

Trends in Household Food Expenditures and Income Elasticity in Slovakia in the Pandemic and Post-pandemic Period

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Abstract

This paper examines the evolution of food security in Slovakia during the pandemic and post-pandemic years (2020-2023), with a focus on economic access to food. Using household data from the Statistical Office of the Slovak Republic, the study examines changes in income, the share of food expenditures, and income elasticity across regions and demographic groups. The findings show that while household incomes remained relatively stable during the pandemic, the post-pandemic period was marked by rising food prices that outpaced wage growth. As a result, the share of income spent on food increased from 14% in 2020 to 17% in 2023. Data suggests differences between regions: Bratislava recorded the lowest share (12%), whereas Nitra reached 20%. Vulnerability was greatest among retirees, while rural households demonstrated slightly better resilience, likely due to their higher levels of self-sufficiency. Although income elasticity improved overall, disparities widened in 2023 between urban and rural areas. These results underline the need for targeted policies to address affordability and regional inequalities in order to strengthen food security under conditions of economic stress.

Keywords

Food security, food expenditure, income elasticity, regional disparities, demographic vulnerability.

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Introduction

Food security has become an increasingly important topic, particularly in recent years, amid the pandemic and the ongoing war in Ukraine. The years 2020-2023 offer a unique context for examining this issue, as they encompass two distinct phases: the COVID-19 pandemic and the subsequent economic recovery. It is also a period of escalating war conflict in Ukraine. During the pandemic years, household income patterns remained relatively stable due to government interventions. Uncertainty and restrictions still substantially affected consumer behaviour. On the other hand, the post-pandemic period was marked by inflationary pressures, with faster increases in food prices than in wages, leading to a rising share of household expenditures allocated to food. This period offers a unique opportunity to investigate the impact of income dynamics, regional disparities, and demographic factors on food security. Results could help to identify vulnerable groups and evaluate the application of traditional economic principles in conditions of price instability.

Food security is defined by the Food and Agriculture Organisation (FAO) as a situation in which all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and preferences for an active and healthy life. According to the FAO concept, food security is built on four pillars: availability, access, utilisation, and stability (FAO, 1996; World Food Summit). The presented study primarily focuses on economic access, which reflects households' ability to purchase food. The analysis concentrates on the relationship between income and the proportion of food expenditures.

Engel formulated a law in 1857 describing the relationship between income and food expenditure. It states that as household income rises, the proportion of income spent on food declines, even if absolute food spending increases (Engel, 1857). However, recent economic shocks—such as the COVID-19 pandemic and subsequent inflationary pressures—challenge the stability of this relationship. When food prices increase faster than wages, households may allocate a growing

share of income to food, contradicting the expected downward trend predicted by Engel's Law.

Food security of the population is significantly influenced by price dynamics, which affect affordability; regional disparities, reflecting differences in wage levels and living costs; and demographic factors, such as age, household composition, and urbanisation. Studies show that vulnerability tends to be higher among low-income households, retirees, and families with multiple children, as these groups have limited flexibility in adjusting consumption patterns (Codjia and Saghaian, 2022; Rashid et al., 2024). Rural households may exhibit greater resilience due to partial self-sufficiency, while urban households rely more heavily on market purchases.

This study adopts a conceptual model in which the income elasticity of food expenditure serves as an indicator of economic access to food. A faster decline in the share of food spending with rising income suggests improved food security; a slower decline indicates a worse situation. By examining this elasticity across regions and demographic groups during the period 2020-2023, the analysis captures both short-term crisis effects and longer-term structural changes in household behaviour. An analogical approach was used in studies by Zereyesus et al. (2025) and Bogmans et al. (2024).

Food security in Slovakia has been widely studied in relation to household consumption patterns, income elasticity, and dietary diversity. Rizov et al. (2014) investigated food security using household budget survey data from 2004-2010, estimating food demand systems and diet diversity models. Their findings show that all major food groups are normal goods, with rural and low-income households being more price- and expenditure-sensitive than urban and high-income households. Demand for meat, fish, and fruits and vegetables was found to be both expenditure and own-price elastic, indicating vulnerability to economic shocks.

Further research by Pokrivčák et al. (2014) applied the Quadratic Almost Ideal Demand System (QUAIDS) to Slovak data, confirming that cereals and meat are necessities, while dairy and fruits are perceived as luxuries. The study also highlighted that food security improved after EU accession, but disparities persisted between rural and urban households. A related analysis by Cupák et al. (2016) found that dietary diversity increased steadily from 2004 to 2010. However, economic

crises temporarily reduced diversity, particularly among rural and low-income households.

