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## **INFLATION DIFFERENTIALS BASED ON HETEROGENOUS CONSUMPTION BASKETS OF SLOVAK HOUSEHOLDS**

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This paper examines the empirical distribution of individual inflation rates derived from household-specific consumption baskets and investigates the relationship between these rates and the socio-economic characteristics of Slovak households. Utilizing household budget survey data and a detailed breakdown of HICP inflation indices from the peak of the recent inflationary shock in January 2022, we calculated household-specific consumption basket weights and individual inflation rates. Due to diverse consumption patterns within the sample, our findings indicate that multi-person households with children and retired households experience the highest levels of inflation. In contrast, wealthier households are significantly less exposed to inflation, owing to a smaller portion of their budget allocated to food and energy. The empirical distribution revealed a range of individual inflation rates, with variations of up to 7.8 percentage points below and 7 percentage points above the official HICP inflation rate. These findings are relevant for designing targeted social policies aimed at reducing poverty and income inequality.

### **Keywords:**

Inflation, Household expenditures, Consumption baskets, Slovakia

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## 1 Introduction

Inflation, a key economic indicator, can impact households in varying ways depending on their consumption patterns and socio-economic characteristics. While aggregate inflation measures offer a general picture, they can mask important differences in how inflation affects individual households. As Hagemann (1982) pointed out, the diversity in household consumption patterns can lead to significant distributional effects, especially when the Consumer Price Index (CPI) is used to adjust incomes for large population groups. Therefore, understanding the variability in inflation rates across different households is crucial for informing and shaping effective economic policies.

The recent inflationary period, driven by the geopolitical pressures of the war in Ukraine beginning in 2022, has had profound and far-reaching effects on global economies, particularly in Central and Eastern Europe. This period of inflation is especially relevant for our analysis as it highlights the vulnerabilities of specific household groups to external shocks. The war exacerbated supply chain disruptions, energy price spikes, and food security concerns, leading to a sharp increase in living costs. In Slovakia, these inflationary pressures were felt unevenly across different socio-economic groups, making it crucial to examine how such a significant external shock differentially impacts households. By focusing on this turbulent period, our study provides insights into the heterogeneity of inflation experiences, revealing which households are most susceptible to price increases and thereby informing potential policy interventions that could mitigate the adverse effects of future economic disruptions.

This paper aims to explore the empirical distribution of individual inflation rates within a representative sample of Slovak households. By leveraging household budget survey data and a detailed breakdown of HICP inflation indices during the peak of the inflationary shock in January 2022, we calculate household-specific inflation rates and examine their relationship with various socio-economic factors. Our analysis reveals notable disparities in inflation experiences across different household types and consumption patterns observable in the data. The findings suggest that these variations in inflation exposure could inform more targeted social policies, aimed at reducing poverty and addressing income inequality.

## 2 Literature Review

One of the early studies analyzing household-level inflation rates in the United States are by Michael (1979) and Hagemann (1982). Michael (1979) used data from the 1960-61 Consumer Expenditure Survey (CES) and examined variations in household price indexes from 1967 to 1974. He found that while there were statistically significant differences in price indexes among certain population subgroups, no subgroup consistently experienced higher or lower price changes over time. Hagemann (1979), using the 1972-73 CES, also found a significant variability in inflation rates across different household types. The detailed comparison of retirees' price indexes with those of wage-earning households reveals that certain categories, such as food, fuel, and medical care, contribute to higher inflation for retirees. These insights highlight the importance of considering diverse household experiences when analyzing inflation and its impacts.

A recent study by Kaplan and Schulhofer-Wohl (2017) uses panel data from US households, detailing products and prices from all their retail purchases. The authors calculate household-level inflation rates, finding an annual interquartile range of 6.2–9.0 percentage points. Their analysis

reveals that most differences in inflation rates among households are due to variations in prices paid for the same goods, rather than differences in consumption bundles. Additionally, lower-income households tend to experience higher inflation, but most of the variation across households is uncorrelated with observable factors. Consequently, almost all the variability in inflation rates comes from differences in household-level prices rather than changes in aggregate inflation.

