4/2022

VÚPSV rilsa
VÝZKUMNÝ ÚSTAV PRÁCE A SOCIÁLNÍCH VĚCÍ
RESEARCH INSTITUTE FOR LABOUR AND SOCIAL AFFAIRS

POLICY PAPER

Household-specific Energy Expenditure and Inflation in the Czech Republic

Filip Mandys

The Czech Republic is currently suffering from one of the highest inflation rates in Europe. While a large share of the country's inflation is due to rising energy prices, the professional literature currently lacks any information on the impacts of energy inflation on different consumer groups. Therefore, this policy paper analyses household-specific energy expenditure and inflation employing a novel dataset and via the application of weighted least squares and weighted average methodologies. The results indicate that the energy expenditure share of total expenditure is most affected by the number of children and pensioners in the household, i.e. increases of 6.6% and 24% respectively for each extra child or pensioner. This result was found to apply particularly to gas and automobile fuel expenditure. An increase in income of one quintile decreases the share of energy expenditure by 3.6%, with the decrease being most pronounced for gas. Furthermore, an increase in the number of person living in flats lowers electricity expenditure by 2.1%, possibly due to the higher energy efficiency of flats. The average Czech household faced an energy price increase of 45.2% between June 2021 and 2022. The groups that faced the highest inflation in percentage terms comprised the self-employed, inhabitants of large cities, high income earners, and single-parents. However, in absolute terms, the average household suffered from an annual loss of CZK 10 000 of purchasing power per capita, with the most affected groups being pensioners, inhabitants of small municipalities, homeowners, and low rather than high income households. This follows from the lowest income households losing CZK 21 000, which is comparatively significantly more than the CZK 26 000 lost by high income households. In addition, the policy paper also discusses the implications of the findings and provides recommendations for policymakers, including the provision of group-specific financial support and legislative incentives to promote energy-saving behaviour.

Contents

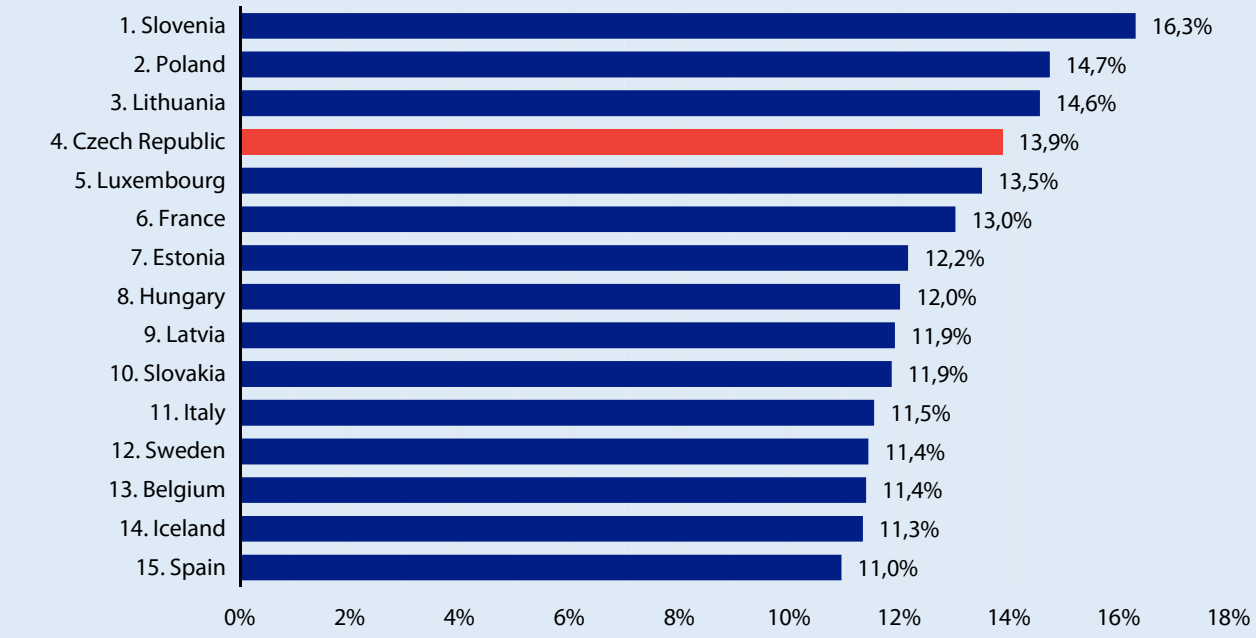
By means of policy papers, experts from RILSA provide a thorough insight into selected social policy topics and suggest recommendations for decision-makers in the respective areas.

1. Introduction

The dynamics of household consumption expenditure are of continuous interest to both researchers and governments around the world. Households typically distribute their income across a wide range of consumption areas, including food and drink, household equipment, recreation and culture and energy within which energy expenditure, in particular, represents a considerable share of total annual household expenditure. As can be seen in Figure 1, the 2021 share of energy of total household expenditure was consistently above 11% in many OECD countries. This high energy share implies that any change in consumer energy prices would exert a significant impact on overall consumer spending. In addition, while expenditure on consumer areas such as restaurants, recreation, and culture can, basically, be reduced to 0% in the case of rampant inflation, in most cases, no such reduction in energy expenditure is possible.

Spending on energy involves ensuring necessities such as lighting, cooking, and heating and, therefore, is considerably more price inelastic than e.g., spending on restaurants. In the case of strong inflationary pressures with a rapid onset (as is the case in Europe due, particularly, to the war in Ukraine), households would, thus, see their energy expenditure soar and their disposable income (and their standard of living) plummet. Consequently, understanding how energy expenditure varies according to consumer characteristics and across consumer groups is of particular interest to policymakers. Such information is crucial for the calculation of important metrics (e.g. household price indices), analysing which consumer groups are most vulnerable to price shocks, and devising policies that most effectively support those groups that are most affected (Druckman and Jackson, 2008; Belaïd and Rault, 2021).

Figure 1 **The Share of energy expenditure of total household expenditure in OECD countries in 2021**



Source: The data used in the figure was obtained from the OECD: the final consumption expenditure of households (OECD, 2022).

Despite the above-mentioned information being crucial for policymakers, especially due to the war in Ukraine and the current geopolitical climate, very little research has been published that focuses on the current situation in the energy markets and thus, there is currently a significant lack of insight into the topic. This is particularly true in the case of the Czech Republic, which is currently suffering from one of the highest inflation levels in Europe (15.1% in June 2022 vs. 11.5% for the EU), and the situation is worsening each month (Trading Economics, 2022). Therefore, this policy paper fills the gap in the literature and makes an important contribution by analysing household-specific energy expenditure and inflation in the Czech Republic between 2017 and 2022. More specifically, this involves, firstly, examining how disaggregated energy expenditure varies according to different consumer characteristics and groups, and the splitting of total energy expenditure into electricity, gas and automobile fuel. This analysis involved the application of weighted least squares (WLS) regression analysis to a contemporary dataset for the Czech Republic that was constructed using data from Eurostat, the OECD, the Czech Statistical Office, and the Czech Household Budget Survey. Secondly, the analysis involved the determination of which consumer groups are being most affected by rapidly rising energy prices using

the weighted average approach. Variations in spending across energy sources and differences in the price levels of these energy sources are likely to lead to households suffering from unequal inflation levels (Hobijn and Lagakos, 2005).

The unique contribution of this policy paper to the literature concerns the construction of a dataset for the Czech Republic from a range of sources using the most up-to-date data available (the most recent data is from June 2022). The use of contemporary data allowed for an accurate analysis of the current situation in the Czech energy market, which has the potential to contribute to the drawing up of policy measures. Furthermore, being in possession of the latest data provides the opportunity to examine the effects that rapidly rising energy prices exert on different consumer groups in the Czech Republic.

A further important contribution of the policy paper involves the disaggregation of energy expenditure and energy prices into energy types (i.e. electricity, gas, automobile fuel etc.) and the subsequent calculation of individualised (for each population subgroup) household-specific energy inflation levels. This allowed for the analysis of which types of households will be most affected by the ongoing energy price crisis in Europe. To the best of my knowledge, no similar analysis using the latest data has been published to date for the Czech Republic. The findings of this policy paper may be highly useful to the government in general and policymakers in particular. Forming an understanding of how energy expenditure varies with differing consumer characteristics and between various socio-economic groups has the potential to significantly enhance the overall knowledge of household energy consumption circumstances (Abrahamse and Steg, 2009), which will allow the government to devise energy saving policies (e.g. a move towards smarter electricity networks (McLoughlin et al., 2012) that accurately target those groups which have the highest energy-saving potential, thus not only reducing their sensitivity to subsequent energy price shocks, but also contributing to the European 2050 climate goals (Besagni and Borgarello, 2018; Belaïd and Rault, 2021). Furthermore, at knowledge of which consumer groups are most vulnerable to rapidly rising energy prices may lead policymakers to devise more specific support policies that effectively target support to those groups that need it most.