Recent studies have shifted focus to crisis periods. Watter (2025) investigated the impact of COVID-19 and the war in Ukraine on household expenditure structures. He found that food expenditures rose to 30.7% of household income in 2021, signalling increased financial pressure and potential deterioration in food security. These conclusions align with broader European research under the FP7 FOODSECURE project, which emphasised affordability as the key challenge for Central and Eastern European countries, including Slovakia.

Overall, previously cited works confirm that income elasticity, price shocks, and demographic factors strongly influence food security in Slovakia. Vulnerable groups—particularly low-income households, retirees, and families with multiple children—face heightened risks during periods of economic instability. These insights provide a foundation for the present study, which extends the analysis to the most recent period (2020-2023), characterised by pandemic recovery and inflationary pressures.

The presented paper aims to analyse the development of food security in Slovakia between 2020 and 2023, focusing on economic access to food, regional disparities, and demographic factors. It also evaluates the impact of income changes on the share of food expenditures across different population groups.

Material and methods

The analysis of access to food for Slovak households and individual population groups was based on data from the Statistical Office of the Slovak Republic on household accounts for the period 2020-2023. For 2020 and 2021, the database contains information on 4,633 households; for 2022, on 4,991 households; and for 2023, on 4,881 households. Table 1 presents the list and descriptions of variables used to characterise Slovakia's food security.

Data from the Slovak household account statistics were cleaned, and extreme values were adjusted using the Winsorization method, replacing high values with the 99th percentile and very low values with the 1st percentile. The data were characterised using box plots stratified by population group. The impact of income on the share of food

Variable	Description	Units	Data source
Income	Net monthly household income after taxes	€	Statistical office of the Slovak Republic, HSBC Survey 2020-2023
Share of food expenditure	Share is calculated as the sum of food expenses divided by total expenses	Share	Statistical office of the Slovak Republic, HSBC Survey 2020-2023
Region	Regional affiliation to individual regions of the Slovak Republic: BA-Bratislava, BB-Banská Bystrica, TN-Trenčín, TT-Trnava, NR-Nitra, PO-Prešov, KE-Košice, ZA-Žilina	-	Statistical office of the Slovak Republic, HSBC Survey 2020-2023
Gender	Gender of the reference person: M-male, F-female	-	Statistical office of the Slovak Republic, HSBC Survey 2020-2023
Urbanization	City - an area with medium to high population density, Village - an area with sparse population	-	Statistical office of the Slovak Republic, HSBC Survey 2020-2023
Age category	Classification of the reference person by age category: retiree - age over 64 years, young adult - adult up to 40 years old, middle-aged - age between 40 and 64 years	-	Statistical office of the Slovak Republic, HSBC Survey 2020-2023

Source: Author's work based on data from the Statistical Office of the Slovak Republic

Table 1: Analysed variables.

expenditures was quantified using Engel's expenditure function, as in the Equation 1. To avoid omitted-variable bias, control variables were used: gender, level of urbanisation, region, and age category.

$$p_i = c_0 + c_1 \ln I_i + \beta_1 \text{Gender}_i + \beta_2 \text{Urban}_i + \sum_{r=1}^7 \gamma_r \text{Region}_{ri} + \sum_{a=1}^2 \delta_a \text{AgeCategory}_i + u_i \quad (1)$$

Where p_i is the share of food expenditures in total household expenditures, c_0 is a constant, $\ln I_i$ is the logged value of household income, and c_1 is the semi-elasticity expressing the impact of income on the share of food expenditures. Gender, Urban, Region, and Age are dummy variables representing these qualitative factors. In the case of gender and urbanisation, there were just two categories (1 dummy variable). The region included 8 categories, represented by 7 dummy variables, and the age category included 3 categories, represented by 2 dummy variables. Coefficients β_1 , β_2 , γ_r , and δ_a express the difference between the category with the dummy variable equal to 1 and the reference category. In equations estimated separately for different categories, dummy variables expressing the same category were omitted. Results include only the analysed value of income semi-elasticity influencing the share of food expenditures, as this was the main focus of the conducted analysis. Functional parameters were estimated using the Ordinary Least Squares method for different time periods. Assumptions about normality of residuals (Shapiro-Wilk test),