Similar analyses have been conducted for various countries, including Ruiz-Castillo et al. (1999) for Spain, Crawford and Smith (2002) for the United Kingdom, Lieu et al. (2004) for Taiwan, Oosthuizen (2007) for South Africa, Sugema et al. (2010) for Indonesia, Janský and Hait (2016) for the Czech Republic, Obinna (2020) for Nigeria, and, more recently, Menyhért (2022) for EU27 countries. While these studies differ in their specific conclusions, they consistently find significant variation in the inflation rates experienced by different households at any given time. Our paper contributes to this literature by presenting evidence from Slovakia during the recent inflationary shock, which peaked around January 2022. We extend the standard empirical approach used in the reviewed literature by employing simple regression analysis to explore the relationship between individual inflation rates and socio-economic characteristics. This allows us to uncover interesting partial correlations with more detailed household types, moving beyond the typical comparisons of average inflation rates between pensioner and wage-earning households or across various income percentiles.

### 3 Methodology and Data

Household-specific inflation rates are derived from household-specific expenditure weights, observed in the Slovak Household Budget Survey (HBS) dataset, and commodity-specific annual inflation rates based on HICP indexes for Slovakia available in the Eurostat Database. Let  $\pi_j$  denote the annual inflation rate, or growth rate of the price index of commodity group  $j = 1, \dots, J$ . Let  $E_{ij}$  denote monthly expenditures of household  $i$  on commodity  $j$ . The expenditure weight  $w_{ij}$  of household  $i$  on commodity  $j$  is defined as:

$$w_{ij} = \frac{E_{ij}}{\sum_{j=1}^J E_{ij}}, \quad (1)$$

and household-specific inflation rate  $\bar{\pi}_i$  is computed as:

$$\bar{\pi}_i = \sum_{j=1}^J w_{ij} \pi_j. \quad (2)$$

As the initial empirical result of our analysis we will depict the histogram of  $\bar{\pi}_i$ , which is relevant in itself, as it highlights the variability of individual inflation rates depending on heterogeneous consumption patterns in the representative sample of households. In the next part we will proceed with regression analysis, in which we relate the individual inflation rate to various socio-economic characteristics observed in the HBS dataset. Our empirical equation takes the simple form:

$$\bar{\pi}_i = \alpha_0 + X_i' A + \varepsilon_i, \quad (3)$$

where vector  $X_i$  contains dummies for three age categories (0-45, 46-63, and 63+), gender, labour market status of the household's head (employed, retired or other); regional dummies for eight NUTS 3 regions in Slovakia; seven household types based on the number of adults, children and retired persons in the household; and deciles of total consumption expenditure. Coefficient  $\alpha_0$  is the intercept, vector  $A$  contains regression coefficients corresponding to vector  $X_i$  and  $\varepsilon_i$  is the

independently and identically distributed zero-mean error term satisfying the exogeneity assumption  $E(\varepsilon_i|X_i) = 0$ . Regression coefficients are estimated by ordinary least squares (OLS) and heteroscedasticity-robust standard errors are considered.

In our empirical analysis, we utilize data from the 2020 Slovak Household Budget Survey (HBS), a representative sample comprising 4,633 households with detailed records of their consumption expenditures for a given month. In addition to consumption data, the survey provides socio-economic characteristics of households and their reference persons. A closer examination of our sample, focusing on the commodity structure of consumption, reveals that the median Slovak household allocates more than half of its total expenditures to food and housing costs (Table 1). At the same time, food and housing costs represent a higher share of the basket for poorer households in lower consumption deciles. These observations underscores the significance of investigating the impact of the recent inflationary shock in early 2022, predominantly driven by rising food and energy prices and having a higher impact on poorer households.