The analysis provided in this policy paper was inspired by earlier studies that focused on household energy economics. More specifically, the literature related to this study can be divided into two strands – firstly, studies that consider energy expenditure and consumption in terms of different consumer characteristics and groups, and secondly, studies that focus on the varying impacts of energy inflation on different consumer groups. While the relationship between energy expenditure and consumer characteristics has been studied for several decades, one of the earliest papers comprising a 1972-1983 UK study conducted by Baker et al. (1989), the consideration of this area in the literature intensified with the increasing environmental concerns of the last two decades. While the residential sector remains relatively understudied (Belaïd, 2016), updated studies on the situation in the UK have been published including papers by Druckman and Jackson (2008), Longhi (2015) and, most recently, Taneja and Mandys (2022).

All the above studies determined widely differing patterns of energy expenditure according to dwelling and socio-economics characteristics. Since such characteristics vary by country, extensive research has focused on individual countries using regression analysis, for example, studies concerning Germany (Rehdanz, 2007), the Netherlands (Abrahamse and Steg, 2009; Brounen et al., 2012), France (Cayla et al., 2011; Belaïd, 2016; Hache et al., 2017), Ireland (McLoughlin et al., 2012), China (Chen et al., 2013), Italy (Besagni and Borgarello, 2018), Botswana (Ofetotse et al., 2021) and Egypt, applying adaptive Lasso and quantile regression (Belaïd and Rault, 2021). The varying influence of inflation on different socioeconomic groups, which suggests that different members of society face different inflation levels, has been studied to a lesser extent. This concerns, particularly, the influence of energy inflation.

Nevertheless, the topic has been under study for several decades, e.g. early papers by Michael (1979) and Hagemann (1982), and later, by Slesnick (1990) that explored the quantitative and qualitative variations in inflation across US households. The importance of the accurate measurement of inflation and price indices was later strongly emphasised in a seminal paper by Boskin et al. (1998), which sparked increased interest in this research area, including, for example, a detailed examination of inflation rates in the UK in 1976-2000 (Crawford and Oldfield, 2002), the USA (Hobijn and Lagakos, 2005; Jaravel, 2019) and Italy in 2005 (Chelli et al., 2009). The authors of these papers in general found that considerable differences exist in inflation levels between households. Nevertheless, none of the studies have focused specifically on the Czech Republic applying a current dataset of household energy expenditure and prices, which further enhances the novelty of this research.

The remainder of the policy paper is organised as follows. Section 2 describes the collection of the data and the construction of the dataset, and provides the basic descriptive statistics. Section 3 covers the methodological approach that was applied to the data. Section 4 presents and discusses the main results, and Section 5 concludes the policy paper.

2. Data

The data used for the construction of the Czech dataset employed in this study was obtained from several online sources for the period 2017 and 2022. The data that was most crucial for the regression and descriptive analysis concerned the measurement of annual household energy expenditure across different consumer groups taking into account employment status, municipality size, housing tenure, income, and family status. Furthermore, energy expenditure was disaggregated into several energy types, i.e. electricity, automobile fuel, gas, solid fuel, heating and liquid fuel. This data was obtained from the Household Budget Survey of the Czech Statistical Office (CZSO), which is available for the period 2018-2021. Information on the household energy expenditure of other OECD countries, for comparison with the Czech Republic, was collected from the OECD data portal. In addition to energy expenditure and household characteristics, the constructed dataset also included information on monthly disaggregated energy price indices for the period 2017-2022. Information on the prices of electricity and gas was taken from Eurostat, the combined general price index for all fuels was obtained from the CZSO, and the prices of automobile fuel were constructed using information from both Eurostat and the CZSO.[1]

Table 1 **Annual per capita household energy expenditure, Czech Republic (2018-2021)**

Consumer Group	2018		2019		2020		2021	
	Perc.	Value	Perc.	Value	Perc.	Value	Perc.	Value
All Households	17%	25 481 CZK	16%	25 131 CZK	14%	22 145 CZK	14%	22 077 CZK
EMPLOYMENT STATUS								
Employees	16%	24 692 CZK	15%	22 858 CZK	13%	19 880 CZK	13%	20 827 CZK
Self-employed	16%	25 527 CZK	16%	24 868 CZK	12%	19 328 CZK	12%	20 293 CZK
Pensioners	20%	26 481 CZK	18%	26 964 CZK	17%	25 706 CZK	18%	26 680 CZK
MUNICIPALITY SIZE								
< 2 000	19%	26 133 CZK	20%	27 792 CZK	19%	26 218 CZK	19%	26 725 CZK
2 000 - 9 999	18%	26 340 CZK	17%	25 538 CZK	16%	22 560 CZK	15%	22 949 CZK
10 000 - 49 999	16%	23 262 CZK	15%	22 082 CZK	13%	18 815 CZK	12%	19 627 CZK
50 000+	14%	23 875 CZK	12%	21 184 CZK	12%	17 557 CZK	10%	18 899 CZK
HOUSING TENURE								
Own house	19%	26 976 CZK	19%	28 302 CZK	19%	26 633 CZK	18%	26 798 CZK
Owner-occupied	14%	22 784 CZK	13%	20 911 CZK	12%	18 363 CZK	11%	18 889 CZK
Co-operative	15%	20 781 CZK	12%	17 749 CZK	11%	16 687 CZK	11%	20 445 CZK
Rented	16%	24 049 CZK	13%	20 850 CZK	9%	14 023 CZK	8%	13 952 CZK
INCOME								
Quintile 1	17%	19 054 CZK	16%	18 283 CZK	14%	15 187 CZK	14%	15 816 CZK
Quintile 2	18%	22 290 CZK	18%	22 830 CZK	16%	20 154 CZK	15%	21 298 CZK
Quintile 3	17%	24 335 CZK	16%	24 876 CZK	15%	21 414 CZK	14%	22 950 CZK
Quintile 4	17%	27 963 CZK	15%	25 514 CZK	13%	23 740 CZK	13%	24 050 CZK
Quintile 5	15%	32 757 CZK	15%	33 196 CZK	13%	29 299 CZK	13%	30 031 CZK
FAMILY STATUS								
No children	18%	29 897 CZK	17%	29 482 CZK	16%	26 724 CZK	16%	27 515 CZK
Children	15%	19 895 CZK	14%	19 065 CZK	13%	16 378 CZK	12%	16 942 CZK
Two-parent	14%	20 069 CZK	14%	19 191 CZK	12%	16 318 CZK	11%	16 337 CZK
Single-parent	17%	21 548 CZK	13%	18 796 CZK	11%	15 769 CZK	12%	17 587 CZK

Source: author's own work based on CZSO data.