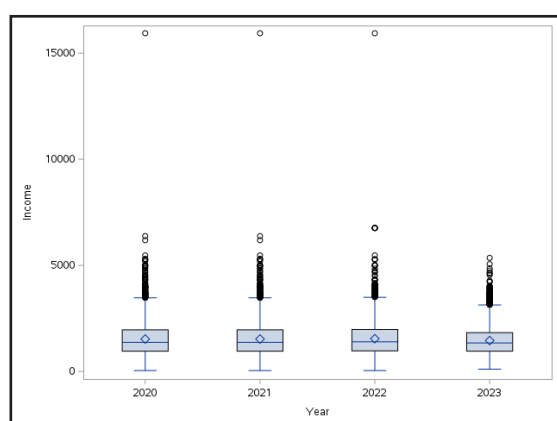
homogeneity of variance (Breusch-Pagan test), and collinearity of variables (Variance inflation factor) were checked using standard procedures. In case of violation of these assumptions, White's robust standard errors were used to ensure the reliability of the results.

Based on economic theory, it can be assumed that its value will be negative. This parameter was estimated for individual time periods and population groups, and the values were compared. A lower value means a faster average decrease in expenditures on basic needs with a 1% increase in income. Conversely, a higher value means that, as income increases, expenditures on the population's basic needs decrease more slowly, which may indicate a worse food security situation. The mentioned analytical procedures were carried out using SAS Enterprise Guide 7.15.

Results and discussion

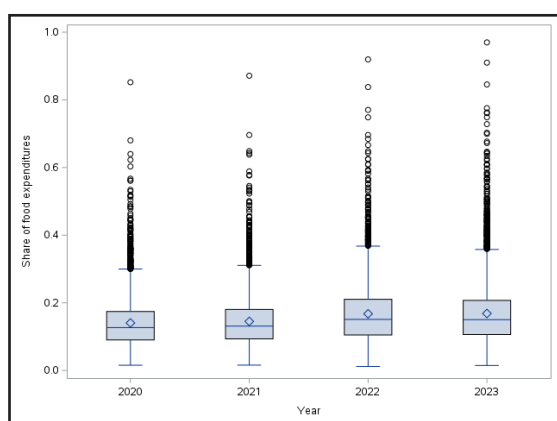
Household statistics from the Statistical Office provides a closer look at how food security is developing in Slovakia. Given the development of factors influencing food security in Slovakia at the end of the analysed period, data from 2020-2023 were used in this case, as they represent the most up-to-date available information. Figures 1 and 2 show how income and the share of expenditures on food developed during this period, that is, variables that significantly affect the population's economic access to food and their subjective perception of food security.

Figure 1 shows the development of total monthly household income, which includes both monetary and non-monetary income after tax, for the period 2020-2023. The development indicates a stable level over the first two years, averaging 1,527 €. The pandemic years 2020 and 2021 were similar in many respects, and there were no significant changes across several variables. This could have been significantly influenced by anti-pandemic measures, which significantly slowed down the dynamics of change in many areas. This concerns not only average income but also income distribution. Figure 2 shows the development of food expenditure shares over the period 2020-2023.



Source: Statistical office of the Slovak Republic

Figure 1: Household income.



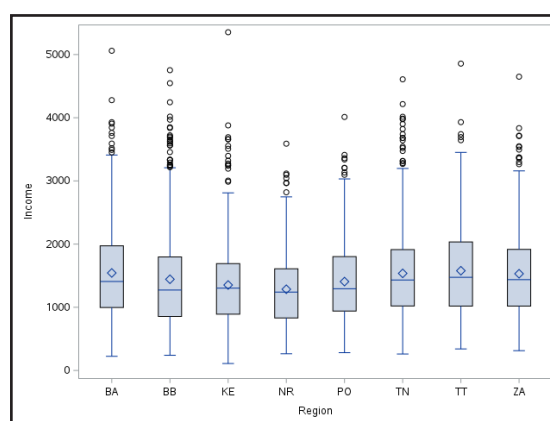
Source: Statistical office of the Slovak Republic

Figure 2: Share of food expenditures.

In 2022, the average income increased slightly to 1,544 €, with no significant changes in the income distribution, but in 2023, the average income declined to 1,457 €. The median income also fell from 1,396€ to 1,342 €, and the variability, as measured by the coefficient of variation, decreased from 51% to 46%. This tendency was also

