1.69	853.34	1.78	929.05	1.60	1 073.84	1.58
Real food expenditures*	542.41	1.38	693.77	1.45	755.32	1.30	873.04	1.28
Share of food expenditures**	27.27		24.52	0.94	21.94	0.85	16.99	0.85

*€ per capita and year, **in total households' expenditures in %

Source: Statistical Office of the SR, authors' calculations

member belong to the 1st income group; households with the highest average net income per 1 household member belong to the 4th income group.

The households with the highest income (4th income group) earn almost 3-times more in comparison with the household group of the lowest income (1st income group) and the growth rate of their net nominal income 2.47 (2008/2000) is the highest from all income groups. On the other hand, the growth rate of the net nominal income in the 1st household income group is the lowest one – 2.23.

The growth rate of the net average real income per one household member that shows real purchase power of population performs similarly. The growth rate of average net real income per 1 household member, which reflects the real change in the purchasing power of the population, is placed in the highest 4th income group. In 2008 compared with 2000, the net real income per 1 household member was increased in this income group by 200%. On the contrary, in the lower income households (1st income group), the

growth rate of the net real income was the lowest of all income groups (index 1.81) in 2008 in comparison with 2000. These facts cause the deepening of the social differences between the particular incomes groups of households which can lead to the different behaviour of the households from the marginal income groups (1st and 4th income group) in the commodity and service markets.

The level of nominal food expenditures confirms it. The households from the 1st income group spent 667.16 € on food in 2008, which represents 27.27% of their total household expenditures. The expenditures of the 4th income group were higher by 61% in 2008 than the ones of the 1st income group. The share of food expenditures of these households in 4th income group is lower than in the 1st group by 10.28%. The share of food expenditures in the total household expenditures decreases with the increased income (Zentková and Hošková 2009). These facts demonstrate the Engel's expenditure function which claims that with the growth of prosperity (measured by the real income), the share

Fat, oil and sweets
2%

Milk and milk products
12.5%

Meat, meat production, eggs and fish
12.5%

Fruits and vegetable
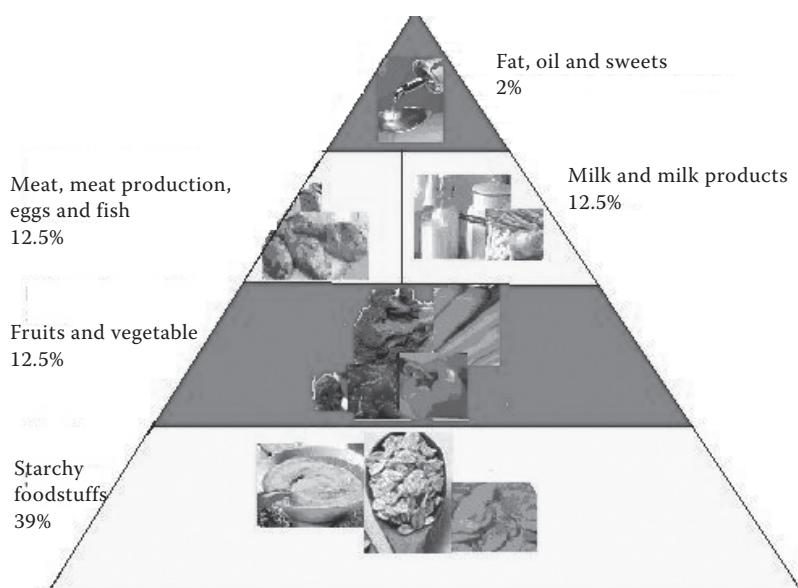12.5%

Starchy foodstuffs
39%

Figure 1. Healthy Eating Pyramid (recommended food basket structure in percentage)

Source: authors' calculations based on food intake recommendations using the data of www.lifeclinic.com, www.nal. usda.gov

of food expenditures in the total household expenditures drops. This tendency is spread all over the world (Zentková and Hošková 2008). A similar situation also exists in the Czech Republic, where according to Melicharová (2006) in the case of the shortage of finance, the expenditures on food are reduced most frequently in the households of the lower income groups.

Food groups

In order to define the household behaviour in the food market, this market is divided into 5 partial markets, taking into account the division of foodstuffs according to the Healthy Eating Pyramid (Figure 1).

