

Consumption of food in relation to income and saturation limit of Slovak households

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Abstract: Food represents everyday need and from this point of view is stable and computable demand on the consumer market. Based on the current development of households' net money income and consumption expenditures, the aim of the paper is to point at the development of food consumption and changes in the cost of living of the population in Slovakia. Previous food consumption analyses proved that eating habits of the Slovak population comply neither with healthy lifestyle nor recommended doses, due to the low level of disposable net money income. In the analysis, linear and nonlinear functions were used in order to evaluate the development and saturation of demand for basic foods in Slovakia in the period 2008–2017. During these years, the share of expenditures on food and non-alcoholic beverages did not significantly change the consumption expenditures; they moved in intervals from 19.2% (2017) to 23.1% (2013), which is still a high share in comparison with EU countries (12.2%). The analysis provided in the paper is a suitable base for food businesses to create a product portfolio based on different net money income and saturation demand for basic foods.

Keywords: expenditures; income saturation of demand; standard of living; Törnquist's function

Nowadays, it is necessary to pay attention to two general questions worldwide – to the problem of consumption in the national economy, and to the specific situation in the tremendous sector of this economy which is providing the population with food (Hrubý 2002). A theoretical model of modern food consumption is built on the assumption that utility from different food groups is accumulated over time in Slovakia (Horská and Sparke 2007). However, individual satisfaction in food consumption depends more on the social and institutional context (Cecchini et al. 2018).

Generally, the economic welfare of the population grows when GDP is growing as well (Zentková and Hošková 2011). Statistical analysis of the standard of living of the population is based on monitoring of income and expenditures, the structure of household

expenditures also showing features of polarisation due to the household income differentiation that influences food consumption (Zentková and Hošková 2011).

Mihina et al. (2018) pointed out that research of household expenditures and consumption is important and consumption may be considered as the ultimate purpose of economic behaviour, thus playing a major role in the economic theory of households.

Nagyová et al. (2016a) noted that the main factor influencing the structure as well as the growth of consumption in Slovakia is the net money income of private households. Disposable net money income and prices are factors that shape the demand for food and other goods. Food is important part of everyday life. However, the importance of the food industry in general decreases (Naglova et al. 2017).

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Hron et al. (2008) stressed that the problem of food consumption is connected to a decrease in the prices of agro commodities. The purchasing power of many households does not allow for full satisfaction of demand for food. In recent years, the economic inequality of the population has increased, and the sphere of poverty has spread in Slovakia, generating malnutrition in parts of the population (Kubicová and Kádeková 2011).

The issue of nutrition and food market has been given a great deal of attention both in the sphere of production, marketing, and at the level of scientific research activity. Numerous studies (Džupina and Cifranič 2013; Polakevičová 2015; Berčík et al. 2016; Nagyová et al. 2016b; Makutenas et. al 2018) indicate that nutrition and total food consumption in Slovak households still do not correspond to a healthy lifestyle.

According to Lesáková (2011), one important feature is the price level. By means of which, the offer of goods is divided into different categories to allow the buyer to choose from different items in a product category.

Food and non-alcoholic expenditures have a special status in the final consumption of households. With rising income, the marginal propensity in food expenditures is declining until it reaches a point where energy consumption does not depend on income anymore. The food consumption does not increase anymore and may also decrease due to changes in objective consumption conditions.

MATERIAL AND METHODS

Statistical Office of the Slovak Republic stated the structure of private households by the economical status of head of households at work (SO SR 2018). In the submitted paper, the households of employees, self-employed and retirees are taken into consideration. In the paper, regression and correlation analysis, as well as basic and chain indices, were used in order to process the numerical material taken from the website of the Statistical Office of the Slovak Republic (net money income, consumption expenditures and food and non-alcoholic beverages consumption of private households in the Slovak Republic) for the period of 2008–2017. Changes in the development of the monitored indicators (k_1, k_2, \dots, k_i) for the whole monitored period (T) were characterised by the average growth factor \bar{k} (Equation 1):

$$\bar{k} = T - 1 \sqrt[k_1 \cdot k_2 \dots k_i] \quad (1)$$

The income elasticity of demand and the boundary saturation of consumer demand for foodstuffs were analysed via the linear regression function, the logarithmic-hyperbolic function and the Törnquist's function for consumer goods, existentially necessary and Engel curves. In these studies, two sets of models can be distinguished, depending on the characterisation of the phase of consumption or expenditures.