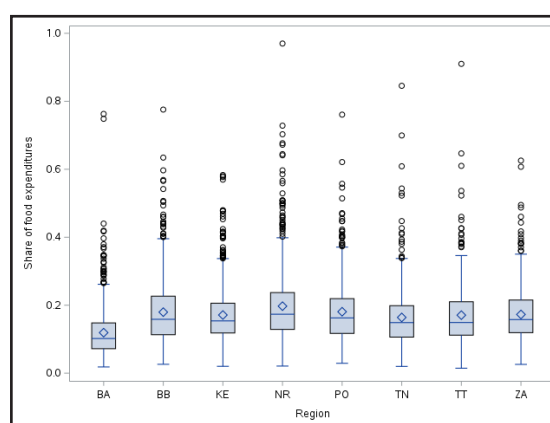
reflected in the share of food expenses, as shown in Figure 2. In 2020, residents spent an average of 14% of their income on food. The share increased to 15% in 2021, and despite the rise in average income in 2022, it reached 17% and remained at that level in 2023. The presented development indicates a worsening situation for households in their economic approach to food, as food prices rose faster than wages.

The distribution of household incomes in individual regions in 2023 is shown in Figure 3. Figure 4, located next to it, shows the distribution of food expenditure shares in individual regions. The total net monthly household income in Slovakia declined slightly in 2023. When comparing incomes across regions, not only are the average and median values interesting, but also the minimum, maximum, and quartiles.



Source: Statistical office of the Slovak Republic

Figure 3: Household income in regions in 2023.



Source: Statistical office of the Slovak Republic

Figure 4: Share of food expenditures in regions in 2023.

The lowest average income in 2023 was in the Nitra region, at 1,285 €, while this region also recorded the lowest income variability at 42%. Other

regions with low average incomes were the Košice region (1,352 €) and the Prešov region (1,406 €). The Košice region also recorded the lowest minimum income and, along with the Nitra region, the lowest maximum income. Although the Banská Bystrica region had a higher average income, its median income was approximately equal to that of the Nitra region. The highest average income in 2023 was recorded in the Trnava region (1,578 €), followed by the Bratislava region (1,543 €) and the Trenčín region (1,536 €).

Figure 4 follows up on the distribution of food expenditure shares in Figure 3. The lowest share of food expenditure in 2023 was recorded in the Bratislava region, where households spent, on average, 12% of their income on food, with the median at 10%. The highest share of income spent on food was in the Nitra region, where it accounted for 20%, followed by the Banská Bystrica and Prešov regions, where it was 18%. The data suggest that the most vulnerable regions in Slovakia are Nitra, Banská Bystrica, and Prešov.

The impact of income on the share of food expenditure in Slovakia

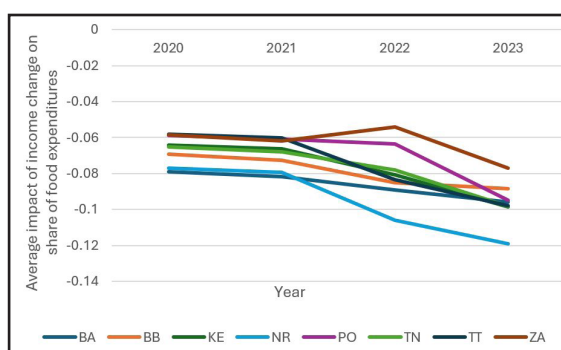
Based on theoretical assumptions, it is expected that, as income increases, the share of expenditure on basic goods, including food, will decrease. It can be assumed that, for a part of the population in a worse food security situation, an increase in income will result in a smaller decrease in the share of food expenditure than for the population in a better economic situation. Table 2 shows the development of the impact of income on the share of food expenditure from 2020 to 2023.

A faster decline in the share of food expenditures will therefore indicate better economic access to food. The development shown in Table 2 thus suggests that, after the pandemic years, there was a slight improvement in access to food, and the share of expenditures on basic needs decreased more rapidly with higher income. Comparing confidence limits for estimated parameters suggests

significant improvement in 2022 and 2023 compared with the pandemic years 2020 and 2021.

Figure 5 shows a summary comparison of average impact across regions over time. Table 3 presents estimates of the impact of income on the share of food expenditures across Slovak regions from 2020 to 2023. At the beginning of the observed period in 2020, the Bratislava region recorded the highest average income elasticity of food expenditures. On the other hand, the slowest decline in the share of food expenditures with increasing income was in the Trnava, Prešov, and Žilina regions. Over the following years, the situation slightly improved, and with higher income, the decline in food expenditures was faster.

In 2023, with rising income, spending decreased the slowest in the Žilina and Banská Bystrica regions. The value in the Bratislava region is no longer the highest, and the fastest decline in the share of spending on food was in the Nitra region. This may be due to the agricultural focus of the Nitra region and the population's ability, to some extent, to supply itself with food from its own production.



