

Inflation Inequality in the Czech Republic

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This project employs Czech Household Budget Survey and Consumer Price Index data to create consumer price indices for various population subgroups in the Czech Republic. We find that subgroup-specific inflation rates are very similar to the inflation rate for all the non-elderly population, with the exception of single-parent households, which experienced a higher inflation rate in 2022 than did the other subgroups. However, the difference was reasonably modest. Importantly, we found that inflation issuing from housing, water, electricity, gas and other fuels is significantly higher for low-income and single-parent households than for high-income and two-parent households. The difference is particularly significant for single-parent households, for which inflation due to increases in housing, water, electricity, gas and other fuel costs represents 40.15 percent of their overall inflation burden compared to 28.44 percent for two-parent households. This finding suggests that the recent increases in electricity and gas prices may exert particularly harmful effects on single-parent households unless the government provides the support necessary to mitigate the adverse effects of rising prices. While all households are being affected by rising living costs, single-parent and low-income households should be prioritized in terms of support. In addition, we calculated that for low-income and single-parent households, the total loss of purchasing power due to inflation amounts to CZK 15,179 and CZK 20,445, respectively.

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1. Introduction

This project aimed to create contemporary consumer price indices (CPIs) for vulnerable (in terms of income and family composition) population groups in the Czech Republic. It is a well-known fact that households with differing incomes and family compositions differ in terms of the allocation of consumption expenditure between various commodities. For example, low-income households in the Czech Republic spend higher shares of their expenditure on housing and food than do high-income households. Hence, when housing or food prices rise, households that spend a relatively larger share of their expenditure on housing and food will be hit harder in terms of the increase in their living costs. Therefore, such differences in the share of expenditure between various population subgroups has the potential to result in inflation inequality. The measurement of the inflation experiences of vulnerable population groups assists in forming an understanding of whether the benefits provided by the Czech government are sufficient to mitigate the consequences of both the COVID-19 epidemic and, more recently, the Russian-Ukrainian war-related inflation faced by vulnerable populations. The deeper analysis of group-specific inflation rates will also help policymakers to better identify the most affected population groups and to design and implement more efficient policies.

We employed data from the Household Budget Survey (HBS), which provides information on the shares of expenditure of twelve broad product categories. It also includes information on a range of household characteristics including income, education level, marital status and the number of children, which we used to measure the shares of expenditure of various product categories for the selected population subgroups. Unfortunately, HBS data provides information only on the annual average expenditure shares of specific product categories and does not provide information on the prices of the products considered. Therefore, we combined HBS data with detailed Consumer Price Index (CPI) data aimed at tracking changes in the prices of the various product categories and at calculating the inflation levels for each of the targeted population subgroups.

We determined that subgroup-specific inflation rates are very similar to the inflation rate for all the non-elderly population, with the exception of single-parent households, which experienced a higher inflation rate in 2022 than did the other subgroups. However, the difference was reasonably modest. Importantly, we found that inflation issuing from housing, water, electricity, gas and other fuels is significantly higher for low-income and single-parent households than for high-income and two-parent households. The difference is particularly significant for single-parent households, for which inflation due to increases in housing, water, electricity, gas and other fuel costs represents 40.15 percent of their overall inflation burden compared to 28.44 percent for two-parent households. This finding suggests that the recent increases in electricity and gas prices may exert particularly harmful effects on single-parent households unless the government provides the support necessary to mitigate the adverse effects of rising prices.

In addition, we calculated the extent to which inflation is impacting the purchasing power of the various population subgroups considered. Our findings suggest that the average household suffered a loss in purchasing power of CZK 21,214 from April 2021 to April 2022. Increases in electricity, gas and other fuel prices accounted for 23 percent of the total loss of purchasing power for the average household. In comparison, households with children suffered a loss of purchasing power of CZK 18,501 from April 2021 to April 2022. Concerning low-income (the lowest income quintile) and single-parent households, the loss of purchasing power was relatively modest, i.e. CZK 15,179 and 20,445, respectively. Therefore, the one-off CZK 5,000 subsidy for all children provided by the Czech government was not sufficient to compensate for the loss of purchasing power experienced by many households.

The remainder of the study is organized as follows. Section 2 provides a brief review of existing literature on inflation inequality across various population subgroups, and provides cross-country comparisons of inflation mitigation policies. Section 3 describes the methodology and the data we employed in the analysis, and section 4 reports our main findings and discusses the implications in the context of the Czech Republic. The study concludes with section 5.

2. Literature Review

2.1 Empirical Evidence of Inflation Inequality

The notion that different population subgroups experience different inflation levels is not new. Amble and Stewart (1994) investigated whether the CPI differs for elderly people in the US, and found that the consumer price index was higher for elderly Americans than for other subgroups over the period 1987 to 1993. They attributed this difference to the fact that elderly people usually spend higher amounts on healthcare. Similarly, Hobijn and Lagakos (2003, 2005) investigated inflation inequality across households in the US between 1987 and 2001. They determined that elderly people experienced 0.38 percentage points higher inflation than the general population. They also found that low-income

households were particularly sensitive to changes in gasoline prices. In addition, the authors found that households with young children experienced lower inflation than other household types. According to Hobijn and Lagakos (2003, 2005), this finding was driven by lower than average healthcare and education costs.