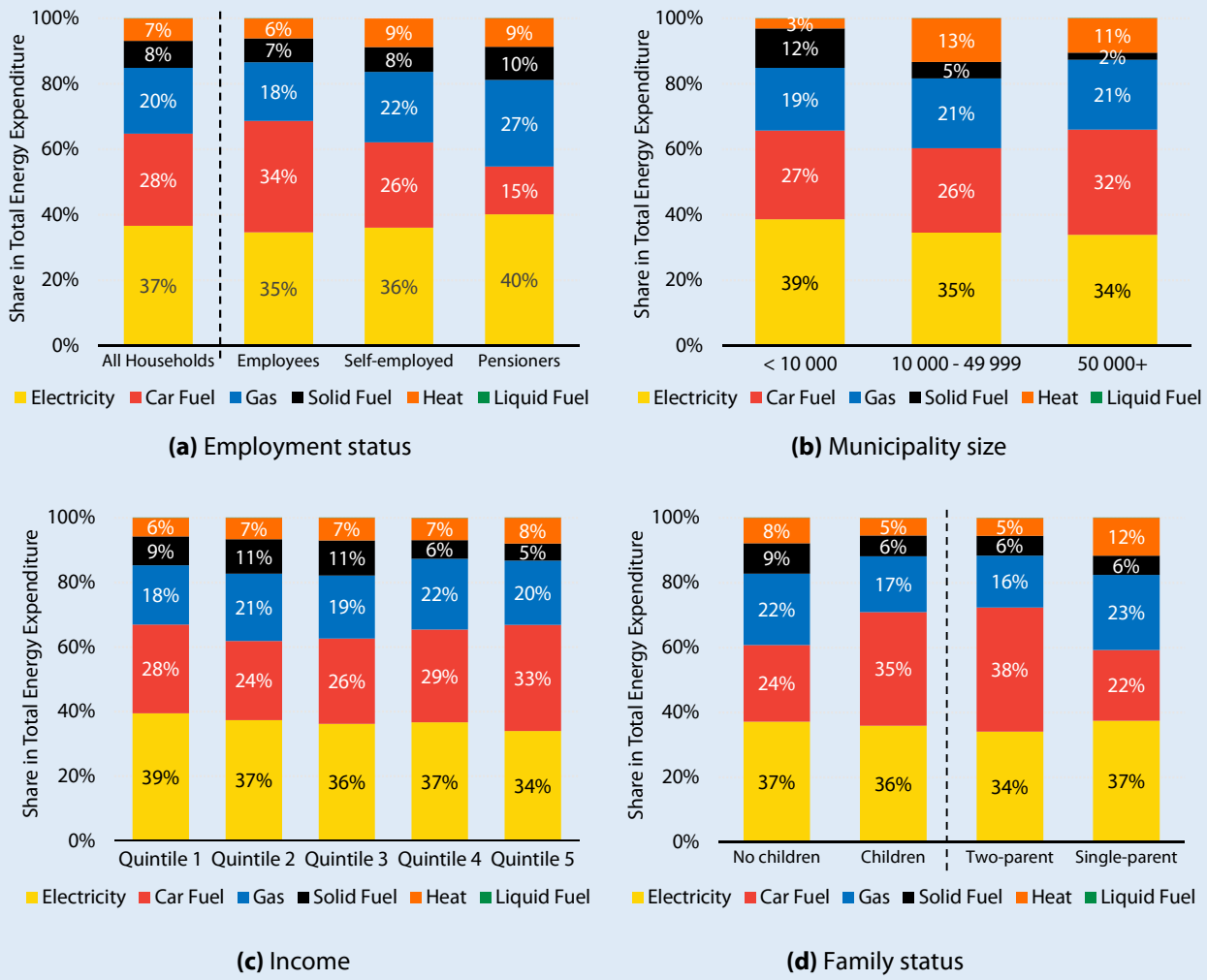
Note: The columns Value show the annual per capita energy expenditure in Czech crowns. The columns Perc. show the share of energy expenditure in total household expenditure.

[1] All the data sources are available online at: All the data sources are available online at: Household Budget Survey, OECD, Eurostat electricity and gas prices, CZSO – general energy prices, CZSO – petrol and diesel prices.

More specifically, the automobile fuel price was calculated as the weighted average of the weekly Czech price of petrol and diesel, weighted by the annual relative share of each engine type in the country.

The average per capita annual household energy expenditure is shown in Table 1 for specific socio-economic consumer groups. Both absolute values in Czech crowns (CZK) and the percentage share of energy expenditure of total expenditure are shown in the table. The mean household expenditure fell by around 3 percentage points between 2018 and 2021, from CZK 25 481 to CZK 22 077. Although the same pattern is evident for most of the consumer groups, there were significant variations concerning energy expenditure across the groups. According to the 2021 percentage shares, pensioners spent around 28% more on energy than did employees. Even larger differences are evident in terms of both municipality size and housing tenure. Households in the smallest towns spend almost double on energy than do households in the largest cities, while homeowners spend more than twice as much as tenants. The expenditure shares across income quintiles are relatively comparable; however, households with no children spend around 25% more on energy than do households with children, and 40% more than do single-parents.

Figure 2 **Disaggregated household energy expenditure according to (a) employment status, (b) municipality size, (c) income and (d) family status in the Czech Republic (2021)**



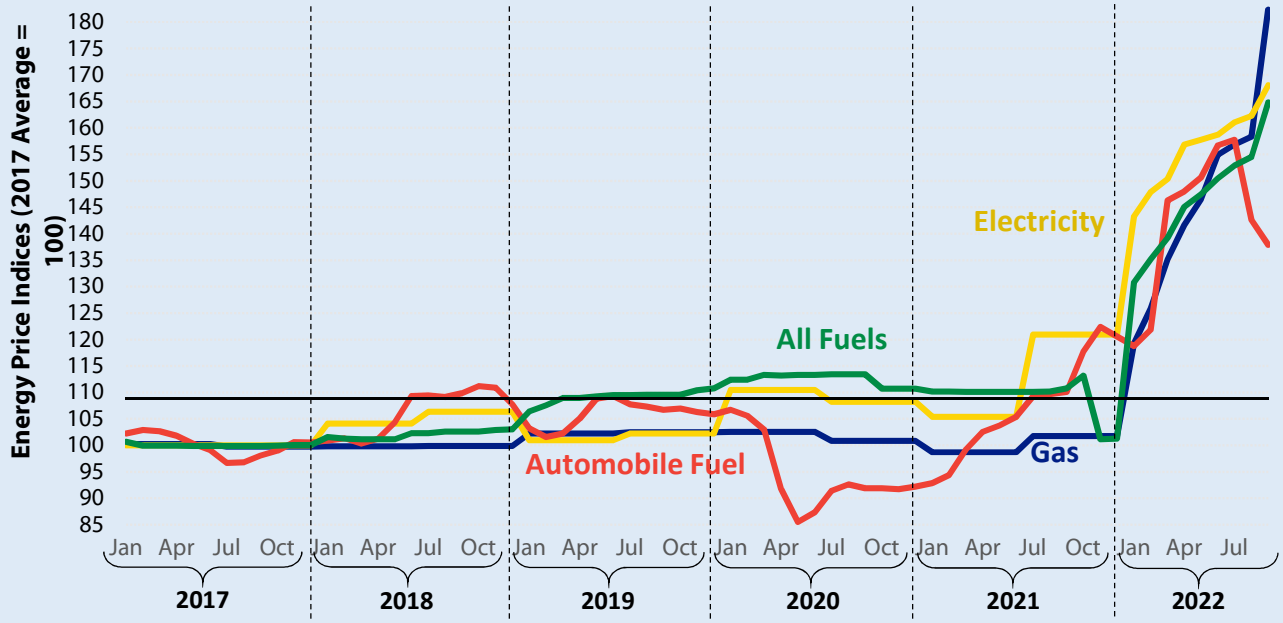
Source: author's own work based on CZSO data.

The disaggregation of energy expenditure into the various constituent fuels across consumer groups is shown in Figure 2. The disaggregated expenditure shares across households are relatively comparable, with electricity, gas, and automobile fuel typically representing over 80% of overall energy expenditure. Pensioners can be seen to spend on average significantly less on car fuel (14%) that employees (34%) and the self-employed (26%). Inhabitants of small towns spend considerably more on solid fuels and less on heating (12% vs. 3%) than persons in large cities, where the situation is

reversed (2% vs. 11%). This suggests that households in smaller towns frequently use solid fuels (such as wood or coal) to heat their homes, while households in cities use central heating systems. Furthermore, there is little variation in the disaggregated energy shares across income quintiles; however, households with children spend around 50% more on automotive fuel than households without children.

The energy price indices for electricity, gas, automobile fuel and "all fuels in general" indicate that price levels increased only gradually between 2017 and mid-2021 (Figure 3). Automobile fuel prices actually fell sharply in the spring of 2020 due to the lower demand caused by the Covid-19 pandemic. However, since mid-2021, all energy prices have experienced a rapid increase due to the geopolitical situation in Europe, with the "all fuels" price index increasing by around 50% since the start of 2022.

Figure 3 **Development of monthly disaggregated energy price indices in the Czech Republic (2017-2022) – the general price of all fuels and electricity, gas and automobile fuel**



Source: The data used in the figure was obtained from the CZSO and Eurostat (CZSO, 2022; Eurostat, 2022).