Source: Author's work based on data from the Statistical Office of the Slovak Republic (HBS survey)

Figure 5: Impact of income increase on the share of food expenditures in the Slovak regions.

Year	Estimate	Pr > t	95% CL Lower	95% CL Upper	R-Square	Significance F
2020	-0.0675	<.0001	-0.0719	-0.0631	0.2185	<.0001
2021	-0.0702	<.0001	-0.0747	-0.0656	0.2199	<.0001
2022	-0.0823	<.0001	-0.0879	-0.0767	0.2234	<.0001
2023	-0.0969	<.0001	-0.1023	-0.0914	0.2509	<.0001

Source: Author's work based on data from the Statistical Office of the Slovak Republic (HBS survey)

Table 2: Effect of income increase on the share of food expenditures on total expenditures.

Year	Region	Estimate	Pr > t	95% CL Lower	95% CL Upper	R-Square	Significance F
2020	BA	-0.0789	<.0001	-0.0906	-0.0672	0.276	<.0001
2020	BB	-0.0694	<.0001	-0.0794	-0.0594	0.2793	<.0001
2020	KE	-0.0641	<.0001	-0.0739	-0.0543	0.245	<.0001
2020	NR	-0.0771	<.0001	-0.0918	-0.0625	0.1836	<.0001
2020	PO	-0.0589	<.0001	-0.0717	-0.0461	0.1587	<.0001
2020	TN	-0.0653	<.0001	-0.0784	-0.0522	0.2046	<.0001
2020	TT	-0.0582	<.0001	-0.075	-0.0414	0.1283	<.0001
2020	ZA	-0.0585	<.0001	-0.0725	-0.0445	0.16	<.0001
2021	BA	-0.0817	<.0001	-0.0938	-0.0696	0.276	<.0001
2021	BB	-0.0726	<.0001	-0.083	-0.0623	0.2844	<.0001
2021	KE	-0.0664	<.0001	-0.0766	-0.0562	0.2447	<.0001
2021	NR	-0.0795	<.0001	-0.0946	-0.0644	0.1841	<.0001
2021	PO	-0.061	<.0001	-0.0743	-0.0478	0.1592	<.0001
2021	TN	-0.0681	<.0001	-0.0816	-0.0546	0.207	<.0001
2021	TT	-0.0602	<.0001	-0.0775	-0.0428	0.1291	<.0001
2021	ZA	-0.0618	<.0001	-0.0763	-0.0473	0.1639	<.0001
2022	BA	-0.0891	<.0001	-0.1027	-0.0755	0.2316	<.0001
2022	BB	-0.0851	<.0001	-0.0989	-0.0714	0.2802	<.0001
2022	KE	-0.0806	<.0001	-0.0937	-0.0674	0.204	<.0001
2022	NR	-0.106	<.0001	-0.1238	-0.0883	0.1931	<.0001
2022	PO	-0.0636	<.0001	-0.0801	-0.0471	0.1511	<.0001
2022	TN	-0.0779	<.0001	-0.094	-0.0618	0.1961	<.0001
2022	TT	-0.0833	<.0001	-0.1042	-0.0624	0.1488	<.0001
2022	ZA	-0.0541	<.0001	-0.0713	-0.0368	0.1321	<.0001
2023	BA	-0.0957	<.0001	-0.1068	-0.0847	0.2975	<.0001
2023	BB	-0.0883	<.0001	-0.1031	-0.0735	0.2109	<.0001
2023	KE	-0.0984	<.0001	-0.1123	-0.0845	0.2418	<.0001
2023	NR	-0.1192	<.0001	-0.1392	-0.0992	0.1827	<.0001
2023	PO	-0.095	<.0001	-0.1119	-0.0782	0.191	<.0001
2023	TN	-0.0981	<.0001	-0.113	-0.0833	0.2451	<.0001
2023	TT	-0.0978	<.0001	-0.1146	-0.0811	0.2022	<.0001
2023	ZA	-0.077	<.0001	-0.0927	-0.0612	0.1699	<.0001

Source: Author's work based on data from the Statistical Office of the Slovak Republic (HBS survey)

Table 3: Effect of income increase on the share of food expenditures on total expenditures.

The advantage of household data is that it provides a more detailed view of individual segments of the population, which may be in different situations regarding food security. Tables 4 and 5 compare the impact of income across age groups and urbanisation levels. Across all groups, a similar tendency can be observed as in Table 2.