McGranahan and Paulson (2005) used Consumer Expenditure Survey data from 1982 to 2004 combined with item-specific Consumer Price Index data to construct monthly inflation measures for various demographic groups in the US. In line with the evidence provided by previous studies, they discovered that elderly people experienced higher inflation than the average population. They also found that the variability of inflation is lower for educated populations and higher for poor and uneducated populations. Garner et al. (1996) investigated whether inflation differs across households from different income groups. They find that during the period 1984 to 1994, there was no significant difference in inflation rates between the poor and the general population in the US. Crawford and Smith (2002) found that over the period 1976 to 2000, the poorest decile of the UK population experienced 0.3 percentage points lower inflation than did the highest income decile. In contrast, Kaplan et al. (2017) used scanner data to estimate inflation across various types of households. They find that low-income households experience higher inflation than does the general population in the US. However, the difference was found to stem from the variability in household-level prices relative to average prices rather than from the variability in aggregate inflation.

Argente and Lee (2021) constructed income-specific price indices for the period 2004 to 2016 in the US. They found that the lowest quartile of the income distribution range experienced a significantly higher annual inflation rate than did the highest quartile; moreover, the gap in inflation rates observed for these two income groups widened during the Great Recession period. The authors also found that product quality substitution and changes in shopping behavior explained almost a half of the observed gap in inflation. Similarly, using scanner data from the US retail sector, Jaravel (2019) found that for the bottom income quintile, retail product annual inflation was 0.66 percentage points higher than for the top income quintile. The author further determined that product innovations led to inflation inequality in the United States over the period 2004 to 2015.

In the context of the current surge in inflation, Claeys and Guetta-Jeanrenaud (2022) found that low-income households are suffering from price increases to a disproportionate degree. Employing Household Budget Survey data from Belgium, Italy and France, the authors that the inflation rates faced by low-income individuals were 1.4, 1.7, and 0.3 pp. higher in December 2021 than those faced by high-income individuals, respectively.

2.2 Cross-Country Comparisons of Inflation Mitigation Policies

This section of the paper provides a review of the various measures introduced by the governments of EU member states, the UK and Norway aimed at protecting their populations from the effects of the recent acceleration in inflation rates. EU countries have implemented a range of measures aimed at tackling the increase in food and energy prices, with **expenditure on these policies amounting to almost €180bn over the period September 2021 to May 2022 (Březovská et al., 2022).**

According to the classification proposed by Sgaravatti, Tagliapietra, and Zachmann (2021), seven main national policies can be identified targeted at protecting the population and businesses from price increases. They include transfers to vulnerable groups, reduced energy tax/VAT rates, retail price regulation, wholesale price regulation, the mandate to state-owned firms, windfall profit tax/regulation and support for businesses. Bethuynne et al. (2022) categorized inflation mitigation measures in the form of two broad types of policies – price and income policies. Price policies are aimed at decreasing the final energy price for households and/or firms, and include measures such as reductions in indirect taxation and levies, subsidies, direct price regulation and social tariffs. Income policies include transfers to vulnerable population subgroups usually in the form of cash or energy vouchers. Other measures include support for firms operating in energy-intensive industries and windfall profit taxes. Table 1 presents a list of policies aimed at mitigating the effects of inflation together with the EU countries (supplemented by the UK and Norway) that have implemented or have proposed the introduction of the respective policies.

Transfers to vulnerable groups comprise the most common measures introduced in EU countries to date¹. The majority of EU member states began to introduce such transfers in the autumn of 2021 and supplemented them with support for firms following the Russian invasion of Ukraine. For instance, on September 15, 2021, the French government introduced a **one-off €100 payment to the 5.8 million households** that had already received energy vouchers. A month later,

¹ However, in terms of the budgetary costs of the various inflation mitigation policies, the governments of EU member states have spent more, on average, on price policies than on income policies (Bethuynne et al., 2022).

the measure was extended to include households that earn less than €2,000 per month net (around 38 million people). Similarly, in January 2022, the German government introduced targeted measures aimed at helping vulnerable households to cover their heating bills. Furthermore, low-income households are entitled to receive one-off grants over the summer to help with the payment of energy bills (Sgaravatti, Tagliapietra, and Zachmann, 2021). Other transfers include an increased commuter allowance (a €135 lump-sum payment for students and vulnerable citizens), increased payments for the children of poor families (an extra €20/month per child), and a €100 subsidy for unemployed persons (Březovská et al., 2022).

Table 1 National Inflation Mitigation Policies

#	Type of Policy	Countries that have implemented or proposed the introduction of the respective policy
1.	Transfers to vulnerable groups (incl. energy vouchers)	All EU countries (except for Bulgaria and Hungary) Energy vouchers: France, Slovenia, Greece, Spain, Romania
2.	Reduced energy tax/VAT	All EU countries (except for Bulgaria, Denmark, Greece, Lithuania, Luxembourg), the UK and Norway
3.	Retail price regulation	Belgium, Bulgaria, Czech Republic (proposed), Estonia, Lithuania (proposed), Poland, Romania, Spain, and the UK
4.	Wholesale price regulation	France, Portugal, Spain
5.	Mandate to state-owned firms	Cyprus, France, Greece, and Portugal
6.	Wind fall profits tax/regulation	Bulgaria, Germany (proposed), Romania, Slovakia, Slovenia (discussed), Spain, and the UK
7.	Support for businesses	Austria, Bulgaria, Czech Republic (discussed), Estonia, Finland, Greece, Italy, Norway, Slovenia, Spain, and the UK

Source: Listed according to Sgaravatti, Tagliapietra, and Zachmann (2021).

