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DISCUSSION PAPER SERIES

IZA DP No. 15738

Welfare and Distributional Impact of Soaring Prices in Europe

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ABSTRACT

Welfare and Distributional Impact of Soaring Prices in Europe

This paper disentangles the distributional and welfare impact of price changes since the start of the cost of living crisis for a subset of European countries with different welfare regimes and price changes. It decomposes the impact of inflation and measures welfare changes using the compensating variation and equivalent incomes in a cross-national comparative perspective. The impact of inflation depends on good-specific price increases and budget shares. Budget shares for necessities (e.g. food, domestic fuel, electricity) are higher in poorer countries and for poorer people. Higher price growth in these necessities has resulted in higher inflation in poorer countries. Counter to the media narrative, the distributional impact is less substantial than expected. A significant cross-country variability exists, however, in inflation levels, composition and relative rates across the distribution. Similar levels of inflation regressivity result from different interplays between the level and disproportionality of inflation along the income distribution. We quantify the compensating variation of inflation with a relatively small behavioural component due to the preponderance of necessities among the goods with high price changes. An important factor concerning the potential impact on households is the savings rate. Households with already low savings are disproportionally feeling the impact on their expenditure.

JEL Classification: D12, D31, D60, E31, I30

Keywords: inflation, distributional effect, welfare effect

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1. Introduction

The outbreak of the COVID-19 crisis at the beginning of 2020 and the start of the war in Ukraine two years later resulted in an unprecedented surge of prices around the globe. In the European Union, annual inflation was almost 10% in July 2022, which represents the largest price increase in the area for decades (Figure 1). This was driven initially by rising freight costs and supply-chain disruptions (Michail et al., 2022), but subsequently by a surge in energy prices, followed by price increases for food, services, and non-industrial goods (Eurostat, 2022). As these price changes affect different groups differently in different countries, we attempt to understand the differential impact of these changes across the income distribution comparatively across several European countries.

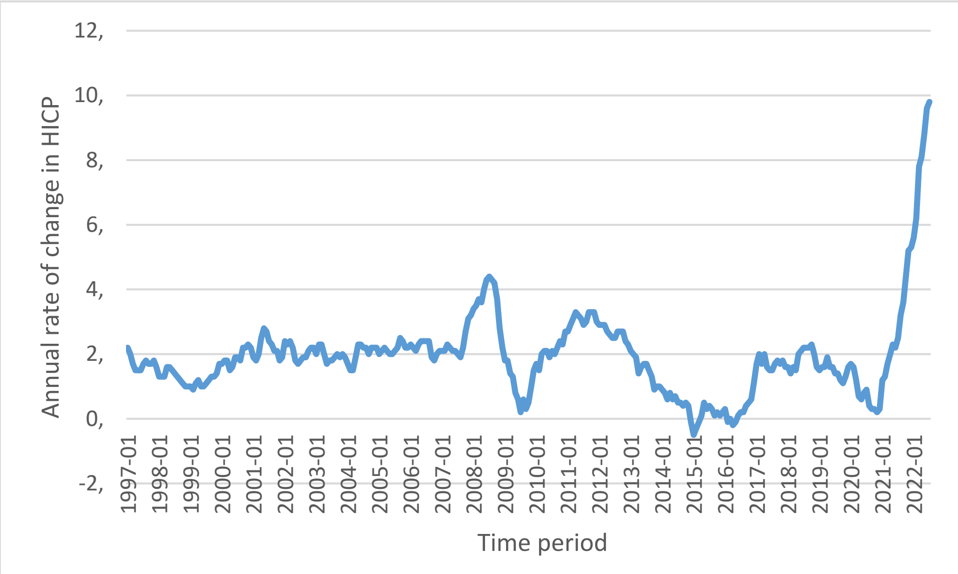

Figure 1. Year-to-year average inflation rate in the European Union

Source: Eurostat (accessed on 24 October 2022).

The large increase in prices raised concerns among policy makers about its potential impact on the standard of living of ordinary people. As highlighted by Fry and Pashardes (1985), the erosion of incomes by inflation plays a central role both in salary negotiations and in the inflation adjustments of monetary benefits and tax allowances. Amaglobeli et al. (2022) report responses to current inflation. Making concrete policy decisions, however, is challenging in the context of rapid inflation due to the lack of up-to-date data on household incomes and expenditures as well as limited empirical evidence on households substitution behaviour when prices for some goods and services are changing differently than for others.