Table 2 **Definitions of the variables used in the regressions**

Variable	Definition
Total energy expenditure	Share of total household expenditure on all energy combined.
Electricity expenditure	Share of total household expenditure on electricity.
Gas expenditure	Share of total household expenditure on gas.
Automobile fuel expenditure	Share of total household expenditure on petrol and diesel.
Income	Five income categories, splitting of the income distribution into quintiles from the lowest to highest.
Flat	Share of households that live in a flat.
Floor area	Average floor area of the household in m^2.
Children	Average number of children living in the household.
Pensioners	Average number of pensioners living in the household.
Single parent	Share of households that are inhabited by a single parent.
Degree	Share of households where the head has a bachelor degree or higher
Energy-specific price	Price levels of total energy, electricity, gas, and car fuel, respectively *(index, 2017 average = 100)*.
Year	Represents each year from 2017 to 2020.

Source: author's own work.

The definitions for all of the variables used in the subsequent WLS regressions are shown in Table 2, while the descriptive statistics of the variables across years are shown in Table 3. As shown previously in Table 1, the share of total household energy expenditure fell between 2018 and 2021, as was the case for all three of the main disaggregated energy sources – electricity, gas, and automobile fuel. The 2021 values indicate that the majority of households live in flats rather than houses, with an average floor area of almost 37m^2. On average, each household has 0.54 children and 0.55 pensioners, with around 10% being single parent households. These values remained relatively similar from 2017 to 2021, although the share of households in which the representative consumer has at least a degree-level education increased from 17% in 2017 to over 22% in 2021. With the exception of automobile fuel, all the energy types saw price increases, with the total energy price (the general all fuels price) increasing by 8,3% between 2017 and 2021.

Table 3 **Descriptive statistics of the variables, Czech Republic (2017-2021)**

Variable	Mean Values				
	2017	2018	2019	2020	2021
Total energy expenditure	16.7%	16.8%	15.9%	14.3%	14.0%
Electricity expenditure	5.3%	5.4%	5.4%	5.1%	5.1%
Gas expenditure	3.3%	3.2%	3.0%	2.9%	2.8%
Automobile fuel expenditure	4.5%	4.7%	4.5%	3.9%	3.9%
Income *(quintiles)*	3	3	3	3	3
Flat	55.1%	54.8%	56.3%	57.6%	59.2%
Floor area *(m^2)*	36.1	36.4	37.2	36.6	37.2
Children	0.53	0.54	0.53	0.55	0.54
Pensioners	0.57	0.57	0.56	0.57	0.55
Single parent	8.9%	8.8%	8.0%	10.3%	10.3%
Degree	17.2%	17.6%	19.3%	20.2%	22.1%
Energy-specific price – total energy *(index, 2017 = 100)*	100.0	103.8	104.4	104.2	108.3%
Energy-specific price – electricity *(index, 2017 = 100)*	100.0	105.2	101.6	109.4	113.2
Energy-specific price – gas *(index, 2017 = 100)*	100.0	99.8	102.4	101.7	100.2
Energy-specific price – car fuel *(index, 2017 = 100)*	100.0	106.3	105.9	94.3	107.3

Source: author's own work based on data from CZSO and Eurostat.

3. Methodology

The two main research questions posed in this policy paper were examined applying two separate methodologies. The relationship between the various consumer groups, characteristics and disaggregated energy expenditure is explored using the WLS regression analysis approach, which involved the regression of disaggregated energy expenditure (i.e., electricity, gas, automobile fuel, and total energy) based on socio-economic attributes, energy-specific prices, and the year variable, with each observation (i.e. group of households) being weighted by its share in the population. The weighting accounts for the fact that each observation refers to a different share of the total population. The energy-specific prices, in particular, are assumed to be the same for each household in a given year. In a similar way to e.g. Baker et al. (1989), conditional demand[2] is modelled so as to maximise household utility in the short term, assuming that households aim to minimise their expenditure, and energy expenditure thus represents part of the overall household expenditure minimisation decision. Since the number of observations available from the main dataset is, unfortunately, very low, only very few explanatory variables are included in each regression. Therefore, separate WLS regressions were run for the consumer characteristics, in order to limit the potential for overfitting.

The energy expenditure model estimated applying WLS takes the general form shown in Equation 1:

$$EE_{it} = \beta_0 + \beta_X X_{it} + \beta_P P_t + \beta_T T_t + \varepsilon_{it} \quad (1)$$

[2] Assuming that household demand is conditional on given technology and the available stock of equipment.

where EE_{it} is the energy expenditure share (total energy, electricity, gas, or car fuel) of observation i in year t, X_{it} represents the values of the socio-economic characteristics, P_t are the energy-specific prices in the index format (total energy, electricity, gas, or car fuel), T_t represents years, and ε_{it} is the error term.

Four separate WLS regressions were estimated for each socio-economic consumer characteristic – one for each type of energy analysed (i.e., total energy, electricity, gas, and automobile fuel). The potential issue of multicollinearity was controlled for via the application of variance inflation factor (VIF) analysis, which confirmed that no multicollinearity was present in the model. In addition, the standard Breusch-Pagan and White tests indicated that heteroskedasticity did not present a problem.

The second research question, which examined those consumer groups that are most affected by energy inflation, was analysed by calculating group-specific energy inflation indices (as in e.g. Hobijn and Lagakos (2005) using the weighted average approach. The reason for different groups/households facing different energy inflation (and thus being affected differently) concerns the heterogeneity of the energy mix consumed by household and the varying prices of each type of energy. If a household consumes large amounts of electricity, but the main energy inflation arises from rising gas prices, the household will be comparatively significantly less affected than households that consume large amounts of gas. Therefore, the average energy inflation rate does not accurately portray the actual energy inflation rate faced by the various socio-economic groups (Crawford and Oldfield, 2002). In a situation with high rates of inflation, differences in household-specific inflation between households are typically also high (Crawford and Oldfield, 2002). Those households the specific energy inflation of which rises more slowly than average inflation will be less affected, while those with a more rapidly rising specific index will be more affected (Hagemann, 1982).

The calculation of the general average energy inflation index was based upon the expenditure patterns of the whole of the Czech population. On the other hand, when calculating the group-specific inflation index using weighted averages, each group's specific disaggregated energy expenditure constitutes the group's weights for each energy type. More specifically, while each energy-specific inflation rate (electricity, gas, etc.) is the same for every consumer group[3], the energy-specific energy expenditure varies considerably across consumer groups, thus assigning a weight to each energy-specific inflation rate. Since Czech monthly energy price index data is available until June 2022, but the yearly energy expenditure data only until 2020, the analysis assumed that the yearly energy expenditure shares did not change in 2021 and the first half of 2022. Therefore, the weighted average estimate of the group-specific energy inflation rate in a given month takes the following form:

$$\tilde{\pi}_{it} = \sum_{j=1}^{J} EE_{itj} \cdot \pi_{tj} \tag{2}$$

where $\tilde{\pi}_{it}$ is the group-specific energy inflation rate for consumer group i in month t, EE_{itj} is the expenditure of consumer group i on energy type j in month[4] t, π_{tj} is the price index (inflation level) of energy type j in month t, and J is the number of energy types.

Were it the case that rich data were available, it would be optimal to base the calculation of the indices not only on prices and expenditure, but also on quantity, quality, and geographic regions. However, since such data is not available, the indices are typically based on consumer behaviour (expenditure) and prices (Chelli et al., 2009). Therefore, since it is assumed that each consumer group faces the same price levels, the group-specific indices differ from one group to another solely according to the weighting system – i.e., by their expenditure (Chelli et al., 2009).

4. Results

4.1 Energy Expenditure Across Consumer Groups

The first results of the WLS analysis, the effects of income on disaggregated energy expenditure regressing disaggreegated energy expenditure shares in total expenditure on income in Table 4. The table displays four similar WLS regressions, one for each type of energy (i.e. total energy, electricity, gas, and automobile fuel), where the energy-specific price is the price that corresponds to each type of energy (e.g. the gas price is used for the measurement of the impact

[3] Due to the limited data available, each consumer group was assumed to face the same price increase as the other groups for each energy type, in a similar way as in Hobijn and Lagakos (2005).

[4] Since consumer group energy expenditure is in the form of yearly data, energy expenditure remained constant for each 12-month period for each consumer group.

on the gas expenditure share). Since the data sources allow for a maximum of 25 observations[5] in each regression, only a limited number of variables are included in each subsequent regression in order to avoid a significantly overfitted model.