The regulation of retail and wholesale prices, which has been introduced in seven and three EU member states, respectively (see the list of countries in the second and third rows of Table 1), is less popular than income policies. Belgium, Spain and Portugal proposed the introduction of a price cap on gas. Concerning Spain and Portugal, which are considered "energy islands" due to their low level of energy interconnection with Northern Europe, the European Commission agreed to a gas price cap at a fixed amount of €50/MWh for 12 months. As a result, the price of gas will be halved for 40 percent of Spanish and Portuguese consumers (Tidey, 2022). In addition, certain countries (e.g. Spain, Estonia, Greece and Norway) announced a subsidy for the electricity consumption of various groups of households (see the detailed descriptions of the various policies provided by Sgaravatti, Tagliapietra, and Zachmann, 2021). Many European countries (with the exception of Bulgaria, Denmark, Greece, Lithuania and Luxembourg) introduced a reduction in energy taxation aimed at decreasing the costs incurred by companies and increasing the disposable income of households. For instance, the French government significantly reduced the tax on electricity (from €22.50 per megawatt hour to €1 for households and 50 cents for businesses) for the period February 2022 to January 2023. However, it has been suggested that reducing energy taxes may act to decrease the level of motivation of households and companies to reduce their electricity and fuel consumption (Arnold, 2022), while putting extra pressure on national budgets that are already severely strained by the COVID-19 pandemic (Amaglobeli et al., 2022).

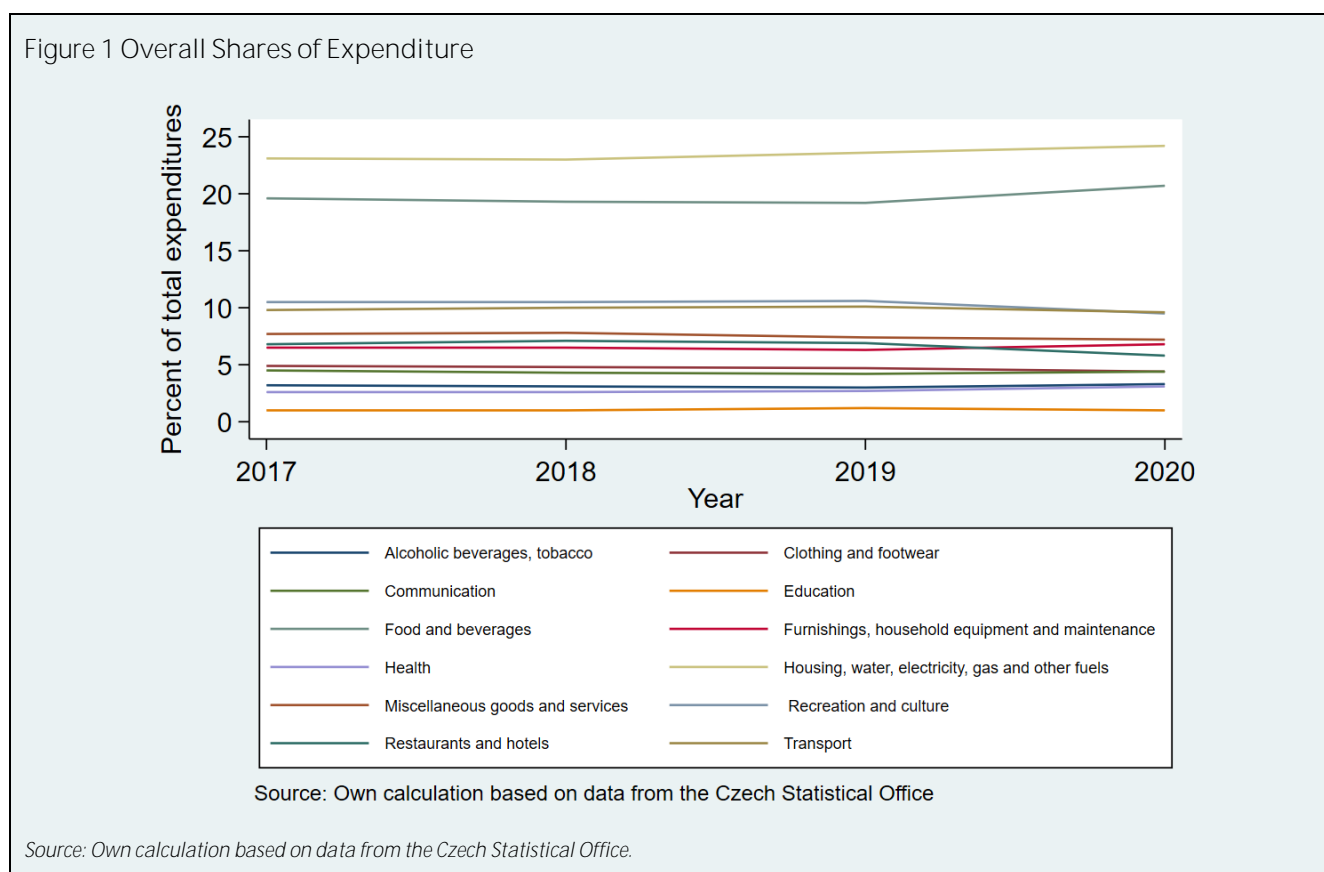
Both income and price policies have their advantages and disadvantages. Compared to income policies, price policies may act to disincentivize consumers in terms of increasing their energy efficiency or replacing traditional energy sources with alternative approaches. In addition, income policies can be more easily targeted at the needs of the most vulnerable households. However, it has been suggested that the implementation of targeted income policies is more difficult than price policies (Bethuynne et al., 2022). Using E-QUEST, a sector-disaggregated version of the Commission's QUEST model, Bethuynne et al. (2022) estimated the social and environmental impacts of price, targeted and non-targeted income policies. Their findings indicate that while all three types of policies are effective in mitigating inflation costs, income policy measures (targeted transfers) are preferable due to their significantly lower impact on greenhouse gas emissions than that of fuel tax cuts. In addition, the authors determined that tax reductions on fossil energy induce higher emissions from the burning of fossil fuels; moreover, they also act to increase reliance on fossil fuels and encourage the consumption of fossil fuel-intensive durable goods. Consequently, tax reductions may result in increasing the EU's reliance on fossil fuel imports and thus render the achievement of the climate targets of the European Green Deal significantly less feasible (Bethuynne et al., 2022).