The literature on the impact of price changes on living standards of individuals is quite vast, dating back 50 years. The first studies in the field have criticized the measurement of aggregate consumer price indices (CPI) highlighting their incapacity to reflect changes in the cost of living of households with heterogeneous needs (see, among other, Allen, 1958; Lydall, 1959; Snyder, 1961; Lynes, 1962; Boskin and Hurd, 1986; Amble and Stewart, 1994; Idson and Miller, 1999; Crawford and Smith, 2002; Hobjin and Lagakos, 2005). Most of these works show that inflation rates faced by different types of households often differ from the average CPI due to differences in the baskets of goods and services they purchase on the market.

Typically, poorer households, households with more children, young or elderly individuals are more prone to face higher individual inflation rates. Furthermore, differences in household specific inflation rates tend to be more substantial when inflation is higher (Crawford and Smith, 2002).

Another stream in the literature constructed group-specific price indices, focusing on the distributional impacts of inflation. Brittain (1960) and Tipping (1970), analysed the unequal effects of inflation along the distribution of household incomes in the United States and Britain. Similarly, Fry and Pashardes (1985) and Crawford and Smith (2002) for the UK and Doorley et al. (2022) for Ireland, focused on the entire distribution of household specific inflation rates, and also identified which types of households face higher than average inflation rates. The main limitation of these papers is that they do not account for behavioural effects, i.e. the possibility of shifting expenditures from one type of products to another in the presence of relative price movements.[2] Failure to account for substitution behaviour, however, might lead to an overestimation of the effect of price increases on the cost of living (Aizorbe and Jackman, 1993; Murphy and Garvey, 2004; Loughrey and O'Donoghue, 2012).

Muellbauer (1974) evaluated the distributional consequences of inflation while accounting for substitution behaviour, estimating a linear expenditure system of demand equations and the implied true cost of living indices for different expenditure levels in Britain. Following this line of research, Creedy and van de Ven (1997) and Loughrey and O'Donoghue (2012) evaluated the distributional effects of inflation in Australia and Ireland.

Our study extends this work by evaluating the distributional impact of the current inflation (2021-2022) in several European countries, thereby contributing to the literature on consumption inequalities during times of economic crisis (e.g. Ballester et al 2014; Bono et al 2017; Meyer and Sullivan 2013). We envisage a three-fold contribution.

First, rather than focusing on the shift in the standard of living of an average individual, we incorporate in our estimates price-related welfare losses (gains) along the entire distribution of household incomes. While doing it, we also account for the elasticity of individual demand for different groups of products and their substitution with each other in response to relative price changes. This approach allows us to evaluate the impact of price changes on household income distribution while accounting for the capacity of households to compensate a part of their welfare losses via a substitution behaviour. Furthermore, in combination with the distributional summary measures, it also makes it possible to evaluate the impact of price changes on the income distribution and redistribution at the country level given that inflation is considered to be one of the main drivers of such changes (Herradi et al., 2022). It should be noted that incomes are also rising during the crisis. Eurostat has indicated that the labour costs have risen 4% in 2022 compared to a price growth of about 10%, indicating an overall welfare loss. As income growth data is both less frequent and, where available, limited in terms of its distributional impact, we make the choice in this paper to limit our analysis to the price impact rather than trying to quantify a "net" welfare impact of combined price and income changes across the distribution.

[2] The importance of accounting for substitution behavior has being highlighted in multiple papers (see, among other, Irvine and McCarthy (1978), Braithwait (1980), Manser and McDonald (1988), Moulton (1996), Creedy and van de Ven (1997), Murphy and Garvey, 2004; and Somerville (2004) for a more recent literature review).