The first set of models is used to describe consumption trends or expenditures for those needs that are in the phase of rapid increase-decrease (linear, parabolic). The elaborated models of the second set reflect the state of saturation of goods consumption, or expenditures for goods and services, while the pace of growth is becoming more moderate and it is possible to set the limit of saturation of consumption and expenditures for these goods. In these cases, the function with an asymptote could be used.

Törnquist formulates three different consumption functions to quantify the relationship between consumption expenditures and income of the population. The differentiation is based on whether the consumer goods in question are necessary and essential goods, less necessary goods, or exclusive and luxury goods. The advantage of Törnquist's consumption functions is in their differentiation according to the relation of individual consumer goods to the needs of the people (Sznajder and Adamczyk 2003).

The most commonly used Engel curves (Varian 2010) are the following (Equations 2–5):

– Linear expenditures function (Equation 2)

$$y = b_0 + b_1 x \quad (2)$$

where: y – dependent variable (expenditures); x – independent variable (income); b_0 – locating constant; b_1 – regression coefficient.

– Working's logarithmic – hyperbolic expenditures function

$$y = \exp\left(b_0 + b_1 \frac{1}{x}\right) \quad (3)$$

– Elasticity of demand

$$e = \frac{b_1}{x} \quad (4)$$

– Boundary of saturation

$$y_{\max} = e^{b_0} \quad (5)$$

Törnquist's expense function for goods of primary, essential consumption that are necessary for living,

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where has to be set the consumption at each level of net money income (Equations 6–7):

$$y = \frac{b_0 x}{x + b_1}, \quad (6)$$

– Income elasticity

$$e = \frac{b_1}{x + b_1}, \text{ saturation point } y = \max \quad (7)$$

Since regression functions are not linear in their parameters, in order to estimate regression coefficients using the least squares method, an approximation to a linear shape was performed. The statistical proof of the regression parameters and the suitability of the selected regression model were verified by using the coefficient of determination R^2 and Snedecor's F -distribution. The results are based on our own calculations. The data of SO SR (2018) was used for the processing.

RESULTS AND DISCUSSION

Development of net money income and consumption expenditures

Over the period under consideration, net money income and final household consumption were driven by GDP growth and by the development of the goods and services prices (SO SR 2018).

After 2010, the dynamics of economic growth accelerated and the impact on the formation of pension ability compared to the previous period was more pronounced. In the period under consideration, the average annual growth of net money income was 3.59% ($k' = 1.0359$), the highest being in 2017–2016 when the year-on-year increase in net money income exceeded 3.3% (Table 1). The level of net money expenditures and its structure is directly affected by the available

resources of households (income, existence of liquidity limitation – availability of loans).

Household consumption expenditures represent the major part of aggregate expenditures. Depending largely on GDP, despite the significant fluctuations in GDP, fluctuations in consumer spending are generally more modest than GDP changes (SO SR 2018).

This trend was reflected in the development of consumption expenditures, which declined year-on-year in 2009 and 2014 and increased by 1.59% on annual average growth over the reference period 2008–2017 ($k' = 1.0159$). Year-on-year growth in expenditures for food and non-alcoholic beverages was more or less copied by the development of total consumption expenditures (Figure 1, Table 1).

In terms of household social groups (self-employed persons – Figure 2, employees – Figure 3, retirees – Figure 4), the households of employees had the highest net money income per person per year.