3. Data and Methodology

Following McGranahan and Paulson (2005), we calculated the monthly consumer price indices (CPI) for each of the target population subgroups based on shares of expenditure on various product categories as reported by the Czech Household Budget Survey. We applied the following equation to measure inflation in month t for population subgroup k :

$$\pi_{t,k} = \sum_{j=1}^m W_{j,t-12,k} \pi_{j,t}$$

Where j represents a specific product category, m signifies the various product categories, $\pi_{j,t}$ is the year-on-year inflation rate for item j and $W_{j,t-12,k}$ is the share of expenditure of item j for members of group k twelve months previously. The expenditure weighting of each product category $W_{j,t-12,k}$ is available from the Czech Household Budget survey for the years 2017 to 2020. The HBS comprises a nationally representative household survey that covers all the regions of the Czech Republic. Unfortunately, the shares of expenditure published in the public-use HBS data are updated only yearly; therefore, we assumed that the product category shares remained constant over a given year. Moreover, since the shares of expenditure are available only up to 2020, we assumed that the product category shares did not change from 2020 to 2021. Figure 1 provides summary statistics on the shares of expenditure with respect to 12 broad product categories for the overall population.



Overall, the shares of expenditure remained relatively stable over time. From 2019 onwards, an increase is evident in the shares of expenditure on food and non-alcoholic beverages and housing, water, electricity, gas and other fuels. In contrast, the shares of expenditure on restaurants, hotels, recreation and culture decreased. These changes in shares of expenditure were most likely driven by the temporary change in lifestyle caused by the COVID-19 pandemic and restrictions on movement between countries. We derived the CPIs on the various product categories from the Consumer Price Index data provided by the Czech Statistical Office (CZSO). We then matched the inflation rates and expenditure categories based on the 12 product category labels provided by the CPI.

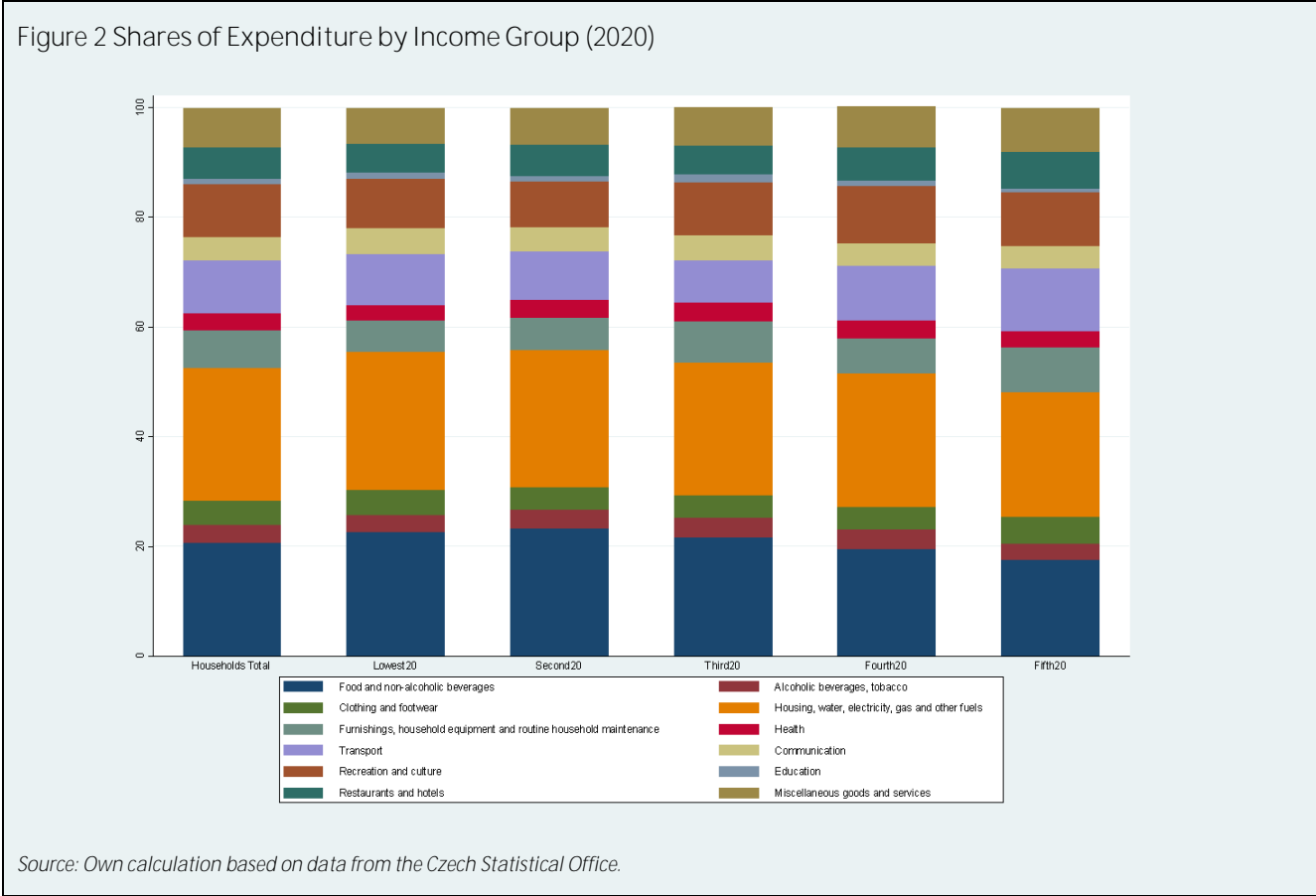
We employed the Household Budget Survey (HBS), which provides information on household characteristics including income, family type and the number of children, to measure the shares of expenditure on the various product categories for ten population subgroups that were defined on the basis of income quantiles, the number of children (households