The influence of income differentiation of Slovak households on share of foodstuffs expenditures out of the foodstuffs total expenditures

The household behaviour in the food market is being analysed by the share of the household expenditures on the particular food groups in the total expenditures on food. The expenditure share of the individual income groups on some kinds of food in 2008 is demonstrated in Figure 2.

The biggest share of the total expenditures on foodstuffs in the households of all income groups is represented by the expenditures on meat, meat products, eggs and fish (Figure 2). This is caused by the relatively high prices of the group of meat, meat products, eggs and fish in comparison with the other groups of foodstuffs. In all income groups, except for the 1st – the lowest income group of households – the expenditures on meat, meat products, eggs and fish represented 33% of the total household expenditures

on food in 2008. The share of the household expenditures in the 1st income group for the purchase of the given group was only by 1% lower. The influence of the income differentiation of the Slovak households on the share of expenditures on meat, meat products, eggs and fish is not substantial. In the period 2000–2008, the share of expenditures on this food group had the growing tendency in the 2nd, 3rd and 4th income groups (Table 2). Taking into consideration that in the observed period, no considerable changes in the development occurred, the most suitable function was the slightly increasing concave function for the equalization of the tendency of development. Based on the these results, we do not assume any considerable differences in the shares of the household expenditures on meat, meat products, eggs and fish out of the total household expenditures on foodstuffs in the future. In the 1st income group of households, the share of expenditures on this food group had an increasing tendency in the period 2000–2008.

A considerable share in the total foodstuffs expenditures of the households of all income groups was represented by the starchy foodstuffs (Figure 2). As the prices of this kind of food group are quite low, 20–24% share of the total foodstuffs expenditures is created unambiguously by the high consumption of the starchy foodstuffs. With the growing income, the expenditure share on this group declines in the total household expenditures on food. The difference between the shares of expenditures on the starchy foodstuffs in the total household expenditures represents 4% between the extreme households (those with the highest and lowest incomes). In this way, the starchy foodstuffs are becoming the group of foodstuffs where there is the most distinguishable influence of the income differentiation of the Slovak households in the household preferences. The tendency of the expenditure shares on the starchy foodstuffs in the total household ex-
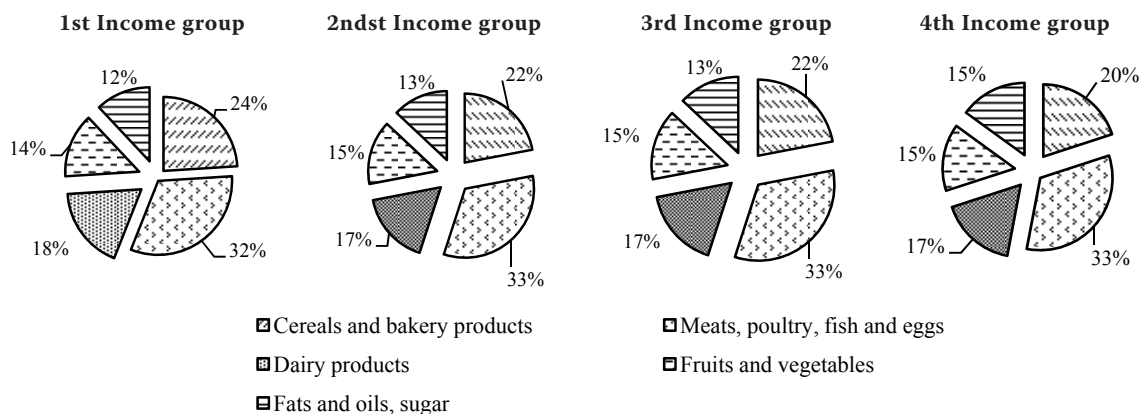

Figure 2. Share of the food groups expenditures in the total food expenditures (SLOVAKIA 2008)

Source: Statistical Office of the SR, authors' calculations

Table 2. Trend of the particular food groups expenditures share in the total food expenditures