Net money income of self-employed persons per person per year increased on a year-on-year basis up to 5 605 EUR in 2017 (Figure 2). Net money income of employees per person per year reached 5 672 EUR in 2017 (Figure 3). As for retirees, the net money income also increased, reaching 5 005 EUR/person/year in 2017 (Figure 4).

Examining consumption expenditures is important not only in terms of size but also in terms of structure. Although there are certain specificities in the behaviour of individual households, we can still observe some regularity. The structure of consumption expenditures in Slovakia shows that the highest portion of spending in 2017 was for food and non-alcoholic beverages 22.4% (increased from 19.7% in 2008), followed by spending for housing and energy at 20.1% (decreased from 20.4% in 2008).

With raising net money income, the expenditures increased as well. Approximately at the same pace

Table 1. Indices of growth of net money income and expenditures of households in the Slovak Republic in 2008–2017

| Indicator | 2008/07 | 2009/08 | 2010/09 | 2011/10 | 2012/11 | 2013/12 | 2014/13 | 2015/14 | 2016/15 | 2017/16 | k' |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------|
| Net money income (%) | 109.9 | 99.4 | 99.5 | 103.7 | 101.3 | 100.9 | 105.5 | 108.4 | 104.3 | 103.3 | 1.0359 |
| Consumption expenditures (%) | 105.5 | 93.7 | 101.0 | 104.5 | 101.0 | 99.5 | 100.0 | 107.8 | 101.1 | 102.3 | 1.0159 |
| Food and non-alcoholic expenditures (%) | 105.3 | 103.3 | 103.5 | 102.7 | 103.1 | 102.5 | 99.8 | 91.3 | 102.0 | 104.9 | 1.0175 |

k' – year-on-year growth

Source: authors' calculations based on data of SO SR (2018)

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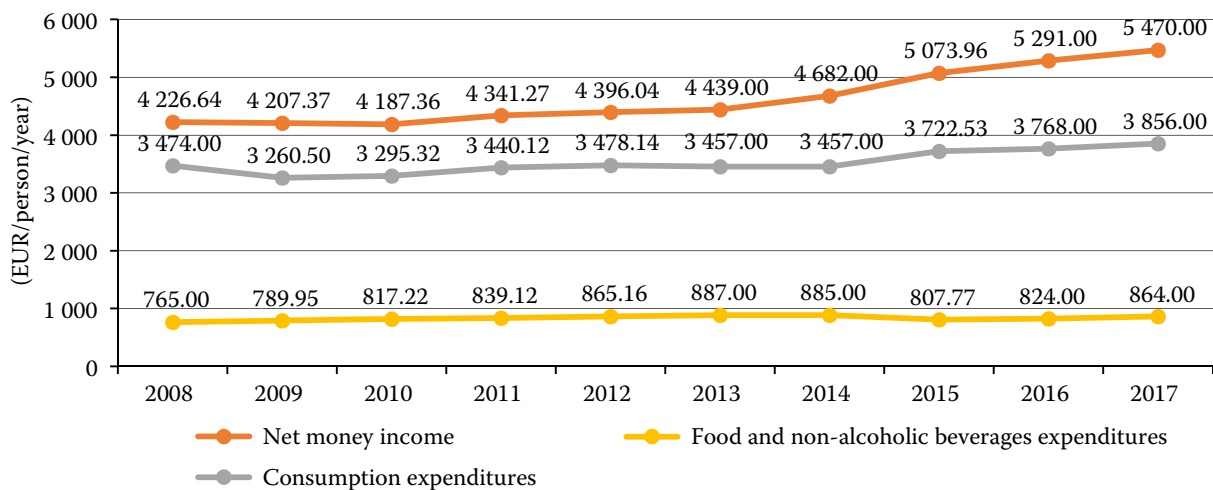


Figure 1. Net money income, consumption expenditures and food and non-alcoholic beverages expenditures of households total in 2008–2017

Source: SO SR (2018)

as the net money income, the total consumption expenditures also increased (Štitková and Mrhalková 2016).