Second, an important contribution of our paper lies in its comparative focus. We choose a subset of countries on the basis of two dimensions, firstly that they represent a cross-section of countries with different inflation experiences in the EU (Figure 2) and secondly representing counties with different welfare regimes. We choose six countries that experienced heterogeneous price increases, i.e. Finland, Hungary, Ireland, Lithuania, Luxembourg, and Portugal. Whereas the annual inflation rate was around 8% in July 2022 in Finland, in Lithuania it was higher than 20%. These countries have different welfare systems in place, which can buffer or exacerbate the distributional consequences of inflation or other economic shocks (Dolls et al., 2012; Dolls et al., 2020; Paulus and Tasseva, 2020).[3]

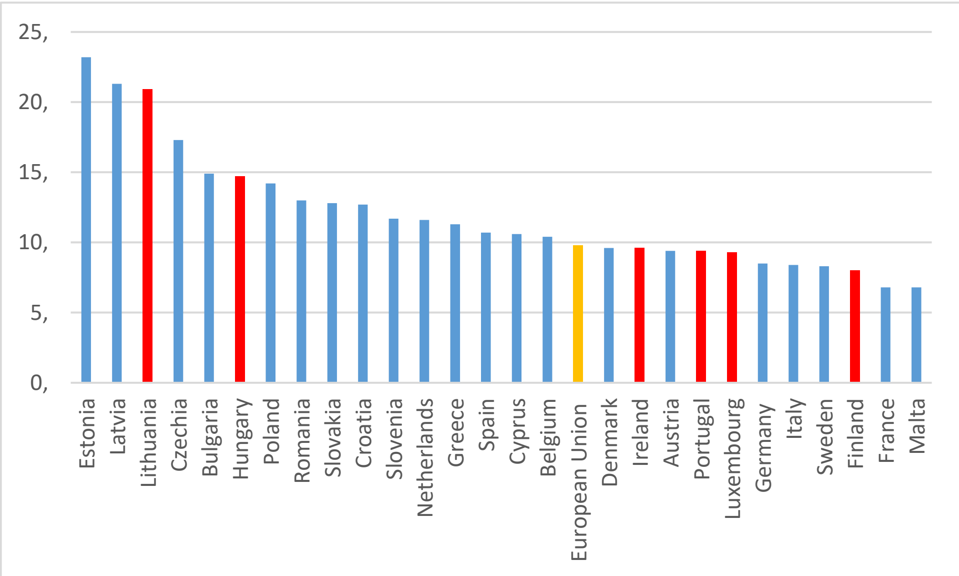

Figure 2. HICP by country (July 2021 – July 2022)

Source: Eurostat (accessed on 24 October 2022).

The comparative angle in the paper, therefore, demonstrates to what extent the distributional and welfare consequences of inflation originating from the same energy crisis differ across countries with different consumption patterns, different levels of dependency on energy imports, and different welfare systems. We extend the work of Bálint (2022), who provided preliminary assessment of social consequences of increasing energy and consumer prices in the EU, zooming in on the drivers of distributional and welfare impacts of inflation while allowing for compensation mechanisms via substitution behaviour of individuals.

Third, in particular, apart from assessing the distributional consequences of inflation for various types of individuals along the distribution, we assess the overall progressive or regressive impact of inflation and quantify which commodity items are driving this impact in each country. For this, we innovate by adapting the methodology applied in taxation in order to examine the interaction between the inflation rates of different commodity groups and the

[3] See Esping-Andersen (1990), Ferreira (1996), Aidukaite (2009), McCashin and O'Shea (2009, and Tausz (2009), among others, for the description of welfare regimes in general and welfare systems of the selected countries in particular.

structure of expenditure in determining the overall levels of progressivity or regressivity of inflation in each country.

Section 2 discusses in detail our methodology and deals with the data and the information on price changes for various commodity groups. The methodology is applied in section 3 to assess the distributional and welfare consequences of inflation. Section 4 concludes.

2. Methodology and Data

We envisage a two-step methodology. First, we evaluate the distributional impact of inflation and we examine the interaction between the inflation rates of different commodity groups and the structure of expenditure in determining the overall levels of progressivity or regressivity of inflation in each country. Second, we utilize microsimulation modelling to assess the distributional and welfare impact of price changes (O'Donoghue, 2021). The approach consists of estimating a demand system to model household expenditure patterns on groups of goods, estimate income and price elasticities and assess consumer welfare.

2.2 Welfare effects and the LES

We discuss first the method for measuring the welfare and distributional effects of price changes facing different types of individuals. Our approach is to obtain a money measure of the change in welfare experienced by individuals, which results from a change in prices (Creedy 2000). We seek to allow for population heterogeneity since individuals have different characteristics; therefore, we choose "exact" welfare measures as opposed to "approximation" measures (see Creedy 2000 for a review).