Food group	Income group				
	trend	R^2		trend	R^2
	1st			2nd	
Cereals	$y_t = 0.06t^2 - 0.72t + 25.81$	0.23		$0.03t^2 - 0.35t + 22.43$	0.17
Fruits and vegetables	$0.10t^2 - 0.67t + 10.24$	0.54		$0.14\,t^2 - 1.19t + 12.07$	0.76
Milk and milk products	$0.03t^2 - 0.54t + 19.68$	0.38		$18.87 - 0.21t$	0.55
Meat, fish, eggs	$30.08t^{0.045}$	0.48		$-0.08t^2 + 0.84t + 32.64$	0.36
Oils, seeds, sugar	$-0.06t^2 + 0.29t + 16.24$	0.73		$-0.10t^2 + 0.93t + 13.94$	0.56
	3rd			4th	
Cereals	$19.94 + 0.13t$	0.29		$0.02t^2 - 0.06t + 19.12$	0.46
Fruits and vegetables	$0.17t^2 - 1.48t + 13.59$	0.72		$0.13t^2 - 0.99t + 13.82$	0.79
Milk and milk products	$18.079e^{-0.0073t}$	0.29		$-0.03t^2 + 0.16t + 17.34$	0.46
Meat, fish, eggs	$-0.06t^2 + 0.46t + 34.35$	0.54		$-0.06t^2 + 0.34t + 35.33$	0.70
Oils, seeds, sugar	$-0.12t^2 + 1.17t + 13.77$	0.65		$0.13t^2 - 0.99t + 13.82$	0.79

Source: authors' calculations

penditures on food in all income groups in the period 2000–2008 is the most suitably described by the slightly increasing convex function which does not assume any considerable changes in the development in the share of the expenditures on them (Table 2).

The expenditures on milk and dairy products have 17–18% share in the total households' expenditures on food. The income differentiation of households (Figure 2) does not influence considerably the change in preferences of the households to buy this food group. The reason is that the share of expenditures in the 2nd, 3rd and 4th income household groups on this food group represents 17%, and in the households of the 1st group, it is only by 1% higher. The share on milk and dairy products in the total household expenditures had a fluctuating trend in the examined period. In 2001–2002, the share increased, and in 2003–2004 it declined. Since then, the tendency has been balanced and we expect the same trend also in the future. The tendency of the development of the share of the expenditures on milk and dairy products in the total food expenditures in

all household income groups is the best described by the downward sloping function (Table 2).

It is clear from the Figure 2 that the group of the fats, oils and sugar has a relatively high share in the expenditures of all Slovak household income groups. The food group of the fats, oils and sugar also does not belong to the groups on which the income differentiation could have a striking influence. The share of households' expenditures of the 2nd, 3rd and 4th income groups on the fats, oils and sugar in the total households' food expenditures was 15% in 2008. The households of the 1st income group spent on the fats, oils and sugar 1% less than the other income groups in 2008. Based on the estimation of the falling concave functions, which reflect the trend of development in 2000–2008 (Table 2), we assume the gradual decrease of the expenditure shares of the fats, oils and sugar in the total food expenditures in all income groups of households.

The share of expenditures on the group of fruit and vegetables in the total food expenditures has a rising

Table 3. Particular foods groups expenditures share in the total household food expenditures in percentage (USA 2008)

Income group	1st	2nd	3rd	4th
Cereals and bakery products	19	18	19	19
Fruits and vegetables	24	25	25	25
Dairy products	16	15	16	17
Meat, poultry, fish, and eggs	32	33	31	30
Fats and oils, sugar	9	9	9	9

Source: Bureau Labour Statistic, USA, authors' calculations

Table 4. Estimation of the Engel's expenditures equations for cereals and bakery products

	Engel's expenditures function	(E_{ie})
1st income group	$re_{11} = 1721.59 \times 1.00001^{ri1}$	(0.53)
2nd income group	$re_{12} = 1831.15 \times 1.000008^{ri2}$	(0.61)
3rd income group	$re_{13} = 2128.83 \times 1.000006^{ri3}$	(0.53)
4th income group	$re_{14} = 2449.34 \times 1.000003^{ri4}$	(0.46)

Source: Statistical Office of the SR, authors' calculations

tendency corresponding with the households' incomes (Figure 2). The difference between the highest and lowest income groups is 3%, which demonstrates the interconnection between the share of the expenditures on fruit and vegetables and the household income differentiation. The trend of the share development of the expenditures on fruit and vegetables in the total households' expenditures in the 1st–4th income groups on food in 2000–2008 is best expressed by the upward sloping convex function, the slope of which is bigger than in other food groups (Table 2). We can predict a more considerable increase of the expenditures share in this food group.