with children, households with one child and households with two children), and family types (single parent and nuclear families). It is important to note that for the purposes of our study, we assumed² that each population subgroup faced the same prices as all the other population subgroups for each of the product categories. Admittedly, this is a restrictive assumption since it is likely that each of the broad product categories were characterized by significant price heterogeneity.

Furthermore, it is probable that some of the targeted population subgroups are more sensitive to price changes than others; hence, the substitution bias may be more significant for the former group. For example, low-income households may be more sensitive to price changes than high-income households. As a result, the substitution bias may be greater for low-income households. Unfortunately, however, we were restricted to the use of just one set of price indices for all the population subgroups since the Czech Statistical Office provides only one set of prices for each product category. A more detailed analysis will be possible when consumer-level scanner data becomes available. Since we applied just one set of prices for each product category, the differences in the inflation rates across the population subgroups stemmed from differences in the average shares of expenditure.

4. Results and Discussion

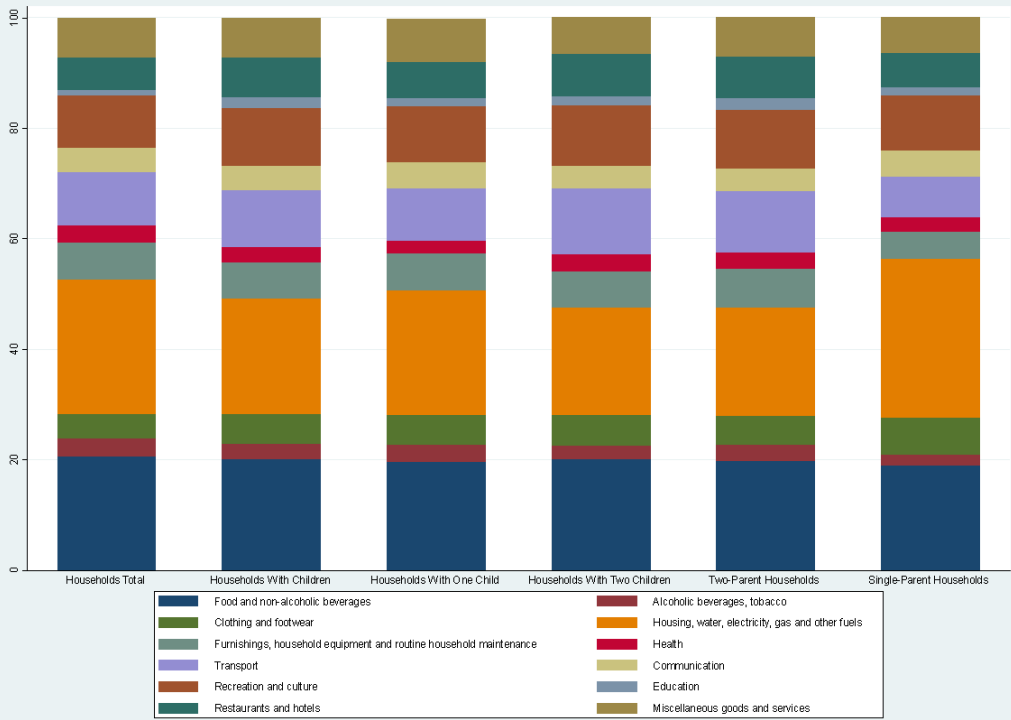
As mentioned above, the only source of potential inflation inequality stemmed from differences in the shares of expenditure across the population subgroups. Therefore, we began our analysis by investigating how the various population subgroups differed in terms of their shares of expenditure on the defined product categories. Figure 2 presents the average yearly shares of expenditure on twelve product categories for five population subgroups based on 2020 data income quantiles.



² Similar assumptions are made by most previous studies that constructed group-specific inflation rates (see, for example, McGranahan and Paulson, 2006).

The lowest and second-lowest household quantiles (in terms of income) spent relatively larger shares of their expenditure on food and non-alcoholic beverages and on housing, water, electricity, and other fuels than did the fourth and fifth income quantiles. In contrast, high-income households spent a relatively larger share of their expenditure on furnishing and household maintenance, restaurants and hotels, and recreation and culture. This suggests that an increase in the prices of essential goods such as food, electricity and gas exerts a more negative effect on low-income households. In terms of family characteristics, single-parent households spent a significantly larger share of their expenditure on housing, water, electricity and other fuels, suggesting that single-parent households will be more affected by the recent increases in electricity and fuel prices (Figure 3).