- ***The linear expenditure system***

The fundamental component of measures of welfare change is the concept of *expenditure function, E(p,U),* which gives the minimum cost needed to reach utility level U for a set a prices described by the vector $p = (p_1, \ldots, p_n)$. One approach is to obtain the required parameters of a specified expenditure function by deriving and estimating the associated demand functions.

The expenditure function is obtained by specifying first the direct utility function. We use the linear expenditure system (LES), which has additive utility functions:

$$U = \sum_{i=1}^{n} (x_i - \gamma_i)^{\phi_i}, \tag{1}$$

where x_i is consumption for each good, γ_i is committed consumption for each good and ϕ_i represents marginal budget shares. Maximizing utility subject to the budget constraint, $y = \sum p_i x_i$, we obtain the linear expenditure functions for each good i (or group of goods):

$$p_i x_i = p_i \gamma_i + \phi_i \left(y_h - \sum_j p_j \gamma_j \right). \tag{2}$$

Differentiating (2) with respect to y and multiplying by $y/p_i x_{i_i}$, we obtain the budget elasticities e_i, from which we will obtain ϕ_i which is needed in the utility function:

$$e_i = \frac{\phi_i y}{p_i x_i} => \phi_i = e_i\, w_i \tag{3}$$

where w_i is the budget share of commodity group i, $0 \leq \phi_i < 1, \sum_i \phi_i = 1$.

Differentiating (2) with respect to p_i and multiplying by $p_i/p_i x_{i_i}$, we obtain the own-price elasticities e_{ii}, from which we will obtain γ_i which is needed in the utility function:

$$e_{ii} = \frac{\gamma_i (1 - \phi_i)}{x_i} - 1 => \ \gamma_i = \frac{(e_{ii} + 1) x_i}{(1 - \phi_i)}. \tag{4}$$

In order to obtain ϕ_i and γ_i, we need first to estimate the budget e_i and price elasticities e_{ii}, which are explained next.

- ***Estimating budget and price elasticities***

In order to estimate the budget elasticities e_i and own-price elasticities e_{ii} needed in the equations above, we estimate a full expenditure system on cross-sectional data (Cornwell and Creedy, 1995; Creedy, 1998).

The first step is to calculate budget elasticities, e_i, which show how the budget shares of each expenditure group, w_i, vary with income. These are estimated using information in the HBS following Creedy (1998). We estimate the LES parameters for each commodity group (i) using Engel functions:

$$w_i^h = \alpha_i + \beta_i lny^h + \varphi_i (lny^h)^2 + \delta_i \mathrm{X}^{\mathrm{h}} \qquad (5)$$

where w_i^h is the budget share of commodity group i of household h in total household consumption y^h, and X are a set of individual and household characteristics of household h. In total we have 19 commodity goods ($i = 1, \ldots, 19$). The parameters of the Engel functions in (5) are estimated via pooled ordinary least squares at the household level.

Using the estimated parameters in (5) for each commodity group ($i = 1, \ldots, 19$) and the budget shares of each commodity group, we obtain the budget elasticities e_i. The formula for obtaining e_i:

$$e_i = 1 + \frac{dw_i}{dy}\frac{lny}{w_i} = 1 + \frac{\beta_i + 2\varphi_i lny}{w_i} \qquad \text{if } \varphi_i \neq 0 \qquad (6)$$

We evaluate the budget elasticities e_i at population sub-group average incomes $\overline{lny}^{pg}$ and budget shares $\overline{w_i}^{pg}$:

$$e_i^{pg} = 1 + \frac{\beta_i + 2\varphi_i \overline{\ln y}^{pg}}{\overline{w_i}^{pg}} \qquad \text{if } \varphi_i \neq 0 \qquad (7)$$

$$e_i^{pg} = 1 + \frac{\beta_i}{\overline{w_i}^{pg}} \qquad \text{if } \varphi_i = 0 \qquad (8)$$

We obtain population sub-group specific elasticities for 10 population sub-groups defined by household types (defined in the data section); in total a matrix of 10×19 budget elasticities. The results section will however discuss the results at the population level, not sub-group specific. The expectation is that budget elasticities are positive implying that all expenditure types rise with income. Values between (0, 1) indicate inelastic goods whose budget shares decrease with income (e.g. necessity items, such as food and fuel, are expected to have budget elasticities below 1). Values above 1 indicate elastic goods or luxuries whose budget shares are expected to increase with income.