The WLS estimation suggests that income has a significant effect on energy expenditure across all types of energy. Concerning total energy, an increase in income from one quintile to the next higher quintile decreases the share of total energy expenditure by 0.47 percentage points, which corresponds to a decrease of around 3.6%. Of the four energy types, gad expenditure exhibits the greatest sensitivity to changes in income. While an increase in income of one quintile decreases the gas expenditure share by 0.22 percentage points, this corresponds to a fall of almost 4%. In addition, while a higher income corresponds to a fall in expenditure on total energy, electricity, and gas, it actually increases expenditure on automobile fuel by around 2.7%. This suggests that richer consumer groups own, on average, a higher number of vehicles and/or use their automobiles more frequently. Please note that since the energy-specific price and year variables serve as controls through all the subsequent regressions, their overall effect will be discussed towards the end of this section.

Table 4 **Results of the effect of income on disaggregated energy expenditure**

Variable	Energy Type			
	Total Energy	Electricity	Gas	Automobile Fuel
Income	-0.470***	-0.218***	-0.106**	0.106***
	(0.129)	(0.053)	(0.038)	(0.036)
Energy-specific Price	-0.041	-0.005	-0.016	0.026**
	(0.073)	(0.033)	(0.056)	(0.010)
Year	-0.693***	-0.050	-0.122***	-0.198***
	(0.244)	(0.114)	(0.040)	(0.036)
No. of Observations	**25**	**25**	**25**	**25**
R-squared	**0.714**	**0.461**	**0.467**	**0.684**

*Note: WLS regressions of disaggregated energy expenditure on income, where the weights correspond to the share of each consumer group in the overall Czech population. The significance levels are: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.*

The effects of two of the housing characteristics on disaggregated energy expenditure are illustrated in Table 5. Both the independent variables, i.e. the share of people living in flats and the floor area, exert a significant impact on the dependent variables, with the exception of "living in a flat" on automobile fuel. In general, the greater the share of people living in flats compared to other types of accommodation and the greater the floor area, the more they correlate with a lower share of energy expenditure of total expenditure. An increase in the share of people living in flats of 1 percentage point reduces total energy expenditure by 0.26 percentage points, which is a fall of 1.8%. Similarly, an increase in the floor area of 1 m^2 decreases the share of total energy expenditure by 0.1 percentage points, or around 0.7%. As shown in previous research (e.g. Gamtessa, 2013; Nie and Kemp, 2014) living in flats and the floor area correlate frequently with household energy expenditure. Flats in general are beneficial in terms of energy efficiency and the reduction of the heating and cooling energy loads and, thus, energy expenditure (Resch et al., 2016). In addition, while a greater floor area may lead to higher energy expenditure in absolute terms, the energy expenditure share of total expenditure may actually fall. A greater floor area typically correlates with a higher income and the enhanced energy efficiency of the accommodation (Gamtessa, 2013). Housing characteristics were generally found to exert the greatest impact on the share of electricity expenditure, i.e. a 1 unit increase in the "flat" and "floor area acts to reduce" electricity expenditure by 2.1% and 0.9%, respectively. The independent variables, however, did not exert a significant effect on automobile fuel expenditure; indeed, the "flat" variable was found to be insignificant in this respect. Nevertheless, a larger floor area correlated with a higher share of automobile fuel expenditure, possibly due to larger houses and flats being owned by richer households who use automobiles more than other households (as shown in Table 4, with the higher spending of richer groups on car fuel).

[5] Ideally, it would be preferable to have a dataset with a large number of observations. However, in a situations that suffer from a lack of data, having a small sample size does not limit the use of regression analysis (e.g. Harrell, 2001). Similarly, a seminal paper by McCloskey (1985) discussed the problems of significance testing and stressed that researchers are not likely to reject a true hypothesis due to a small sample size. The author explained that a very large sample size would lead to coefficients that would always be statistically significant, except for the extreme case of zero correlation. Consequently, econometric analysis should rely more on coefficient size rather than solely on statistical significance (McCloskey, 1985).

Table 5 **Results of the effect of housing attributes on disaggregated energy expenditure**

Variable	Energy Type			
	Total Energy	Electricity	Gas	Automobile Fuel
Flat	-0.257***	-0.106***	-0.056**	-0.007
	(0.058)	(0.024)	(0.020)	(0.021)
Floor Area	-0.099***	-0.047***	-0.021***	0.022***
	(0.021)	(0.009)	(0.007)	(0.008)
Energy-specific Price	-0.054	-0.010	0.020	0.025**
	(0.057)	(0.026)	(0.052)	(0.010)
Year	-0.345	0.095	-0.054	-0.198***
	(0.206)	(0.092)	(0.044)	(0.043)
No. of Observations	**25**	**25**	**25**	**25**
R-squared	**0.832**	**0.694**	**0.568**	**0.685**

Note: WLS regressions of disaggregated energy expenditure on housing attributes, where the weights correspond to the share of each consumer group in the overall Czech population. The significance levels are: $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$.

The influence of the household composition on energy expenditure is shown in Table 6. Both the number of children and, especially, the number of pensioners in a household have a significant effect on disaggregated energy expenditure, with the exception of the effect of children on gas. An increase in the number of children in a household of one increases the share of total energy expenditure by 0.92 percentage points, which is almost 6.6%. The effect of pensioners is even stronger; an extra pensioner in a household raises total energy expenditure by over 24%. The household composition has the greatest effect on gas and automobile fuel expenditure. An increase in the number of pensioners of one increases expenditure on gas by 0.95 percentage points (almost 34%), while an extra child in a household decreases car fuel expenditure by 0.36 percentage points (a fall of 7.9%). Interestingly, a higher number of children and pensioners increases the use of total energy, electricity, and gas, but decreases the use of automobile fuel. This implies that households with more children and/or pensioners spend a smaller share of their disposable income on using their cars than households without children or pensioners.

Table 6 **Results of the effect of household members on disaggregated energy expenditure**

Variable	Energy Type			
	Total Energy	Electricity	Gas	Automobile Fuel
Children	0.921**	0.464***	0.138	-0.272*
	(0.333)	(0.131)	(0.100)	(0.137)
Pensioners	3.468***	1.519***	0.947***	-0.557***
	(0.471)	(0.185)	(0.142)	(0.194)
Energy-specific Price	-0.043	-0.008	-0.015	0.026**
	(0.047)	(0.020)	(0.037)	(0.010)
Year	-0.670***	-0.035	-0.118***	-0.201***
	(0.157)	(0.070)	(0.026)	(0.034)
No. of Observations	**25**	**25**	**25**	**25**
R-squared	**0.886**	**0.808**	**0.780**	**0.721**

Note: WLS regressions of disaggregated energy expenditure on household members, where the weights correspond to the share of each consumer group in the overall Czech population. The significance levels are: $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$.

The final set of WLS regressions, which analyse the effects of the characteristics of the representative consumer on energy expenditure, is shown in Table 7. The effect of these independent variables is, in general, weaker than for the previous regressions, with smaller coefficients and with the "single parent" variable being significant for only two of the four regressions. An increase in the share of single parents (i.e. a decrease in the share of two-parent households) of one percentage point decreases total energy expenditure by only 0.06 percentage points, which is a fall of 0.5%. Similarly, an increase in the share of representative consumers that have at least a degree-level education of one percentage point

reduces total energy expenditure by less than 1%. The results suggest that the greatest effect of the individual characteristics considered is on electricity expenditure. A one unit increase in the "single parent" and "degree" variables acts to reduce electricity expenditure by 0.7% and 1.1%, respectively. The independent variables were found to exert only a negligible impact on household expenditure on automobile fuel.

Table 7 **Effects of representative consumer characteristics on disaggregated energy expenditure**

Variable	Energy Type			
	Total Energy	Electricity	Gas	Automobile Fuel
Single Parent	-0.064**	-0.026**	-0.020**	-0.002
	(0.028)	(0.011)	(0.009)	(0.010)
Degree	-0.122***	-0.056***	-0.030***	0.017**
	(0.021)	(0.008)	(0.007)	(0.008)
Energy-specific Price	-0.049	-0.003	-0.024	0.026**
	(0.058)	(0.023)	(0.048)	(0.010)
Year	-0.478**	0.029	-0.071*	-0.222***
	(0.197)	(0.081)	(0.036)	(0.039)
No. of Observations	**25**	**25**	**25**	**25**
R-squared	**0.830**	**0.747**	**0.637**	**0.683**

Note: WLS regressions of disaggregated energy expenditure on representative consumer characteristics, where the weights correspond to the share of each consumer group in the overall Czech population. The significance levels are: $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$.