Consumption expenditures and food and non-alcoholic beverages expenditures (2008–2017)

Development of consumption expenditures.

The share of household consumption expenditures in GDP in Slovakia reaches a long-term level of about 53.8% (SO SR 2018). However, this share is a little lower than the EU-28 average reaching 54% (2017). Engel pointed out (Varian 2010) that the poorer is an individual, a family, or a nation, the greater

is the percentage of its income must be spent on preserving physical existence, with the largest share spent for food. He stated that the share of expenditures for clothing are stable, while the expenditures for housing, heating and lighting vary according to level of income, when the share of these expenditures increases with increasing income. This results in a close link between the volume of income and satisfaction of higher needs, for example, the need to create savings (Matoušková 2010).

In terms of the structure of expenditures for pure food commodities, the expenditures for meat and meat products account for the largest share of food consump-

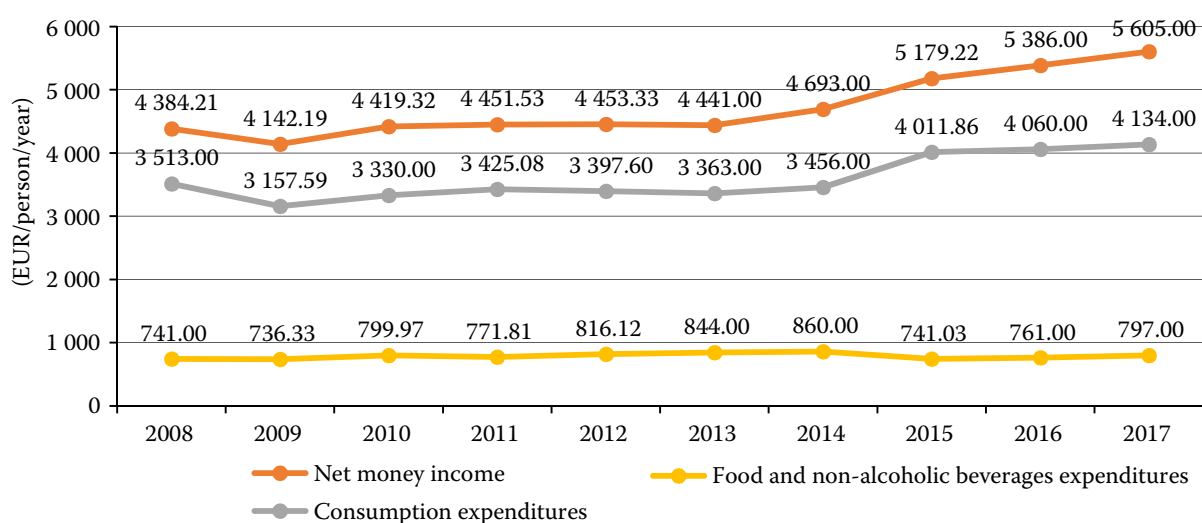


Figure 2. Net money income, consumption expenditures and food and non-alcoholic beverages expenditures of households of self-employed persons in 2008–2017

Source: SO SR (2018)