**Table 1 GPG by age categories in Czechia, hourly wages**

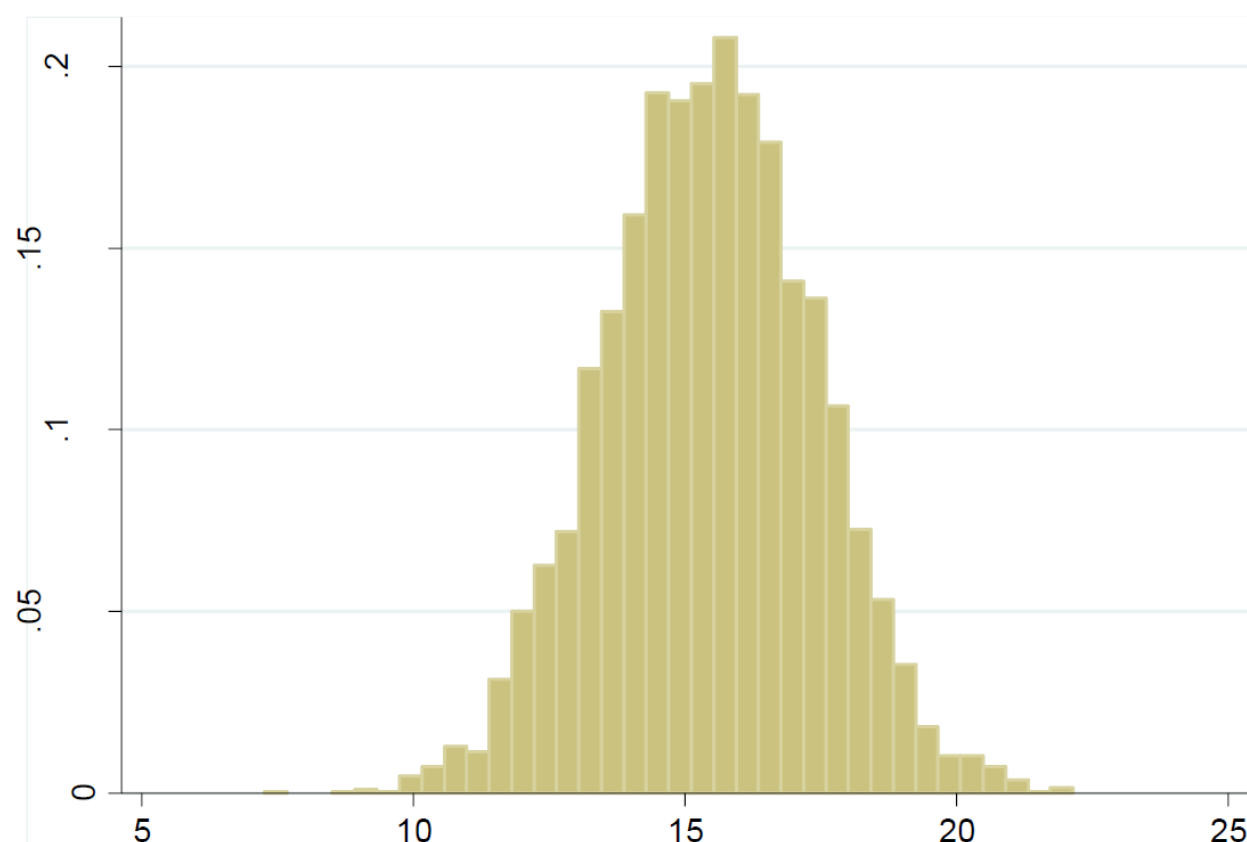
| Deciles of total consumption expenditure | Food Weight | Housing Weight | Food + Housing |
|------------------------------------------|-------------|----------------|----------------|
| 1                                        | 29.3%       | 38.7%          | 68.0%          |
| 2                                        | 28.7%       | 35.9%          | 64.6%          |
| 3                                        | 28.8%       | 30.8%          | 59.6%          |
| 4                                        | 27.1%       | 28.6%          | 55.7%          |
| 5                                        | 26.7%       | 27.0%          | 53.7%          |
| 6                                        | 25.9%       | 22.8%          | 48.7%          |
| 7                                        | 25.0%       | 21.2%          | 46.2%          |
| 8                                        | 24.3%       | 20.1%          | 44.4%          |
| 9                                        | 22.1%       | 16.6%          | 38.7%          |
| 10                                       | 17.7%       | 13.4%          | 31.1%          |

Sources: Household Budget Survey 2020, Slovak Statistical Office; own calculations.