After obtaining e_i, we can calculate ϕ_i in (3) using the population sub-group specific $\overline{w_i}$. We obtain a matrix with 10×19 estimates for

$$\phi_i^{pg} = e_i^{pg} * \overline{w_i}^{pg}. \qquad (9)$$

In order to calculate γ_i in (4), besides ϕ_i, we also need the own-price elasticities of demand e_{ii}. For estimating price elasticities we follow an approximate method described in Creedy

(2001). The set of price elasticities can be obtained using a result established by Frisch (1959) for directly additive utility functions. This requires the use of the elasticity of marginal utility of expenditure with respect to total expenditure, also known as the Frisch parameter, ξ. Own and cross-price elasticities take the form:

$$e_{ij} = -e_i w_j \left(1 + \frac{e_i}{\xi}\right) + \frac{e_i \delta_{ij}}{\xi} \tag{10}$$

where δ_{ij} = 1 if i=j and 0 otherwise. Own-price elasticities are expected to be negative since price increases are expected to decrease demand of the good. The closer e_{ij} is to -1, the more elastic the demand reaction is to price increases. The e_i and w_j used here are the population sub-group budget elasticities e_i^{pg} and the commodity groups average shares by population sub-groups $\overline{w_i}^{pg}$. Therefore the e_{ij} will also be estimated by population sub-groups, e_{ij}^{pg}.

$$e_{ij}^{pg} = -e_i^{pg} \overline{w_j}^{pg} \left(1 + \frac{e_i^{pg}}{\xi}\right) + \frac{e_i^{pg} \delta_{ij}}{\xi} \tag{11}$$

To obtain estimates of ξ, we follow the approach in Creedy and Dixon (1998) and Lluch et al. (1977), which allows the relationship between ξ and total expenditure to vary according to the relationship:

$$\ln(-\xi) = \phi - \alpha \ln(\frac{y}{ER} + v) \tag{12}$$

where the parameters ϕ, α and v are derived via trial and error (the values used here are 7.1, 1.05, 177). y represents mean total expenditure and ER the exchange rate relative to the dolar. In our analysis, ξ is derived country-specific.

We have now all ingredients to estimate the subsistence consumption γ_i for each household:

$$\gamma_i^h = \frac{(e_{ii}^{pg} + 1) x_i^h}{(1 - \phi_i^{pg})}$$

After estimating the LES parameters γ_i and ϕ_i, we proceed next with the welfare evaluation.

- ***Welfare Effects of Price Changes***

We discuss next how we obtain a money metric measure of the change in welfare experienced by individuals as a result of a change in prices. A money metric change in welfare is defined as the difference in minimal expenditures evaluated at a set of reference consumer prices p_r to reach the pre- and post-change utility levels (Deaton 2003).

From (2), we derive the Marshallian demand functions, $x_i^h = \gamma_i^h + (\phi_i^{pg}\ (y^h - \sum_j p_j\ \gamma_j^h))/p_i$, which we substitute into U to obtain the indirect utility function, V:

$$V(p, U^h) = \frac{y^h - A}{B}$$

$$A = \sum_i p_i \gamma_i^h \; ; B = \prod_i \left(\frac{p_i}{\phi_i^{pg}}\right)^{\phi_i^{pg}} . \tag{13}$$

The expenditure function $E(p, U)$ is then given by:

$$E(p, U^h) = A + BU^h. \tag{14}$$

This is the fundamental ingredient in the construction of our welfare function: it gives the minimum cost of achieving the utility level U for a set of prices defined by the vector p.

Compensating variation

A money metric of the change in welfare can be evaluated based on the concept of *compensating variation* (CV). Assume that the vector of prices changes from p_0 to p_1, which implies that utility changes from U_0 to U_1 as a result of the associated change in consumption.