The analysis of the particular income households groups in the Slovak Republic on the foodstuffs groups shows that, despite the considerable household income differentiation, the preferences of households in the food purchases are very similar. In the value relation, the household expenditures on the particular food groups differ considerably among the income groups. The share of the particular food in the total house expenditures is mostly identical in all income groups. A similar situation exists in the developed countries. We can use the example of the comparison of the share of expenditures on the particular food groups in the total household food expenditures in the USA (Table 3).

Similarly, neither the share of expenditures on the particular food groups of the Slovak households nor the share of expenditures on the particular foods in American households shows any considerable fluctuations related to the household income differentiation. The most substantial difference in the expenditure share influenced by the different income level of households is showed in Table 3 for the group of meat, meat products, eggs and fish, and milk and

dairy products. While in the Slovak Republic, a continual development exists in the expenditure share on these two groups among the individual income groups (Figure 2), in the American households, the fluctuating tendencies are obvious. A surprising fact is that there is not a different reaction in the 1st income group, but in the 2nd one.

Quantification of the household income influence on the food expenditures

For the quantification of the Slovak household income influence on the particular food expenditures, the Engel's expenditure functions are estimated by the regression analysis in the division according to the food groups and income household groups.

Foodstuffs group: Cereals and bakery products

In Table 4, the Engel's expenditure functions give the estimations for the group of starchy foodstuffs. Table 5 given the basic tests of model.

The influence of income on the starchy foodstuffs is considerable according to the Engel's expenditure functions. The biggest influence of the household income on the starchy foodstuffs is in the 2nd income group. The change of the real income on one household member explains almost 80% of the changes in the real expenditures on the starchy foodstuffs in this income group (Table 5).

Along with the change of the real income per 1 household member, the expenditures of all households on this foodstuffs group are being changed at the 1 percent level of significance.

It is obvious from the calculated elasticity of expenditures (E_{ie}, Table 4) that the household expenditures on

Table 5. Tests of Engel's expenditures equations estimation – cereals and bakery products

Income group		1st	2nd	3rd	4th
Adjusted R-squared		0.7032	0.7999	0.7252	0.7563
F-statistics		0.0029	0.0007	0.0022	0.0014
P-value	$b\ (ri)$	0.0029	0.0007	0.0022	0.0014
The most fitted regression model		exponential	exponential	exponential	exponential

Source: authors' calculations based on the Statistical Office of the SR data

Table 6. Estimation of the Engel's expenditures equations for fruits and vegetables

	Engel's expenditures function	(E_{ie})
1st income group	$re_{21} = 473.41 \times 1.00002^{ri1}$	(0.94)
2nd income group	$re_{22} = 706.59 \times 1.00001^{ri2}$	(0.85)
3rd income group	$re_{23} = 747.94 + 0.01 \times ri3$	(0.63)
4th income group	$re_{24} = 1194.98 \times 1.000003^{ri4}$	(0.51)

Source: Statistical Office of the SR, authors' calculations

Table 7. Tests of Engel's expenditures equations estimation – fruits and vegetables

Income group		1st	2nd	3rd	4th
Adjusted R-squared		0.5054	0.6729	0.4870	0.4862
F-statistics		0.0191	0.0041	0.0220	0.0221
P-value	b (ri)	0.0191	0.0041	0.0220	0.0221
The most fitted regression model		exponential	exponential	linear	exponential

Source: authors' calculations based on the Statistical Office of the SR data

the starchy food of the 2nd income group are changed the most considerably in comparison with the changes of household expenditures in other income groups. If the real income per 1 household member in the 2nd income group increases by 10%, then the household expenditures on the starchy food rise by 6.1%. The lowest growth of the expenditures on the starchy food with the rise of the real income per 1 household member is according to the expenditure elasticity in the Table 4 in the households of the 4th income group ($E_{ie} = 0.46$). A very low difference in the value of the coefficient of the income expenditure elasticity between the individual income groups proves a very low influence of the household income differentiation on the reaction of the household expenditures on the starchy foodstuffs to the income change.

Foodstuffs group: Fruits and vegetables

The estimations of the Engel's expenditure functions of the group of fruit and vegetables are presented in the Table 6, the tests of models in the Table 7.

The change of the real income per 1 household member explains the most significant change in the expenditures on fruits and vegetables in the 2nd income household group. According to the adjusted determination index in the Table 7, the change of the real income per 1 household member explains 67.29% of the changes of expenditures on fruit and vegetables in the 2nd income group. Along with the change of the real income per 1 household member, the expenditures on fruits and vegetables are being changed at the 1 percent level of significance.