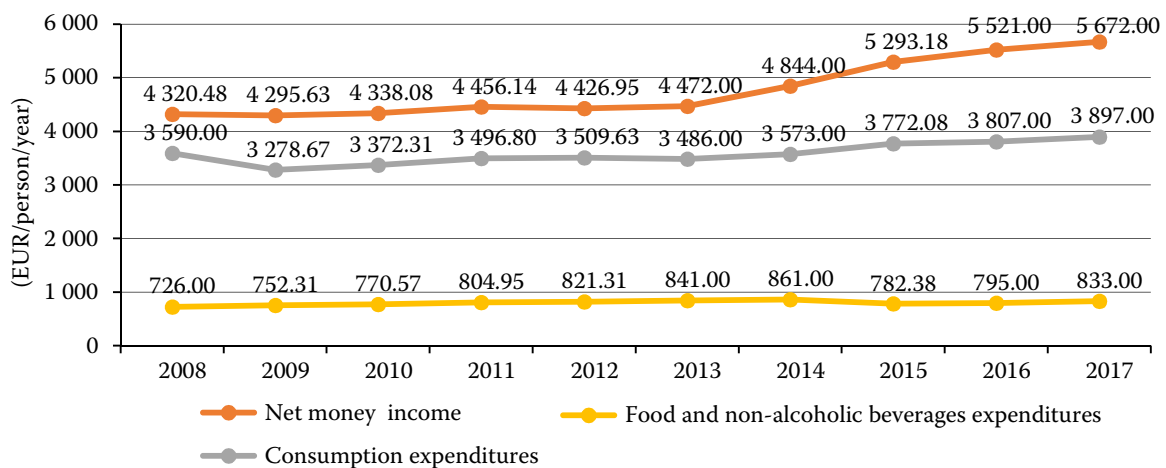


Figure 3. Net money income, consumption expenditures and food and non-alcoholic beverages expenditures of households of employees in 2008–2017

Source: SO SR (2018)

tion, around 30%. Almost the same share was spent by households on bread, cereals, milk, and eggs. At least 3.4% of food expenditures were spent by households for fish and fish products.

In the case of most basic food, consumption per capita in Slovakia was below the level of consumption in EU countries, above all as regards the consumption of fruit and vegetables (SO SR 2015). When assessing the demand for and consumption of commodities of animal origin, the consumption of meat and meat products may be variable, but the year-on-year trend is growing. However, the growing consumption trend has not yet met the recommendations for the level of recommended

dietary allowances, which has been in use in Slovakia since 2000. A comparison of the meat and meat products consumption shows that in 2017 the principles of rational nutrition in Slovak households did not meet the recommended dietary allowances of food commodities such as beef, veal and fish. In 2017, despite its year-on-year increase, the consumption of beef and veal reached only 29% of the recommended daily values based on date from SO SR (2015) (Table 2). Slovak consumers, due to the high prices of beef and especially calf meat and lower purchasing power, prefer pork and poultry meat. The annual growth in consumption of pork covered the substitutional demand for beef and

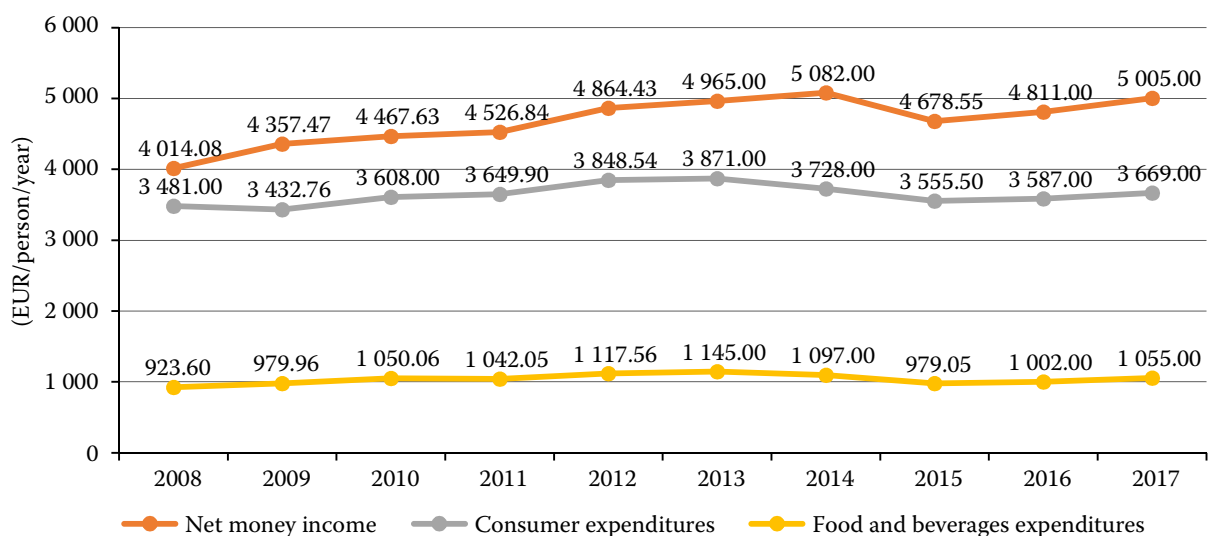


Figure 4. Net money income, consumption expenditures and food and non-alcoholic beverages expenditures of households of retirees in 2008–2017