The comparison between age categories shows that the slowest decline in the food expenditure share is among the pensioner group, for whom food security is the worst. The categories of young adults (ages 18-40) and the middle generation (ages 40-64) fare better. The differences between these

two categories in terms of the impact of income on the share of food expenditures decreased in 2022 and 2023. Comparison of interval estimates suggests significant differences between pensioners and other categories, with the worst situation in the pensioners' segment. Young adults and the middle-aged generation did not differ substantially, and initial differences in 2020 changed to almost identical results in 2023.

An interesting comparison is the development of income's influence on the share of food expenditures between urban and rural areas, as shown in Table 5. From similar values in 2020

Year	Age category	Estimate	Pr > t	95% CL Lower	95% CL Upper	R-Square	Significance F
2020	Pensioner	-0.0522	<.0001	-0.0618	-0.0425	0.0995	<.0001
2020	Young adults	-0.0816	<.0001	-0.0909	-0.0723	0.2601	<.0001
2020	Middle age	-0.0695	<.0001	-0.0754	-0.0636	0.2532	<.0001
2021	Pensioner	-0.0546	<.0001	-0.0645	-0.0446	0.1005	<.0001
2021	Young adults	-0.0848	<.0001	-0.0944	-0.0752	0.2625	<.0001
2021	Middle age	-0.0722	<.0001	-0.0782	-0.0661	0.2551	<.0001
2022	Pensioner	-0.0704	<.0001	-0.0823	-0.0585	0.1233	<.0001
2022	Young adults	-0.0928	<.0001	-0.1048	-0.0808	0.2384	<.0001
2022	Middle age	-0.0837	<.0001	-0.0912	-0.0761	0.2438	<.0001
2023	Pensioner	-0.0797	<.0001	-0.0892	-0.0702	0.1944	<.0001
2023	Young adults	-0.1067	<.0001	-0.1197	-0.0937	0.3044	<.0001
2023	Middle age	-0.1041	<.0001	-0.1119	-0.0963	0.2826	<.0001

Source: Author's work based on data from the Statistical Office of the Slovak Republic (HBS survey)

Table 4: Impact of income change on share of food expenditures - age.

Year	Urbanisation	Estimate	Pr > t	95% CL Lower	95% CL Upper	R-Square	Significance F
2020	City	-0.0662	<.0001	-0.0716	-0.0607	0.2208	<.0001
2020	Rural area	-0.0705	<.0001	-0.0781	-0.0630	0.2310	<.0001
2021	City	-0.0687	<.0001	-0.0743	-0.0630	0.2218	<.0001
2021	Rural area	-0.0735	<.0001	-0.0813	-0.0657	0.2336	<.0001
2022	City	-0.0785	<.0001	-0.0854	-0.0716	0.2210	<.0001
2022	Rural area	-0.0900	<.0001	-0.0996	-0.0803	0.2441	<.0001
2023	City	-0.0924	<.0001	-0.0990	-0.0858	0.2450	<.0001
2023	Rural area	-0.1058	<.0001	-0.1153	-0.0963	0.2619	<.0001

Source: Author's work based on data from the Statistical Office of the Slovak Republic (HBS survey)

Table 5: Impact of income change on share of food expenditures - urbanisation.

and 2021, the differences between them gradually increase. An income increase in rural areas leads to a larger decrease in the share of food expenditures than in cities. The difference between average values in urban and rural areas widened further in 2023. However, according to the confidence limits, this difference remains insignificant at the 0.05 level.

The results in Table 5 indicate that self-sufficiency options in rural areas can be strengthened with increasing income and ultimately lead to a faster decline in the share of spending on basic food than in cities. Table 6 compares the effect of income changes on the share of food expenditures by gender. The trend follows that of the previous figures and tables, and an improving situation can be observed over the years 2020-2023. Interestingly, the average parameter values suggested a slightly better situation for female households during the pandemic period. However, the difference between genders fluctuated until 2023, when the opposite result emerged,

with values suggesting a better situation in households with a male as the reference person. However, the interval estimates do not show any potentially significant differences between the parameters estimated for males and females.