The income elasticity coefficient of the expenditures in households of the 4th income group significantly differs comparing to the income elasticity coefficient of the expenditures in the 1st income group. While the households of the 1st income group react to 10% growth of the real income by 9.4% growth, the households of the 4th income group only by 5.1% growth of expenditures on fruits and vegetables. This fact shows a considerable influence on the income differentiation of the Slovak households on the reaction to the expenditures on fruits and vegetables to the income change. The high value of the expenditures-income elasticity coefficient on the fruit and vegetables in the 1st income group means the tendency to perceive the group of fruit and vegetables as more luxury in

Table 8. Estimation of the Engel's expenditures equations for milk and dairy products

	Engel's expenditures function	(E_{ie})
1st income group	$re_{31} = 1161.72 + 0.02 \times ri_1$	(0.47)
2nd income group	$re_{32} = 12.56 \times ri_2^{0.48}$	(0.48)
3rd income group	$re_{33} = 28.90 \times ri_3^{0.41}$	(0.41)
4th income group	$re_{34} = 2436.09 \times 1.000002^{ri4}$	(0.35)

Source: Statistical Office of the SR, authors' calculations

Table 9. Tests of Engel's expenditures equations estimation – milk and dairy products

Income group		1st	2nd	3rd	4th
Adjusted R-squared		0.8322	0.8860	0.8950	0.7786
F-statistics		0.00037	0.00009	0.00007	0.00101
P-value	b (ri)	0.00037	0.00009	0.00007	0.00101
The most fitted regression model		linear	power	power	exponential

Source: authors' calculations based on the Statistical Office of the SR data

comparison with the other foodstuffs groups. If the real income per 1 household member in the 1st income group decreases, then the expenditures on fruits and vegetables will be reduced first.

Foodstuffs group: Milk and dairy products

The estimation of the Engel's expenditure functions of milk and dairy products are shown in the Table 8, the appropriateness tests of models in the Table 9.

With the change of the real income per 1 household member, the expenditures on milk and dairy products are changed at the 1 percent level of significance. The adjusted determination index is the highest in the Engel's expenditure function of the group of milk and dairy products in the 3rd income household group. The change of the real income per 1 household member explains 89.5% of the changes in expenditures of the 3rd income group.

The expenditures-income elasticity coefficients of the expenditures achieve higher values in the households from the lower income groups (1st and 2nd income groups). If a real income per 1 member of the household from the 2nd income group increases by 10%, the expenditures on milk and dairy products rise by 4.8%. The households of the 4th income group

increase the expenditures on this group of foodstuffs with 10% growth of the real income per 1 household member by 3.5%.

The value of the coefficients of the expenditures-income elasticity on milk and dairy products varies between the particular household income groups. The ranking of households into the particular income groups influences the reaction of the expenditures on milk and dairy products to the change of income in a very low rate.

The coefficients of income elasticity of expenditures on milk and dairy products of the households in the 4th income group are the lowest in comparison with the elasticities calculated in other food groups. If the real income per 1 member of the household in this income group decreases, it reduces the expenditures on milk and dairy products the least. The given facts put the group of milk and dairy products for the households of the 4th income group into the position of the basic foodstuffs group with the relatively stable expenditures.

Foodstuffs group: Meat, fish, eggs

The estimation of the Engel's expenditure functions for the group of meat, meat products, eggs and fish

Table 10. Estimation of the Engel's expenditures equations for meat, fish, eggs

	Engel's expenditures function	(E_{ie})
1st income group	$re_{41} = 1.95 \times ri_1^{0.70}$	(0.70)
2nd income group	$re_{42} = 6.27 \times ri_2^{0.60}$	(0.60)
3rd income group	$re_{43} = 3822.06 \times 1.000005^{ri3}$	(0.47)
4th income group	$re_{44} = 4887.45 \times 1.000002^{ri4}$	(0.36)

Source: Statistical Office of the SR, authors' calculations

Table 11. Tests of Engel's expenditures equations estimation – meat, fish, eggs

Income group		1st	2nd	3rd	4th
Adjusted R-squared		0.7520	0.7683	0.7472	0.7222
F-statistics		0.0015	0.0012	0.0016	0.0023
P-value	b (ri)	0.0015	0.0012	0.0016	0.0023
The most fitted regression model		power	power	exponential	exponential