Source: SO SR (2018)

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Table 2. Consumption of selected types of food in the Slovak Republic in relation to recommended dietary allowances

| Commodity (kg/person/year) | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | RDA fulfillment in 2017 (%) |
|----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----------------------------|
| Meat together | 58.2 | 58.7 | 55.8 | 56.3 | 52.5 | 53.3 | 47.9 | 50.6 | 58.4 | 62.8 | 1.09 |
| Beef and veal | 5.0 | 4.4 | 4.3 | 3.8 | 3.6 | 4.4 | 4.2 | 4.3 | 4.8 | 5.2 | 0.29 |
| Pork | 32.3 | 32.0 | 30.8 | 31.6 | 30.0 | 30.9 | 28.0 | 30.9 | 35.4 | 35.9 | 1.62 |
| Poultry | 19.3 | 20.7 | 19.0 | 19.9 | 17.7 | 16.9 | 14.5 | 14.1 | 16.9 | 20.2 | 1.35 |
| Fats together | 23.0 | 23.6 | 23.1 | 22.1 | 18.12 | 18.9 | 17.7 | 18.1 | 18.6 | 22.0 | 1.00 |
| Milk and dairy products | 153.0 | 153.8 | 162.8 | 152.4 | 158.6 | 158.5 | 166.8 | 169.2 | 176.2 | 174.6 | 0.79 |
| Drinking milk | 48.3 | 49.5 | 54.5 | 53.1 | 54.3 | 49.3 | 48.3 | 48.1 | 46.5 | 46.4 | 0.51 |
| Cheese and curd together | 9.2 | 9.8 | 9.9 | 10.4 | 10.1 | 11.4 | 11.5 | 12.2 | 14.0 | 13.5 | 1.35 |
| Fish | 4.9 | 4.6 | 5.1 | 4.7 | 4.8 | 5.1 | 5.4 | 5.3 | 5.1 | 5.5 | 0.92 |
| Vegetable and vegetable products | 100.6 | 102.5 | 94.6 | 100.6 | 100.9 | 104.7 | 104.7 | 100.9 | 108.3 | 103.3 | 0.81 |
| Fruit and fruit products | 65.0 | 55.3 | 53.6 | 50.6 | 52.1 | 54.9 | 60.8 | 65.7 | 60.4 | 62.4 | 0.65 |

RDA – recommended dietary allowances are based on data from Statistical Office of the Slovak Republic (Food Consumption in the SR; SO SR 2015)

Source: authors' calculations based on data of SO SR (2018)

veal, and in 2017 its consumption exceeded the recommended daily values by 62%. Consumption of poultry meat was lower and in 2017 it only exceeded the recommended dietary allowances by 35%.

Consumption of milk and dairy products increased over the period under consideration. In terms of recommended dietary allowances and rational nutrition for dairy products, in 2017, the consumption was only 79% of the recommended dietary allowances (RDA; RDA = 220 kg/person/per year). There persists a relatively low and still decreasing demand for drinking milk. In 2017, its consumption was only 46.4 kg per capita, reaching only 51% of the RDA. In Slovak households, drinking milk is becoming a less popular product, being replaced by other products often referred to as fermented products, and with schoolchildren replacing milk by a wide range of sugar-sweetened soft drinks.

Consumption of fruit and vegetables, regardless to their year-round availability, does not reach the level of RDA, which is similar to consumption of dairy products. The level of consumption in relation to RDA was only 81% for vegetables and only 65% for fruit in 2017 (Table 2). In 2017, there was a decline in consumption of both southern as well as fresh domestic fruit and fruit products, with a consumption of 62.4 kg/person/year.