Based on the results presented, it can be concluded that during the period 2020-2023, there was a slight improvement in the situation, and that, with an increase in income, the decline in the share of spending on necessities for the population was faster. On the other hand, 2023 is marked by increasing differences in the rate of this decline, particularly between urban and rural areas and between men and women. It can be assumed that, in terms of food access, low-income residents in cities, especially pensioners, are at greater risk. From a territorial perspective, the Žilina, Banská Bystrica, and Prešov regions are the most vulnerable, where, with a higher average share of the population's spending on food, the decline in spending is slower at higher income levels. In the Nitra region, on the other

Year	Age category	Estimate	Pr > t	95% CL Lower	95% CL Upper	R-Square	Significance F
2020	Male	-0.0647	<.0001	-0.0707	-0.0586	0.2193	<.0001
2020	Female	-0.0726	<.0001	-0.0791	-0.0660	0.2212	<.0001
2021	Male	-0.0675	<.0001	-0.0737	-0.0613	0.2230	<.0001
2021	Female	-0.0752	<.0001	-0.0820	-0.0685	0.2213	<.0001
2022	Male	-0.0798	<.0001	-0.0876	-0.0719	0.2212	<.0001
2022	Female	-0.0874	<.0001	-0.0956	-0.0792	0.2284	<.0001
2023	Male	-0.1017	<.0001	-0.1094	-0.0940	0.2590	<.0001
2023	Female	-0.0936	<.0001	-0.1013	-0.0858	0.2535	<.0001

Source: Author's work based on data from the Statistical Office of the Slovak Republic (HBS survey)

Table 6: Impact of income increase on share of food expenditures - gender categories.

hand, an interesting contrast emerged. Despite a higher average share of food expenditures in total expenses, the decline in this share was steepest among higher-income households.

Discussion

The paper's results confirmed the rising share of food expenditures and the income elasticity. It shows that the share of food expenditures in Slovakia increased from 14% in 2020 to 17% in 2023 despite income growth. It could be caused by food price inflation. This confirms Engel's observation that the share of food expenditures decreases with increasing income, a pattern that may be disrupted by shocks such as higher inflation. Similar results were reported by Kubicová and Kádeková (2011) and Nagyová et al. (2013), who also found the relationship to be vulnerable to income shocks.

The study also identified significant disparities among Slovak regions in the share of food expenditures, with the highest values in Nitra, Banská Bystrica, and Prešov region (up to 20%). In comparison, in the Bratislava region it was only 12%. This aligns with Michálek's (2023) conclusion, which also confirmed persistent regional inequalities in Slovakia, and with the International Monetary Fund's report (2024).

Analysis focused on COVID and post-COVID years and confirmed findings by Watter (2025), who observed similar trends in spending by Slovak households and concluded that spending on essentials increased after the pandemic. This also aligns with global conclusions (e.g., Gebeyehu et al., 2023; Beckman et al., 2021), which confirmed increased food insecurity worldwide after the COVID-19 pandemic. This was caused especially by income shocks and rising prices.

The groups most affected by food insecurity

during the COVID years were pensioners, women, and large families, which aligns with Sumsion et al. (2024). The study also confirms the findings of Millard et al. (2022) regarding rural households' greater resilience, driven by higher self-sufficiency.

Conclusion

The paper presents several main trends in Slovakia's food security. The pandemic years were characterised by relative stability in expenditure and income patterns. The reason was government measures that minimised economic shocks. However, the post-pandemic years brought new challenges. Despite a temporary increase in average income in 2022, in 2023, a decline in both median and average household income followed, accompanied by a continued increase in the share of food expenditures. This indicates that food price inflation outpaced wage growth, which reduced economic access to food for many households.

Based on the paper's results, significant regional disparities can be concluded. At the same time, Bratislava maintained the lowest share of food spending, in Nitra, Banská Bystrica, and Prešov, the highest values were recorded, with food expenditures reaching up to 20% of household income. Interestingly, the Nitra region, despite its high food expenditure share, recorded the fastest decline in this share as income rose. The reason could be the local agricultural resources, which may provide some resilience to food security in this region.

The demographic analysis focused on identifying vulnerable groups. Results showed that retirees allocate a larger share of their income to food, making them more vulnerable to inflation and price fluctuations. Age and urbanisation were also found to be significant factors. Rural households are better

positioned to reduce their food expenditure share as income rises, possibly due to self-sufficiency options.

These findings emphasise two main conclusions. While income growth generally improves access to food across regions, significant structural inequalities persist. Policy makers should focus on supporting the most vulnerable groups, which are low-income urban households and pensioners.

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Important issues in Slovak food security also led to significant disparities in regional vulnerability.