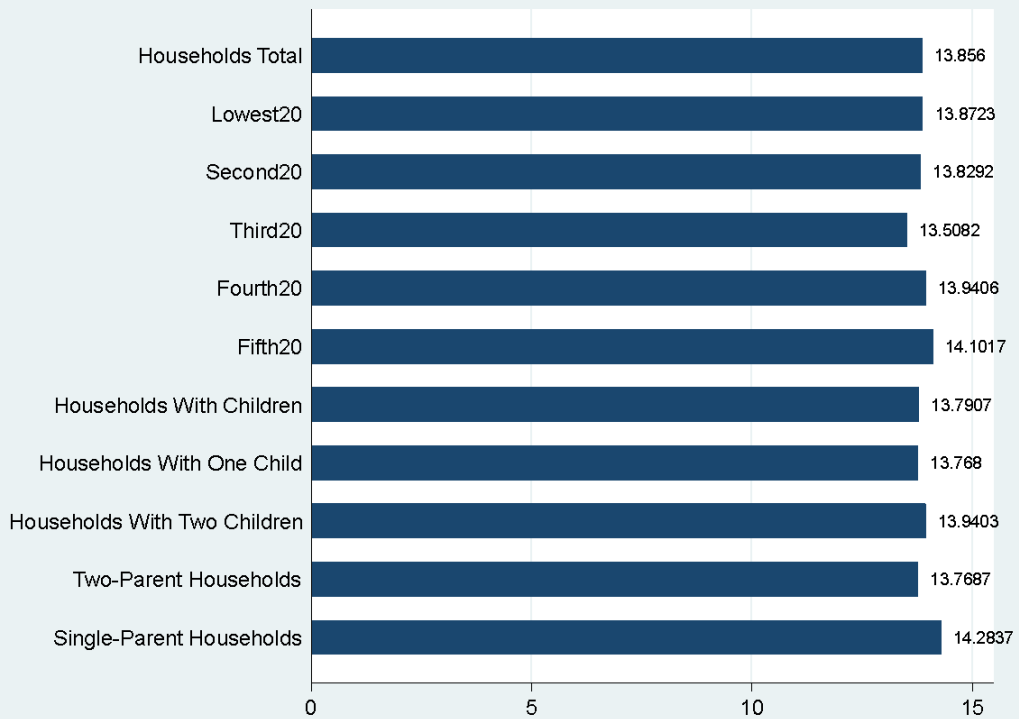
Figure 3 Shares of Expenditure by Family Characteristics (2020)



Source: Own calculation based on data from the Czech Statistical Office.

The next stage of the analysis consisted of the calculation of the year-on-year change in the CPI for each of the population subgroups and their comparison with the cumulative inflation rate for the total non-elderly population of the Czech Republic. Figure 4 presents the results in graph form. It is clear that single-parent households experienced higher inflation in 2022 than did two-parent households. However, the difference was reasonably modest 0.515 percentage points. Overall, the population subgroup-specific inflation rates were found to be very similar to those of the total non-elderly population.

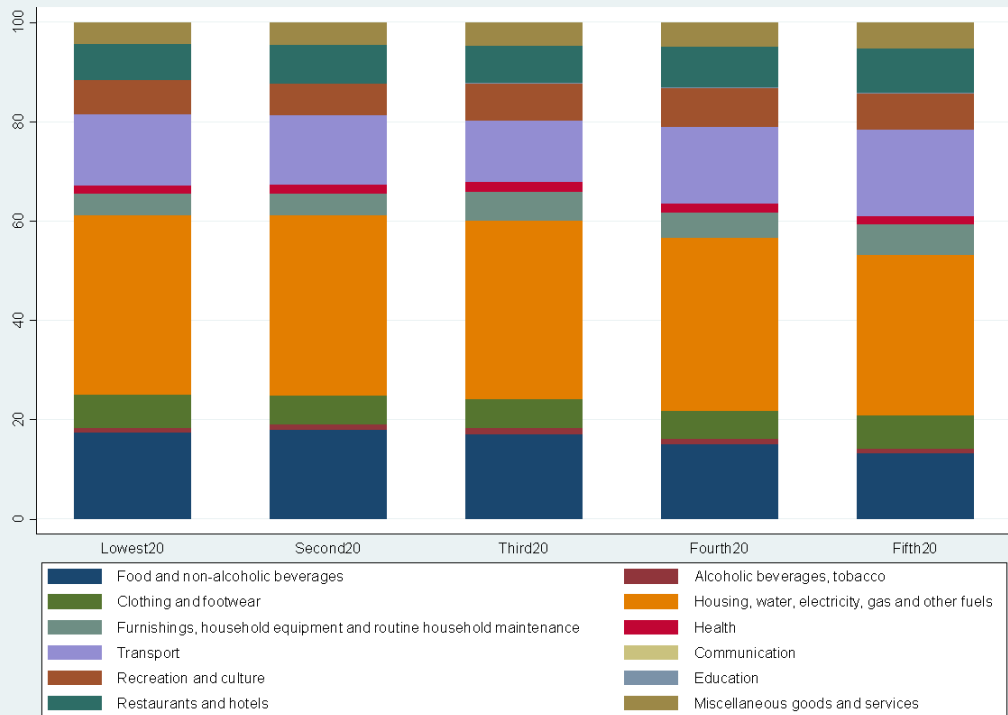
Figure 4 Year-on-Year Changes in the Consumer Price Index by Household Income Quantiles and Family Characteristics (April 2022)



Source: Own calculation based on data from the Czech Statistical Office.

Following the methodology proposed by McGranahan and Paulson (2005), we subsequently applied Equation 1 to calculate the contributions to the CPI of the various product categories for the defined population subgroups. Figures 5 and 6 illustrate the contributions to the year-on-year change in the CPI from twelve product categories for the population subgroups based on income and family characteristics, respectively. It is clear that inflation from food and non-alcoholic beverages was considerably higher for the low-income (those in the lowest and second income distribution quantiles) than for the high-income households. Conversely, the contributions to the year-on-year change in the CPI stemming from increases in the prices of non-essential goods and services such as furnishings, household equipment, restaurants, and recreation was higher for the high-income and two-parent households than for the low-income and single-parent households.