The *compensating variation (CV)* is the monetary compensation that households should receive after price increases (under p_1) given the initial total expenditure y_0^h in order to maintain their utility (to be equally well off) as before the price change (under p_0). Formally, this implies:

$$V(p_1, y_0^h + CV^h) = V(p_0, y_0^h). \tag{15}$$

Expressed as difference in expenditure functions, CV^h becomes:

$$\begin{aligned} CV^h &= E(p_1, U_0^h) - E(p_0, U_0^h) \\ &= A_1 + B_1 U_0^h - y_0^h \end{aligned} \tag{16}$$

Substituting U_0^h, we obtain:

$$CV^h = \left[A_1 + \frac{B_1}{B_0}(y_0^h - A_0)\right] - y_0^h \text{ .}^4 \tag{17}$$

The welfare effect for each household ΔW_h equals the CV^h which evaluates the pure price change from p_0 to p_1 by comparing the expenditure function for the two price vectors, evaluated at the pre-change utility level while holding income constant at pre-change levels. In case of a price increase, ΔW^h will capture welfare losses due to price increases (expressed as positive amounts).

$$\Delta W_{CV}^h = CV^h = \left[\sum_i p_{1i}\gamma_i^h + \prod_i \left(\frac{p_{1i}}{p_{0i}}\right)^{\Phi_i^{pg}} \left(y_0^h - \sum_i p_{0i}\gamma_i^h\right)\right] - y_0^h \tag{18}$$

We will report CV relative to initial expenditure levels $\frac{CV^h}{y_0^h}$.[5]

Equivalent income

Another approach to measuring the welfare effects to prices changes relies on equivalent income. The equivalent income is defined as the value of income, y_e, which at some reference set of prices, p_r, gives the same utility as the actual income level. Formally this implies: $V(p_r, y_e^h) = V(p, y^h)$.

[4] This expression can also be re-arranged as $CV^h = A_0[A_1/A_0 + B_1/B_0(y_0^h/A_0 - 1)] - y_0^h$, where the term A_1/A_0 falls under the Laspeyres family of price indices using the committed expenditure γ_i as weight and B_1/B_0 is the weighted geometric mean of price relatives: $\frac{A1}{A0} = \frac{\sum_i p_{1i}\gamma_i^h}{\sum_i p_{0i}\gamma_i^h}$; $\frac{B1}{B0} = \prod_i \left(\frac{p_{1i}}{p_{0i}}\right)^{\Phi_i^{pg}}$.

[5] The welfare change can also be expressed in terms of equivalent variation, which we discuss in the annex.

An important feature of equivalent income is that it allows the comparison of alternative policies using a common set of reference prices.

The welfare change is measured as the change in equivalent income between before (y_{e0}^h) and after price changes (y_{e1}^h).

In our context, where $p_r = p_0$, this implies that before price changes:

$$V(p_o, y_{e0}^h) = V(p_0, y_0^h) \Rightarrow y_{e0}^h = y_0^h. \quad (19)$$

After price changes:

$$V(p_o, y_{e1}^h) = V(p_1, y_1^h) \quad (20)$$

$$\frac{y_{e1}^h - A_0}{B_0} = \frac{y_1^h - A_1}{B_1} \quad (21)$$

The minimum expenditure to achieve this utility level at the reference prices is:

$$y_{e1}^h = A_0 + \frac{B_0}{B_1}(y_1^h - A_1)\ ] \quad (22)$$

Expanding the formula, we obtain equivalent incomes:

$$y_{e1}^h = \sum_i p_{0i}\gamma_i^h + \{\prod_i (\frac{p_{0i}}{p_{1i}})^{\Phi_i^{pg}}\}\{y_1^h - \sum_j p_{1j}\gamma_j^h\} \quad (23)$$

The welfare effect for each household ΔW^h equals:

$$\Delta W_{y_e}^h = y_{e1}^h - y_{e0}^h = [\sum_i p_{0i}\gamma_i^h + \{\prod_i \left(\frac{p_{0i}}{p_{1i}}\right)^{\Phi_i^{pg}}\}\{y_1^h - \sum_j p_{1j}\gamma_j^h\}] - y_0^h \quad (24)$$

Social welfare evaluations based on y_{e1}^h and y_{e0}^h

The distributions of values of y_{e1}^h and y_{e0}^h can be used to calculate values of a social welfare function for population sub-groups or for the whole population. The change in welfare could then be evaluated in terms of its overall effect according to the value judgments implicit in the welfare function.