As for price indexes used in the calculation of household-specific inflation rates, we use annual growth rates of HICP sub-indexes in a breakdown by 47 product categories for January 2022, available from Eurostat Database.

## 4 Results

Figure 1 below shows a histogram of individual inflation rates for households in the dataset. The empirical distribution has an average inflation rate of 15.4% and the whole range spans from the lowest individual inflation rate of 7.3% to the maximum recorded rate at 22.1%. Such a heterogeneous range of individual inflation rates across households can be problematic from a policy perspective because aggregate inflation measures, like the Consumer Price Index (CPI), may mask the significant differences in how inflation impacts different socio-economic groups. This can lead to inadequate policy responses that fail to address the specific needs of vulnerable households, such as those with lower incomes or those disproportionately affected by rising costs in essential goods like food and energy. To uncover the exposure of certain households to higher than average inflation rates, in what follows, we will test the partial correlation of a wide range of socio-economic characteristics with individual inflation rates.

**Figure 1 Histogram of household-specific inflation rates (annual % change, January 2022)**

Sources: Household Budget Survey 2020, Slovak Statistical Office; own calculations.

The estimated coefficients from equation (3) are presented in Table 2 below. Among regional dummies, significant differences in individual inflation rates were found for Trnavský and Žilinský regions compared to the base of Bratislavský, with an inflationary premium of up to 0.5 p.p. No statistically significant differences were observed in other regions. Household type, however, shows a strong correlation with inflation. Single-person households, set as the baseline in the analysis, experience the lowest inflation. Households with all children over 25 years old face the highest inflation, i.e. 1.2 p.p. higher than single-person households. Households with dependent children also face higher inflation than single-person households or childless couples. Next, education level also shows a significant correlation with inflation rates. Households with at least one person holding a higher education degree have 0.14 p.p. lower inflation than those with secondary education only, which served as the baseline category in our analysis. There is no significant difference between households with secondary education and those with only basic education. Further, age category of the household's reference person is also statistically significant. Households where the reference person is over 64 years old experience 0.41 p.p. higher inflation rate compared to those where the reference person is under 45, which was the baseline.

**Table 2 Determinants of household-specific inflation rates (OLS estimates)**

| Variable | Coefficient | Std. Err. | t-stat. | p-value |
|----------|-------------|-----------|---------|---------|
|----------|-------------|-----------|---------|---------|

|                                             |           |       |        |       |
|---------------------------------------------|-----------|-------|--------|-------|
| NUTS 3 regions (base: Bratislavský kraj)    |           |       |        |       |
| Trnavský                                    | 0.494***  | 0.105 | 4.70   | 0.000 |
| Trenčiansky                                 | -0.014    | 0.102 | -0.14  | 0.889 |
| Nitriansky                                  | 0.064     | 0.097 | 0.66   | 0.511 |
| Žilinský                                    | 0.312***  | 0.101 | 3.09   | 0.002 |
| Banskobystrický                             | 0.079     | 0.099 | 0.80   | 0.421 |
| Prešovský                                   | -0.063    | 0.099 | -0.64  | 0.522 |
| Košický                                     | -0.135    | 0.097 | -1.40  | 0.163 |
| Household composition (base: Single person) |           |       |        |       |
| 1 parent, children <25 years old            | 0.616***  | 0.164 | 3.76   | 0.000 |
| 1 parent, children ≥25 years old            | 0.795***  | 0.119 | 6.66   | 0.000 |
| Couple without children                     | 0.578***  | 0.096 | 6.02   | 0.000 |
| Couple, children <25 years old              | 0.954***  | 0.104 | 9.18   | 0.000 |
| Couple, children ≥25 years old              | 1.204***  | 0.122 | 9.84   | 0.000 |
| Other type                                  | 1.020***  | 0.115 | 8.87   | 0.000 |
| Education (base: Secondary)                 |           |       |        |       |
| Primary                                     | -0.030    | 0.062 | -0.48  | 0.634 |
| Tertiary                                    | -0.143**  | 0.063 | -2.27  | 0.023 |
| Age (base: 0-45 years)                      |           |       |        |       |
| 46-63 years                                 | 0.052     | 0.062 | 0.84   | 0.403 |
| 64+ years                                   | 0.414***  | 0.145 | 2.86   | 0.004 |
| Consumption deciles (base: 1)               |           |       |        |       |
| 2                                           | -0.205    | 0.141 | -1.45  | 0.146 |
| 3                                           | -0.521*** | 0.143 | -3.65  | 0.000 |
| 4                                           | -0.79***  | 0.143 | -5.54  | 0.000 |
| 5                                           | -0.838*** | 0.144 | -5.83  | 0.000 |
| 6                                           | -0.994*** | 0.147 | -6.78  | 0.000 |
| 7                                           | -1.216*** | 0.146 | -8.34  | 0.000 |
| 8                                           | -1.336*** | 0.148 | -9.06  | 0.000 |
| 9                                           | -1.511*** | 0.15  | -10.10 | 0.000 |
| 10                                          | -2.342*** | 0.149 | -15.69 | 0.000 |
| Economic activity (base: employed)          |           |       |        |       |
| retired                                     | 0.611***  | 0.137 | 4.46   | 0.000 |
| other                                       | 0.231     | 0.142 | 1.63   | 0.102 |
| Female reference person                     | 0.149**   | 0.058 | 2.57   | 0.010 |
| Constant                                    | 15.328*** | 0.146 | 104.70 | 0.000 |
| Observations                                | 4633      |       |        |       |
| R <sup>2</sup>                              | 0.193     |       |        |       |