Expenditures for food and non-alcoholic beverages and limit of demand saturation in households divided by economical status of households at work

Food and non-alcoholic beverages expenditures have been on the rise in recent years in Slovakia, accounting for 24.4% of households' total consumption expenditures in 2011, followed by consumer spending on housing, water, electricity and gas; travel expenses, recreational and cultural expenditures; and households' expenditures on various goods and services. However, there are considerable differences in the structure of individual consumption expenditures and we evaluate them differently, in view of the possibilities resulting from the economic status of the household priority in employment. During the period under study, the households of retirees had the highest share of household, water and energy expenditures and of expenditures on food and non-alcoholic beverages. On the other hand, households of retirees showed a lower share of spending on various goods and services, hotels, restaurants and transport, but their healthcare spending in 2017 represented 3.37% of their consumption expenditures, while on the national population level the healthcare expenditure represented only 2.89% of consumption expenditure (SO SR 2018).

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Table 3. Estimates of parameters of expenditures functions (linear, Working and Törnquist) and saturation of food demand for individual households divided by economical status of head of household at work

| Households | Parameters of function | Income elasticity | Saturation of demand (EUR) | R^2 |
|---------------|---|-------------------|----------------------------|--------|
| | $NMFE = 319.22 + 0.109 NMI$ | 0.53 | – | 0.930* |
| Employees | $NMFE = \exp\left(7.045 - 1\,669 \times \frac{1}{NMI}\right)$ | 0.51 | 1 160 | 0.967* |
| | $NMFE = \frac{1\,476 - 936 \times NMI}{3\,804 + NMI}$ | 0.54 | 858 | 0.961* |
| Self-employed | $NMFE = 363.99 + 0.099 NMI$ | 0.49 | – | 0.586* |
| | $NMFE = \exp\left(7.047 - 1\,645 \frac{1}{NMI}\right)$ | 0.48 | 1 168 | 0.715* |
| | $NMFE = \frac{1\,445 \times NMI}{3\,590 + NMI}$ | 0.52 | 865 | 0.766* |
| Retirees | $NMFE = 522.01 + 0.115 NMI$ | 0.42 | – | 0.899* |
| | $NMFE = \exp\left(7.192 - 1\,219 \frac{1}{NMI}\right)$ | 0.38 | 1 408 | 0.966* |
| | $NMFE = \frac{1\,503 \times NMI}{2\,124 + NMI}$ | 0.40 | 1 056 | 0.969* |

*statistically proven parameter, significance level $\alpha < 0.01$; NMFE – net money food expenditures; NMI – net money income; R^2 – coefficient of determination; estimates of parameters of expenditure functions – linear, Working and Törnquist for goods of primary, essential consumption

Source: authors' calculations based on data of SO SR (2018)

We used the analytical form of the linear expenditures function to empirically reflect the magnitude of net money expenditures for food and non-alcoholic in relation to net money income during the years 2008–2017, as well as Working's logarithmic-hyperbolic expenditures function and a model of the Törnquist function for existentially necessary goods.

Estimates of statistical parameters of Engel's expenditures characteristics for food and non-alcoholic beverages, coefficients of income elasticity, and food saturation levels in monitored household groups are shown in Table 3.

Estimated parameters of regression expenditures functions for food and non-alcoholic beverages are statistically high and reflect the share of food expenditures variability and net money income, explained by the regression model from 58.6–96.6%. Smaller leakage of dependence (58.6–71.5%) and explaining the variability

of food and non-alcoholic expenditures to net money income from models used by self-employed households. Higher average net money income per household member of self-employed people enable them to cover nutritional needs at a higher level. With further increases in income due to the physiological limits of increase in food consumption, the tightness of the food expenditure dependency on the monetary income decreases, which is also reflected in the lower coefficients of the income elasticity of food expenditure, especially in households of retirees. Based on the parameters of the linear regression model, it can be noted that in households of retirees, with an increase in the net money income of 100 EUR/person/year, food and non-alcoholic beverages expenditures may increase by an average of 11.5 EUR/person/year. In self-employed households, an increase in the average net money income of 100 EUR/person/year can be expected to increase

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consumption expenditures for food and non-alcoholic beverages by an average of 9.9 EUR/person/year and by 10.9 EUR/person/year in the family of employees.