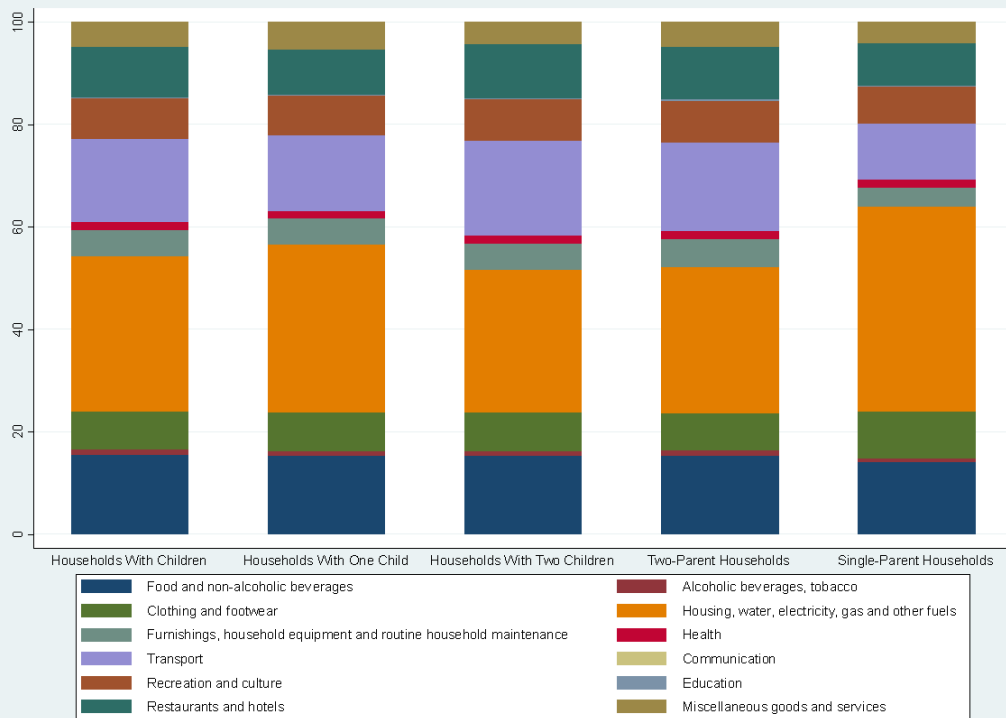
Figure 5 Contributions to the Year-on-Year Change in the CPI from the Considered Product Categories for Five Population Subgroups Based on Income Quantiles (April 2022)



Source: Own calculation based on data from the Czech Statistical Office.

More importantly, the contribution to the CPI of increases in the prices of housing, water, electricity, gas and other fuels was found to be significantly greater for low-income and single-parent households than for high-income and two-parent households. The difference was more pronounced for single-parent households, for which inflation from housing, water, electricity, gas and other fuels accounted for around 40.15 percent of the overall inflation burden compared to approximately 28.44 percent for two-parent households. This finding suggests that the recent increases in electricity and gas prices may exert particularly harmful effects on single-parent households unless the government provides the support necessary to mitigate the adverse effects of rising prices.

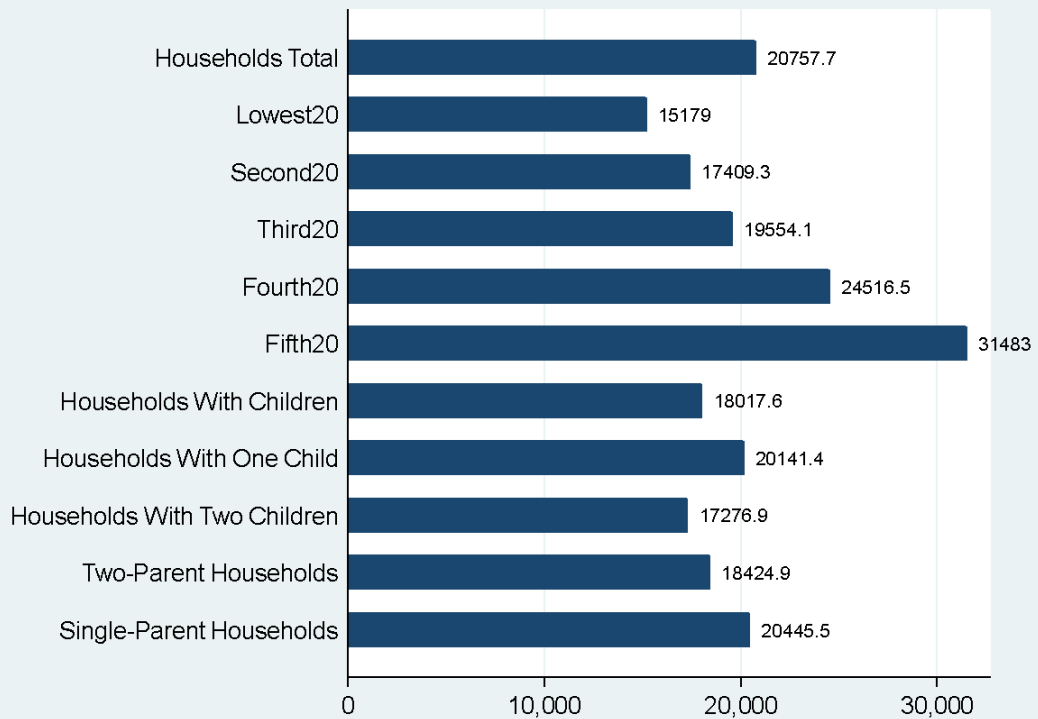
Figure 6 Contributions to the Year-on-Year Change in the CPI from the Considered Product Categories for the defined Population Subgroups Based on Family Characteristics (April 2022)



Source: Own calculation based on data from the Czech Statistical Office.