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References

- [1] Beckman, J., Baquedano, F. and Countryman, A. (2021) "The impacts of COVID-19 on GDP, food prices, and food security", *Q Open*, Vol. 1, No. 1, p. qoab005. ISSN 2633-9048. DOI 10.1093/qopen/qoab005.
- [2] Bogmans, C., Pescatori, A. and Prifti, E. (2024) "How do Economic Growth and Food Inflation Affect Food Insecurity?", *IMF Working Papers*, 2024(188), p. A001. ISSN 1020-792X. DOI 10.5089/9798400287336.001.A001.
- [3] Codjia, C. O. and Saghaian, S. H. (2022) "Determinants of Food Expenditure Patterns: Evidence from U.S. Consumers", *Sustainability*, Vol. 14, No. 13, p. 8156. ISSN 2071-1050. DOI 10.3390/su14138156.
- [4] Cupák, A., Pokrivčák, J. and Rizov, M. (2016) "Diverzifikácia spotreby potravín na Slovensku (Diversity of Food Consumption in Slovakia)", *Politická Ekonomie*, Vol. 64, No. 5, pp. 608-626. ISSN 0032-3233. DOI 10.18267/j.polek.1082. (In Slovak).
- [5] Engel, E. (1857) "Die productions-und consumtionsverhältnisse des Königreichs Sachsen", *Zeitschrift des Statistischen Bureau des Königlich Sächsischen Ministeriums des Innern*, Vol. 8, pp. 1-54. ISSN 2628-359X. (In German).
- [6] FAO (1996) "An Introduction to the Basic Concepts of Food Security", *World Food Summit*. FAO, Rome.
- [7] Gebeyehu, D. T., East, L., Wark, S. and Islam, M. S. (2023) "A systematic review of the direct and indirect COVID-19's impact on food security and its dimensions", *BMC Public Health*, Vol. 23, p. 2298. ISSN 1471-2458. DOI 10.1186/s12889-023-17104-6.
- [8] International Monetary Fund, European Department. (2024) "Regional Inequality in Slovakia", *IMF Staff Country Reports*, 2024(076), p. A003. ISSN 1934-7685. DOI 10.5089/9798400271021.002.A003.
- [9] Kubicová, Ľ. and Kádeková, Z. (2011) "Comparison of the income development and the food demand elasticities of the private households in Slovakia", *Agricultural Economics - Czech*, Vol. 57, No. 8, pp. 404-411. ISSN 0139-570X. DOI 10.17221/36/2010-AGRICECON.
- [10] Nagyová, Ľ., Stávková, J. and Kádeková, Z. (2013) "Income disparities and their impact on the level and development of food expenditures of households in Slovakia", *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, Vol. 61, No. 7, pp. 2569-2575. ISSN 1211-8516. DOI 10.11118/actaun201361072569.

- [11] Michálek, A. (2023) "Income inequalities and poverty in Slovakia: Development and changes", *European Spatial Research and Policy*, Vol. 30, No. 2, pp. 207-233. ISSN 1231-1952. DOI 10.18778/1231-1952.30.2.12.
- [12] Millard, J., Sturla, A., Smutná, Z., Duží, B., Janssen, M. and Vávra, J. (2022) "European Food Systems in a Regional Perspective: A Comparative Study of the Effect of COVID-19 on Households and City-Region Food Systems", *Frontiers in Sustainable Food Systems*, Vol. 6. ISSN 2571-581X. DOI 10.3389/fsufs.2022.844170.
- [13] Pokrivčák, J., Cupák, A. and Rizov, M. (2014) "Food demand and consumption patterns in the new EU member states: The case of Slovakia", EAAE Congress Paper.
- [14] Rashid, F. N., Sesabo, J. K., Lihawa, R. M. and Mkuna, E. (2024) "Determinants of household food expenditure in Tanzania", *Agriculture & Food Security*, Vol. 13. ISSN 2048-7010. DOI 10.1186/s40066-023-00462-0.
- [15] Rizov, M., Cupák, A. and Pokrivčák, J. (2014) "Food security and household consumption patterns in Slovakia", LICOS Discussion Paper No. 360.
- [16] Sumsion, R. M., June, H. M. and Cope, M. R. (2023) "The impact of COVID-19 on food security: a review", *SN Social Sciences*, Vol. 3, p. 176. ISSN 2662-9283. DOI 10.1007/s43545-023-00762-z.
- [17] Watter, P. (2025) "Food Security in Eastern and Central Europe During the COVID-19 Pandemic: A Case Study of Slovakia", *International Scientific Days 2024 - Proceedings*, pp. 454-461. ISBN 978-80-552-2816-7. DOI 10.15414/2024.9788055228167.454-461.
- [18] Zereyesus, Y. A., Xia, T., Nava, N. J., Li, X. and Cardell, L. (2025) "International income and price elasticity estimates: An update", Economic Research Service, U.S. Department of Agriculture, Report No. TB-1971. DOI 10.32747/2025.9228006.ers.