The relative expression of changes in consumer demand due to changes in household net money income may be characterised by income elasticity coefficients. Based on a linear regression model, it can be concluded that in households of employees one percentage point increase in annual net money income allows the annual increase of consumer expenditures for food and non-alcoholic beverages by 0.53%, in households of self-employed this annual increase of consumer expenditures for food and non-alcoholic beverages is 0.49%, and in households of retirees it is only 0.42%. Based on the above-mentioned values of expenditure elasticity coefficients, it can be stated that the nutritional needs of the households of retirees are satisfied to a lesser extent than food needs in the households of employees and self-employed persons. The values of the net money income (consumer expenditures) elasticity coefficients are presented in Table 3. These results confirm the findings of other authors (Lesáková 2011, Zentková and Hošková 2011).

As can be seen in Table 3, the demand for food and non-alcoholic beverages based on the Törnquist's function can be estimated at 1 056 EUR/person/year in households of retirees. The limit of demand for food and non-alcoholic beverages in households of self-employed persons is only 865 EUR/person/year and 858 EUR/person/year in households of employees.

CONCLUSION

In Slovakia, income and property inequality is increasing and it also manifests itself by different levels of satisfaction of the population's nutritional needs. There are rising inequalities and polarisation, especially at the regional levels of the country, connected with its impact on the problems of financing the pension system and reducing household consumption. During the period under review, net money income grew on an average year-on-year basis, excluding the years 2009 and 2010. This development corresponds also with consumption expenditures in 2009. In the development of the food market, there is a constant evolution in all disaggregated social groups – the lowest food and non-alcoholic expenditures were 726 EUR/person/year in the households of employees in 2008, while the highest one was in the households of retirees, up to 1 055 EUR/person/year in 2017. Between 2008 and 2017, consumption expenditures

for food and non-alcoholic beverages did not change significantly and ranged from 15.57% (2016) to 19.98% (2013), which is in comparison with EU countries (12.2%) still a high share. Based on the analysis, it can be concluded that Slovakia still lags behind the European average. According to Eurostat (2017), UK households' expenditure on food and non-alcoholic beverages is only 8.1% of their consumption expenditures, and this share is less than 10% also in Luxembourg, Austria and Germany.

The development of the food market is marked by a higher degree of non-satisfaction of nutritional needs that is also reflected in the higher coefficients of income elasticity.

From the point of view of the structure of food expenditures, there is an increase in meat and cheese consumption. The consumption of pork meat exceeded the recommended values by 62%, the consumption of cheese and curd exceeded the recommended values by 35%. On the other hand, the consumption of milk and dairy products only reached 51% of RDA, consumption of vegetables and vegetable products reached 81% of RDA values, and consumption of beef and veal only amounted to 29% of their RDA values. With rising income, only slight changes in terms of food consumption can be expected in the behaviour of the population. Prices of inevitable goods and services grew much faster than prices of luxury goods and services, while the former made up the greatest share in the consumer basket of lower-income households.

According to Figiel and Kufel-Gajda (2017), the level of economic development determines the direction of food innovation related to the quality of consumed food. This leads to the conclusion that the demand for food will be replaced by the demand for higher quality food when a certain threshold income is reached.

Considering the stated facts, with ageing population and with the availability of greater varieties of goods and services due to application of advanced technologies, we can expect changes in the character of consumption in the near future. The analysis provided in this paper, therefore, offers suggestions for food businesses to create a product portfolio based on different income and saturation demand for basic foods.

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