Sources: Household Budget Survey 2020, Slovak Statistical Office; own calculations.

Note: \*, \*\*, \*\*\* denote statistical significance at 10%, 5% and 1% levels based on robust standard errors.

Additionally, household consumption divided into deciles shows a clear trend where higher consumption correlates with lower inflation. The highest consumption decile has 2.34 p.p. lower inflation than the lowest, indicating that households with higher consumption allocate a smaller percentage of their budget to high-inflation categories like food and housing. Subsequently, the primary economic activity of the household's reference person also influences inflation. Households with a retired reference person experience 0.61 p.p. higher inflation, demonstrating a strong

correlation between inflation and the economic activity of the reference person. Finally, gender of the reference person shows that households where the reference person is female have 0.15 p.p. higher inflation. However, this indicator is not too straightforward to interpret due to the presence of both genders in many households.

To summarize the key empirical findings from the above analysis, we can conclude that significant variations in individual inflation rates are observed across different household characteristics. The two most influential factors driving inflationary differences in the sample are household type and total consumption expenditure, with the latter serving as a proxy for income levels. The negative correlation with total consumption likely stems from wealthier households allocating a smaller portion of their budget to high-inflation categories like food and energy. In contrast, factors such as regional differences in consumption patterns, education levels, age categories, gender, and the labor market status of the reference person contribute less to explaining the observed inflationary heterogeneity.

## 5 Conclusion

In this paper, we explored the statistical relationship between household-specific inflation rates and the socio-economic characteristics of Slovak households. We employed detailed consumption data from the Slovak Household Budget Survey to create individualized consumption basket weights and used price indices, categorized into 47 commodity groups, to calculate household-specific inflation rates. Our analysis of the empirical distribution of these rates among Slovak households revealed that the lowest observed individual inflation rate was 7.3%, while the highest reached 22.1%, compared to the official HICP inflation rate of 15.1% in January 2023. Regression analysis identified significant partial correlations between inflation rates and socio-economic characteristics. Household composition and total consumption expenditure emerged as the most influential factors driving inflationary differences. The results indicate that higher household-specific inflation rates are associated with older or retired reference persons, lower total household expenditure (suggesting poorer economic status), and the presence of children in the household.

These findings align with previous studies conducted in various countries, which similarly concluded that a household's economic indicators are negatively correlated with inflation rates. The outcomes of this research have significant implications for the design and implementation of social policies aimed at poverty alleviation, emphasizing the need to consider variations in household consumption patterns.

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