We also calculated the extent to which inflation impacted the purchasing power of the various population subgroups. Figure 7 presents the decline in purchasing power due to increases in overall prices and the prices of electricity, gas and other fuels for the population subgroups based on income quantiles and household characteristics. The results suggest that the average household lost CZK 20,757 in purchasing power from April 2021 to April 2022. In comparison, households with children lost CZK 18,018 in their overall purchasing power from April 2021 to April 2022. For low-income (lowest income quintile) and single-parent households, the loss of purchasing power was relatively modest, i.e. CZK 15,179 and 20,445, respectively. Therefore, the one-off CZK 5,000 subsidy for all children provided by the Czech government was not sufficient to compensate for the loss of purchasing power experienced by lower-income households.

Figure 7 Loss of Purchasing Power over the Last 12 Months (from April 2021 to April 2022) by Income Groups and Family Characteristics



Source: Own calculation based on data from the Czech Statistical Office.

5. Conclusion and Policy Recommendations

In conclusion, employing Czech Household Budget Survey and Consumer Price Index data, we calculated contemporary consumer price indices for differing (in terms of income and household characteristics) population subgroups in the Czech Republic. We determined that the subgroup-specific inflation rates were very similar to that of the total non-elderly population. The only exception concerned single-parent households, which experienced higher inflation in 2022 than did the other subgroups. However, the difference was reasonably modest. Importantly, we found that inflation issuing from housing, water, electricity, gas and other fuels is significantly higher for low-income and single-parent households than for high-income and two-parent households. The difference is particularly significant for single-parent households, for which inflation due to increases in housing, water, electricity, gas and other fuel costs represents around 40 percent of the overall inflation burden compared to approximately 28 percent for two-parent households. In addition, we calculated the total loss of purchasing power due to inflation, which revealed that low-income and single-parent households suffered losses of CZK 15,179 and CZK 20,445, respectively.

From the policy perspective, our findings and evidence from previous papers suggest that:

- (i) the recent increases in electricity and gas prices may exert detrimental effects on single-parent households unless the government provides the support necessary to mitigate the adverse effects of rising prices;
- (ii) the total losses of purchasing power for low-income and single-parent households stand at CZK 15,179 and CZK 20,445, respectively. The one-off subsidy of CZK 5,000 for every child provided by the Czech government is, therefore, not sufficient to compensate for the loss of purchasing power experienced by low-income and single-parent households. Compensation for declines in purchasing power should, instead, be addressed with long-term rather than one-off solutions;

- (iii) compensation measures for the loss of purchasing power should combine a range of responses to inflation. For instance, subsidies for low-income households with children could be combined with energy vouchers or cash transfers to help with electricity costs;
- (iv) EU governments have introduced new measures or reinforced previously introduced inflation mitigation policies that can be broadly divided into price and income policies. While price policies are effective in decreasing prices, they may act to disincentivize consumers and firms from improving their energy efficiency and/or shifting to alternative energy sources, thus leading to an increase in greenhouse gas emissions and increased reliance on imported fossil fuels. Therefore, targeted income policies such as cash transfers and energy vouchers targeted at vulnerable population subgroups should be the preferred option (Bethuyne et al., 2022);
- (v) the non-uniform impacts of inflation on the purchasing power of various population subgroups suggest that compensation for the loss of purchasing power should also be non-uniform. Moreover, compensation for the loss of purchasing power should target the most vulnerable groups in society, e.g. low-income and single-parent households.

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Abstract in Czech

Inflační nerovnost v České republice

Studie si klade za cíl vypočítat indexy spotřebitelských cen pro různé skupiny domácností České republiky. Pracujeme s daty Statistiky rodinných účtů a indexem spotřebitelských cen. Zjistili jsme, že míry inflace specifické pro jednotlivé skupiny českých domácností jsou velmi podobné míře inflace pro celkovou populaci nezahrnující seniory. Jedinou výjimkou jsou domácnosti rodičů-samoživitelů, které v roce 2022 čelí vyšší inflaci. Rozdíl je však relativně nízký. Dále zjišťujeme, že inflace v kategorii bydlení, voda, elektřina, plyn a další energie je vyšší u domácností s nízkými příjmy a u domácností rodičů-samoživitelů než u domácností s vyššími příjmy a domácností se dvěma rodiči. Největší rozdíl je viditelný u domácností s jedním rodičem, pro které rostoucí ceny bydlení, vody, elektřiny, plynu a dalších energií představují 40,15 % celkové inflace oproti 28,44 % u úplných rodin. Rápidní zvýšení cen elektřiny a plynu bude mít proto závažné dopady zvláště na domácnosti rodičů-samoživitelů, pokud jim stát neposkytne nezbytnou pomoc. Přestože rostoucími životními náklady jsou zasaženy všechny domácnosti, ve vládní pomoci by měly být upřednostněny domácnosti samorodičů a domácnosti s nízkými příjmy. Dále jsme vypočítali snížení kupní síly jako důsledek inflace pro nízkopříjmové domácnosti a domácnosti rodičů-samoživitelů ve výši 15 179 Kč, respektive 20 445 Kč.



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