The variables that measured the price of each energy type and the year were included in each regression as control variables and served for the measurement of the effect of prices and the time trend on disaggregated energy expenditure. The time trend coefficient can be seen to be very consistent through Tables 4-7, i.e. it is insignificant for all energy types except for automobile fuel expenditure. The results imply that a shift of one year forward is reflected in a fall in the expenditure share of 0.5-0.7 percentage points. Similarly, the effect of prices for different energy types is very consistent across the regressions, and is significant with concern solely to automobile fuel. In this case, an increase in the car fuel price of 1% leads to an increase in the share of expenditure on car fuel of 0.026 percentage points, which corresponds to an expenditure increase of 0.67%. This suggests that an increase in automobile fuel prices by 1% is reflected in a fall in the consumption of automobile fuel of 0.33%, thus suggesting a relatively low level of consumer sensitivity to fuel prices.

To summarise, the results suggest that the disaggregated energy expenditure share in the Czech Republic is most affected by the household composition factor. The effect of household and socio-economic characteristics on energy expenditure is well established in the literature (e.g. Meier and Rehdanz, 2010; Huang, 2015; Longhi, 2015; Taneja and Mandys, 2022). An increase in the number of children and pensioners of one raises the total energy expenditure share by 6.6% and 24%, respectively. This effect is particularly significant concerning gas and automobile fuel expenditure. The effect of income is also considerable; an increase in income of one quintile decreases total energy expenditure by 3.6%. Once again, the effect is particularly strong for gas, with a fall in expenditure of almost 4%. Furthermore, a greater share of households living in flats exerts a negative impact on electricity expenditure, i.e. an increase of one percentage point reduces electricity expenditure by 2.1%. The housing and representative consumer characteristics have, in general, only a small effect on the shares of energy expenditure. In addition, an increase in the car fuel price of 1% can be expected to decrease the consumption of car fuel by just 0.33%.

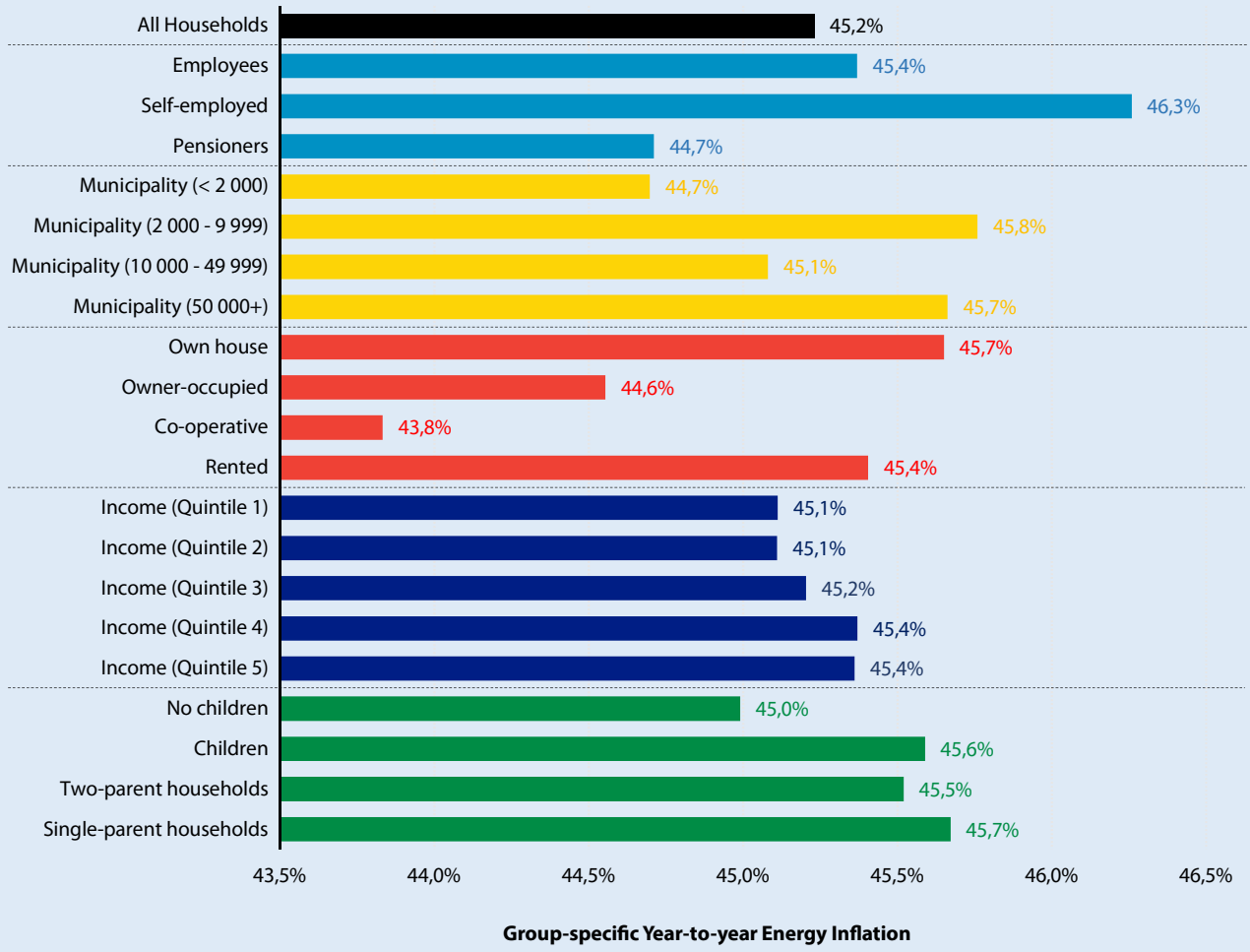
4.2 Household-specific Energy Inflation

The second set of results related to the consumer groups that are most affected by the high energy inflation rate in the Czech Republic. The consumer group-specific total energy inflation between June 2021 and June 2022 is shown below in Figure 4. The values represent the percentage increase in the total energy price level for each socio-economic group that occurred from June 2021 to June 2022. As the figure illustrates, the total energy price across all households increased significantly over the year, i.e., by over 45%. However, differences are evident in terms of the group-specific energy inflation levels, suggesting that certain socio-economic groups suffered from higher-than-average inflation. The inflation

levels range from 43.8% for households living in co-operative housing, to 46.3% for self-employed persons. As such, the self-employed were, overall, the most affected socio-economic group in terms of energy price increases over the year.

Pensioners, on the other hand, faced a lower-than-average inflation rate, i.e. 44.7%. Consumer groups based on municipality size display a wide variation across the various groups; however, the largest municipality size faced an above-average energy inflation rate (45.7%) compared to the smallest municipality size (44.7%). Both homeowners and tenants experienced an above average inflation level; however, this was especially pronounced when compared to co-operative households (43.8%). Furthermore, the analysis of the income quintiles revealed only a small variation in the energy inflation rate, with the higher quintiles experiencing a slightly higher inflation rate than the lower quintiles (45.4% vs. 45.1%). Finally, in terms of family status, households without children faced, on average, a slightly below average inflation rate. On the other hand, single-parent households suffered from a higher inflation rate, thus rendering them one of the more affected socio-economic groups.