Source: authors' calculations based on the Statistical Office of the SR data

Table 12. Estimation of the Engel's expenditures equations for fats, oils, sugar

	Engel's expenditures function	(E_{ie})
1st income group	$re_{51} = 8.75 \times ri_1^{0.50}$	(0.50)
2nd income group	$re_{52} = 0.52 \times ri_2^{0.48}$	(0.48)
3rd income group	$re_{53} = 2.76 \times ri_3^{0.61}$	(0.61)
4th income group	$re_{54} = 1843.75 \times 1.000004^{ri4}$	(0.59)

Source: Statistical Office of the SR, authors' calculations

is given in the Table 10, the tests of models in the Table 11.

The adjusted determination index is the highest in the households of the 2nd income group. The change of the real income per 1 member of the household explains 76.83% of the changes of expenditures in this income group on meat, meat products, eggs and fish. The estimation of the regression coefficient is different from zero at the 1 percent level of significance in each particular model.

The coefficient of income elasticity of the expenditures on meat, meat products, eggs and fish decreases considerably with the income increase (similarly as in the group of fruits and vegetables).While the households of the 1st income group with the increase of the real income per 1 household member by 10% increase their expenditures on this food group by 7%, the households from the 4th income group with the same pace of the income growth increase their expenditures on meat, meat products, eggs and fish by 3.6%. The difference between the income elasticity coefficients of expenditures of 0.36 proves a considerable influence of the income differentiation of the households in the reaction of this food group to the change of the real income.

Foodstuffs group: Fats, oils, sugar

The estimation of the Engel's expenditure functions for the group of oils, fats and sugar given in the Table 12, the appropriateness tests of models in the Table 13.

The changes in the expenditures on the group of oils, fats and sugar are explained by the changes in the real income per 1 member of the household in

the highest level in the 4th income group. The adjusted determination index of the estimated Engel's expenditure function in this income group is 0.7616. The estimation of the regression coefficient is different from zero at the 1 percent level of significance.

The higher income households react more considerably to the change of the real income per 1 member of the household by 10%. The households of the 3rd income group increase their expenditures on oils, fats and sugar by 6.1%. With the same growth rate of the real income per 1 member of the household in the 4th income group, the expenditures increase by 5.9%. The difference between the extreme values of coefficients of the income elasticity of expenditures among the individual income groups is 0.13, which shows a very low influence of the income differentiation of households ton the reaction of the expenditures on oils, fats and sugar to the income change.

CONCLUSIONS

The purpose of this article was to give the quantification of the influence of the households' income on their behaviour in the food market. The households' behaviour in the food market is being analysed through their food expenditures, therefore, the first part of the article is devoted to the analysis of the Slovak households' expenditures on food. The household income differentiation is taken into consideration via the division of the households into four income groups according to the level of their annual net income per 1 member of the household. The food market is divided into five partial markets

Table 13. Tests of Engel's expenditures equations estimation – fats, oils, sugar

Income group		1st	2nd	3rd	4th
Adjusted *R*-squared		0.6158	0.7308	0.6246	0.7616
F-statistics		0.0075	0.0020	0.0069	0.0013
P-value	b (*ri*)	0.0075	0.0020	0.0069	0.0013
The most fitted regression model		power	power	power	exponential

Source: authors' calculations based on the Statistical Office of the SR data

taking into account the Healthy Eating Pyramid. The tendency of the development of the household expenditures share on the particular food groups in the total household food expenditures quantified by the regression analysis in the division according to the household income groups.

In the first part of the article, we analysed the households' preferences through the expenditure share on the particular foodstuffs groups in the total food expenditures. The analysis results proved that the ranking of the households into the particular income groups does not influence considerably the changes of preferences towards the purchase of the particular food groups. A similar phenomenon is typical also in the developed countries.

In the second part of the article, the influence of the income differentiation of the Slovak households on the foodstuffs expenditure is quantified by the estimation of the Engel's expenditure functions through the regression analysis. The analysis results showed that the different level of the household income influences the sensitivity of the expenditure reaction of the particular foodstuffs groups on the households' income, measured via the income elasticities of the household expenditures. The most significant differences in elasticity among the particular household income groups were recorded in the groups of fruits and vegetables, meat and meat products, eggs and fish.

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