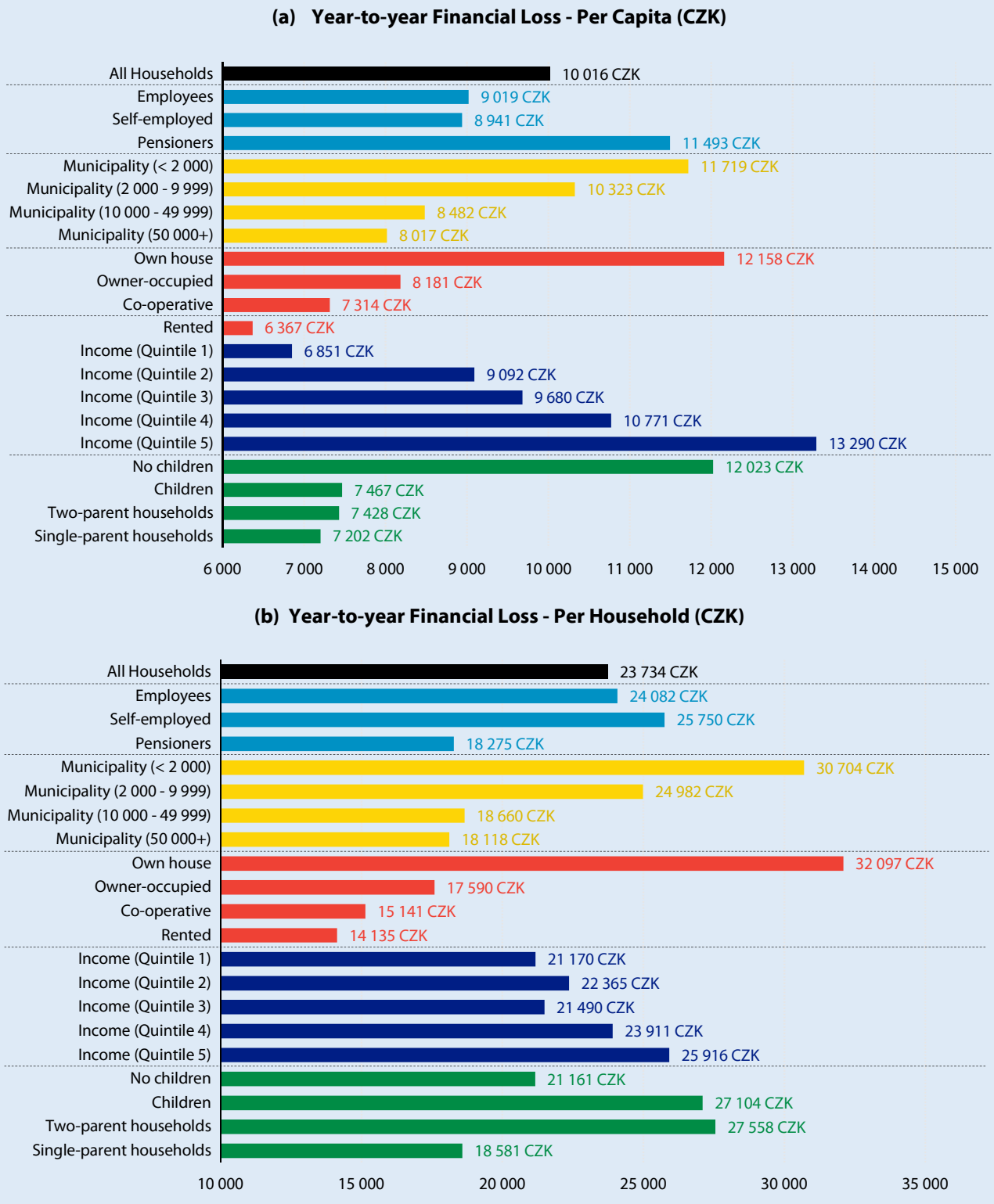
Figure 4 **Percentage year-to-year increase in energy prices by consumer groups (energy price increases between June 2021 and June 2022)**



Source: author's own work based on data from CZSO and Eurostat.

While Figure 4 illustrates the consumer groups that faced the largest energy price increases, it does not consider the resulting loss of purchasing power across the groups. The group-specific annual monetary loss per capita due to the increase in energy prices is shown in Figure 5a. Figure 5b also shows the annual monetary loss, but per household rather than per capita, taking into account the household size of the socio-economic groups. The results suggest that the average household has lost CZK 10 016 per capita in disposable income, which corresponds to CZK 23 734 per household. Nevertheless, the annual per capita decrease in disposable income varied considerably, ranging from CZK 6 397 for tenants to CZK 13 290 for the highest income group.

Figure 5 **Year-to-year loss of disposable income by consumer groups in Czech crowns (financial loss from June 2021 to June 2022). (a) loss per capita, (b) loss per household.**



Source: author's own work based on data from CZSO and Eurostat.

In terms of employment status, pensioners are the most affected by rapidly rising energy prices, having lost CZK 11 493 in disposable income over the last year. However, as pensioners typically have a smaller household size, employees and the self-employed in fact suffered higher losses per household. Households in smaller municipalities, on average, were affected by a higher loss in purchasing power than those in larger towns. The smallest municipality households experienced a financial loss that was almost 50% higher than households in the largest municipalities. In addition,

homeowners consistently experience a significantly higher financial loss than all the other housing tenure groups, and have lost almost twice the disposable income of tenants.

In terms of income, households experience a higher financial loss the higher their earnings. Households in the lowest income quintile lost CZK 6 851 per capita on average compared to CZK 13 290 for the highest quintile earners, and this trend is consistent even at the "per household" level, albeit less pronounced. Nevertheless, the poorest households are likely to have been the most severely affected by rising energy prices: for the poorest households, a loss of CZK 21 000 is comparatively much more damaging than a loss of CZK 26 000 for the richest households. Finally, in terms of family status, households with no children have been most affected by energy inflation. Interestingly, single-parent households were found to be comparatively less affected by energy inflation than the other socio-economic groups according to both the per capita and per household results.

5. Conclusion

Since the beginning of 2022, Europe has faced rapidly increasing price levels across all the sectors of the economy, a situation that has been seriously influenced by the Russo-Ukrainian war. This rampant inflation is especially pronounced in the Czech Republic, where inflation reached 15.1% in October 2022 compared to 11.5% in the EU (Trading Economics, 2022), a significant share of which is due to soaring energy prices. However, the literature currently lacks a contemporary complex insight into the effects of energy inflation and the drivers of energy expenditure. Therefore, this policy paper provides an important contribution by examining how energy expenditure varies across different consumer groups and characteristics, and which groups are being most affected by rising energy prices. A novel, contemporary dataset was collected from several different sources, and the WLS and weighted average methodologies were used for the analysis.

The findings suggest that energy expenditure in the Czech Republic is most affected by the composition of the household, specifically the number of children and pensioners. An extra child or pensioner acts to increase the share of energy expenditure of total expenditure by, on average, 6.6% and 24%, respectively, and this effect is most pronounced for expenditure on gas and car fuel. An increase in income of one quintile was found to decrease the energy expenditure share by 3.6%, with, again, gas expenditure comprising the strongest effect. Furthermore, an increase in the share of people living in flats by one percentage point acts to reduce the electricity expenditure share by 2.1%.

The results also revealed those socio-economic groups that face the highest energy inflation rates. While, on average, households faced a price increase of 45.2% over the year under study, many groups suffered higher rates of inflation, i.e. the self-employed, households in the largest cities, higher income households and single-parent households. In terms of losses in purchasing power, the average household lost around CZK 10 000 per capita over the year due to energy inflation alone. However, the highest losses in purchasing power per capita were suffered by pensioners, households in the smallest municipalities, homeowners, households without children, and higher income households. Nevertheless, households with the lowest incomes are likely to have been most affected since their loss of CZK 21 000 is comparatively much more significant than a loss of CZK 26 000 for the highest income households.

It is anticipated that the results of this policy paper will provide useful information for Czech policymakers and the government in terms of the formulation of group-specific policies, especially in the current inflationary climate, and the significant contribution of the Russo-Ukrainian war in this respect. A detailed knowledge of the factors that influence disaggregated energy expenditure will help in terms of the design and implementation of policies that promote energy saving behaviour for the most energy-intense consumer groups, i.e. those with the highest energy saving potential (Brounen et al., 2012; Ofetotse et al., 2021).

Furthermore, understanding which consumer groups face the highest energy inflation rates and which suffer from the greatest loss in purchasing power will allow policymakers to better understand the macroeconomic situation, and thus, to more effectively support the most affected consumer groups. The results suggest that those most affected consist of pensioners, households in small municipalities, and low income households. However, faced with continuously rapidly increasing energy prices and the uncertain geopolitical future, the government should also attempt to implement more long-term structural changes and promote policies that lead to greater energy efficiency and conservation. Such an approach will help to permanently reduce household energy use and lower the sensitivity of households to energy inflation shocks in the future (Longhi, 2015). Measures should include the creation of incentives to install modern technology, such as smart meters, and the introduction of tax reductions and deductibles for installing energy saving equipment (Belaïd, 2016; Taneja and Mandys, 2022).

In addition to policies that encourage consumers to improve their household energy efficiency, efforts should be made to inspire a behavioural change in households that leads to more sustainable energy use (Belaïd, 2016; Belaïd and Rault, 2021). This could be achieved by educational and awareness-inducing campaigns that focus on the teaching of energy-saving practices and changing household behaviour (Cayla et al., 2011). Past research has shown that government-backed energy labels and certificates that provide information on household-specific energy efficiency (compared to the information provided by the market) also have the potential to improve the awareness (and energy saving behaviour) of consumers (Brounen et al., 2012). In effect, the implementation of road-map policies that lead to structural changes in the medium- and long-terms should become a governmental policy goal, one that would not only have a profound positive environmental impact, but which would also reduce consumer sensitivity to energy inflation shocks in the future.

References

Abrahamse, W. and Steg, L. (2009). How do socio-demographic and psychological factors relate to households' direct and indirect energy use and savings? *Journal of Economic Psychology*, 30(5):711–720.

Baker, P., Blundell, R., and Micklewright, J. (1989). Modelling household energy expenditures using micro-data. *The Economic Journal*, 99(397):720–738.

Belaïd, F. (2016). Understanding the spectrum of domestic energy consumption: Empirical evidence from France. *Energy Policy*, 92:220–233.

Belaïd, F. and Rault, C. (2021). Energy expenditure in Egypt: Empirical evidence based on a quantile regression approach. *Environmental Modeling & Assessment*, 26(4):511–528.

Besagni, G. and Borgarello, M. (2018). The determinants of residential energy expenditure in Italy. *Energy*, 165:369–386.

Boskin, M. J., Dulberger, E. L., Gordon, R. J., Griliches, Z., and Jorgenson, D. W. (1998). Consumer prices, the consumer price index, and the cost of living. *Journal of Economic Perspectives*, 12(1):3–26.

Brounen, D., Kok, N., and Quigley, J. M. (2012). Residential energy use and conservation: Economics and demographics. *European Economic Review*, 56(5):931–945.

Cayla, J.-M., Maizi, N., and Marchand, C. (2011). The role of income in energy consumption behaviour: Evidence from French households data. *Energy Policy*, 39(12):7874–7883.

Chelli, F., Gigliarano, C., Mattioli, E., et al. (2009). The impact of inflation on heterogeneous groups of households: An application to Italy. *Economic Bulletin*, 29(2):1276–1295.

Chen, J., Wang, X., and Steemers, K. (2013). A statistical analysis of a residential energy consumption survey study in Hangzhou, China. *Energy and Buildings*, 66:193–202.

Crawford, I. and Oldfield, Z. (2002). *Distributional aspects of inflation*. Citeseer.

CZSO (2022). Inflation, Consumer Prices [Accessed: 16th December 2022].

Druckman, A. and Jackson, T. (2008). Household energy consumption in the UK: A highly geographically and socio-economically disaggregated model. *Energy Policy*, 36(8):3177–3192.

Eurostat (2022). HICP - monthly data (index) [Accessed: 16th December 2022].

Gamtessa, S. F. (2013). An explanation of residential energy-efficiency retrofit behavior in Canada. *Energy and Buildings*, 57:155–164.

Hache, E., Leboullenger, D., and Mignon, V. (2017). Beyond average energy consumption in the French residential housing market: A household classification approach. *Energy Policy*, 107:82–95.

Hagemann, R. P. (1982). The variability of inflation rates across household types. *Journal of Money, Credit and Banking*, 14(4):494–510.

Harrell, F. E. et al. (2001). Regression modeling strategies: with applications to linear models, logistic regression, and survival analysis, volume 608. *Springer*.

Hobijn, B. and Lagakos, D. (2005). Inflation inequality in the United States. *Review of Income and Wealth*, 51(4):581–606.

Huang, W.-H. (2015). The determinants of household electricity consumption in Taiwan: Evidence from quantile regression. *Energy*, 87:120–133.

Jaravel, X. (2019). The unequal gains from product innovations: Evidence from the US retail sector. *The Quarterly Journal of Economics*, 134(2):715–783.

Longhi, S. (2015). Residential energy expenditures and the relevance of changes in household circumstances. *Energy Economics*, 49:440–450.

McCloskey, D. N. (1985). The loss function has been mislaid: The rhetoric of significance tests. *The American Economic Review*, 75(2):201–205.

McLoughlin, F., Duffy, A., and Conlon, M. (2012). Characterising domestic electricity consumption patterns by dwelling and occupant socio-economic variables: An Irish case study. *Energy and Buildings*, 48:240–248.

Meier, H. and Rehdanz, K. (2010). Determinants of residential space heating expenditures in Great Britain. *Energy Economics*, 32(5):949–959.

Michael, R. T. (1979). Variation across households in the rate of inflation. *Journal of Money, Credit and Banking*, 11(1):32–46.

Nie, H. and Kemp, R. (2014). Index decomposition analysis of residential energy consumption in China: 2002–2010. *Applied Energy*, 121:10–19.

Ofetotse, E. L., Essah, E. A., and Yao, R. (2021). Evaluating the determinants of household electricity consumption using cluster analysis. *Journal of Building Engineering*, 43:102487.

OECD (2022). Final consumption expenditure of households [Accessed: 16th November 2022].

Rehdanz, K. (2007). Determinants of residential space heating expenditures in Germany. *Energy Economics*, 29(2):167–182.

Resch, E., Bohne, R. A., Kvamsdal, T., and Lohne, J. (2016). Impact of urban density and building height on energy use in cities. *Energy Procedia*, 96:800–814.

Slesnick, D. T. (1990). Inflation, relative price variation, and inequality. *Journal of Econometrics*, 43(1-2):135–151.

Taneja, S. and Mandys, F. (2022). Drivers of UK household energy expenditure: Promoting efficiency and curbing emissions. *Energy Policy*, 167:113042.

Trading Economics (2022). Inflation rates. Trading Economics – European Inflation [Accessed: 16th December 2022].

About Author

Dr. Filip Mandys (filip.mandys@rilsa.cz) has been working as a researcher at RILSA since May 2022. His research interests include energy and environmental economics, labour economics, applied econometrics, and finance. He also works for the European Investment Fund (EIF) in Luxembourg.

Abstract in Czech

Energetické výdaje domácností a inflace v České republice

Česká republika v současnosti trpí jednou z nejvyšších inflací v Evropě. Zatímco velký podíl inflace v zemi je způsoben rostoucími cenami energií, v literatuře v současnosti chybí jakékoli informace o dopadu energetické inflace na různé skupiny spotřebitelů. Tento policy paper tudíž analyzuje energetickou inflaci a výdaje na energie domácností pomocí nejnovějších dat a aplikací metod vážených nejmenších čtverců (WLS) a váženého průměru. Výsledky naznačují, že podíl energetických výdajů na celkových výdajích je nejvíce ovlivněn počtem dětí a důchodců v domácnosti – zvyšuje se o 6,6 % a 24 % za každé další dítě nebo důchodce. Tento výsledek platí zejména pro výdaje za elektřinu a plyn. Zvýšení příjmu o jeden kvintil snižuje podíl energetických výdajů o 3,6 %, přičemž pokles je nejvýraznější u elektřiny. Zvýšení podílu lidí žijících v bytech dále snižuje výdaje za elektřinu o 2,1 % v důsledku vyšší energetické účinnosti bytů. Z výsledků plyne, že průměrná česká domácnost čelila mezi červnem 2021 a 2022 nárůstu cen energií o 45,2 %. Mezi skupiny, které čelily procentuálně nejvyšší inflaci, patřili OSVČ, obyvatelé velkých měst, lidé s vysokými příjmy a samoživitelé. V absolutním vyjádření však průměrná domácnost utrpěla roční ztrátu 10 000 Kč na obyvatele, přičemž nejvíce postiženými skupinami byli důchodci, obyvatelé malých obcí, majitelé domů a domácnosti s nízkými příjmy. Domácnosti s nejnižšími příjmy ztratily 21 000 Kč, což je poměrně výrazně více než 26 000 Kč, o které přišly domácnosti s vysokými příjmy. Tento policy paper dále pojednává o důsledcích těchto zjištění a poskytuje doporučení pro tvůrce politik, včetně poskytování finanční podpory pro specifické skupiny a legislativních pobídek na podporu energeticky úsporného chování.

Research Institute for Labour and Social Affairs
Prague, 2022

Policy Papers VÚPSV, v. v. i.
ISSN 2695-1029

RILSA
Dělnická 213/12
170 00 Praha 7
tel.: +420 211 152 711
e-mail: rilsa@rilsa.cz
data box: xy9n88n
https://www.rilsa.cz