Following Creedy (2001), we utilize a variant of the Atkinson (1970) social-welfare function:

$$W(e) = \frac{1}{H}\sum_h \frac{(y_e^h)^{1-e}}{1-e} \quad (25)$$

where H is the number of households, e is the inequality aversion parameter and y_e^h is equivalent income obtained above. This can be expresses as $W(e) = \frac{y_{ede}(e)^{1-e}}{1-e}$, where y_{ede} is the equally distributed equivalent income value which, if distributed to the entire population, would give the same value of social welfare as the existing distribution of income. A more convenient abbreviated form of the welfare function is simply captured by y_{ede},

$$W(e) = y_{ede}(e) = \overline{y}_e * (1 - A(e)) \quad (26)$$

where $\overline{y_e}$ is mean equivalent income and $A(e)$ is the Atkinson's measure of inequality evaluated for the distribution of equivalent incomes y_e^h. This form expresses the trade-off between mean equivalent income and its equality, or the trade-off between efficiency and equity. Since the overall welfare evaluation combines different household types, equivalent incomes y_e^h are expressed per equivalent adult by dividing the household equivalent income by the squared root of the household size.

The social welfare function above is used to evaluate the change in welfare due to the increase in prices, relative to the initial situation pre-price changes.

$$\Delta W = (y_{ede_1} - y_{ede_0})/y_{ede_0}. \tag{27}$$

The welfare change can be decomposed into the contribution of the efficiency and equity components of welfare and their interactions by expanding and manipulating the difference in (26):

$$\begin{aligned} \Delta W &= [\overline{y}_{e_1}(1 - A_1(e)) - \overline{y}_{e_0}(1 - A_0(e))]/\overline{y}_{e_0}(1 - A_0(e)). \\ \Delta W &= (\overline{y}_{e_1} - \overline{y}_{e_0})/\overline{y}_{e_0} + (A_1(e) - A_0(e))/A_0(e) \\ &\quad + (\overline{y}_{e_1} - \overline{y}_{e_0})/\overline{y}_{e_0}(A_1(e) - A_0(e))/A_0(e) \\ \Delta\%W &= \Delta\%\overline{y_e} + \Delta\%A(e) + (\Delta\%\overline{y_e} * \Delta\%A(e)) \end{aligned} \tag{28}$$

2.1. Assessing the distributional impact of inflation

We evaluate how the composition of household consumption basket of goods varies across countries (budget shares of main commodity items) and how this translates into the overall CPI inflation. This allows us to assess the role of each commodity item in driving inflation and to identify the largest contributors towards inflation in the six countries. In order to gauge the distributional impact of inflation, we examine the composition of expenditure and the composition of inflation across the income distribution within each country. This allow us to assess the overall progressive or regressive impact of inflation and to identify which commodity items are diving the regressive/ progressive effect.

In order to quantify the progressive/regressive effects and to deepen our understanding of the distributional impact of inflation and how this differs across the six countries, we calculate several distributional measures inspired by the taxation literature (see Lambert 2001).

The distributive effect of price changes can be calculated using the Reynolds-Smolensky index:

$$RS = CI_{X+C} - CI_X \tag{29}$$

where CI_X is the concentration index for pre-price change total expenditure (ranked by quintiles of household disposable income) and CI_{X+C} is the concentration index for post-price change total expenditure (X = initial expenditure, C = change in expenditure due to price changes). RS captures how price changes affect the expenditure shares of quantiles of people in the income distribution. A positive RS implies that a higher share of expenditure is concentrated in the hands of richer households after the price increases than pre-change. In this situation, the price changes have a progressive impact (higher at the top).

We adapt the Pfahler (1990) approach used in taxation (see also Lambert (2001) and Decoster et al. (2002)) to decompose the overall distributional effect of inflation (progressive/regressive) into an inflation rate effect and an inflation structure effect or aggregate inflation progressivity/regressivity, as originally proposed by Kakwani (1977) for taxation. In our context, the Kakwani index (K) can be used to capture the base effect or the disproportionality between the structure of initial expenditure and the increase in expenditure due to price changes. In other words, it captures the progressivity or the regressivity of the inflation rate structure per se:

$$K = CI_C - CI_X \quad (30)$$

where CI_C captures the income-related inequality in the changes in total expenditure (C) due to price changes and CI_X measures the income-related inequality in total initial expenditure. A positive K marks a progressive inflation rate structure where the increase in expenditure is concentrated more at the top of the income distribution. In other words, the Kakwani approach measures the disproportionality impact from price changes.

Following Pfahler (1990) and Lambert (2001), the relation between RS and K is:

$$RS = \frac{r}{1+r} * K \quad (31)$$

where r is the average inflation rate. This allows us to decompose the distributional impact of price changes into inflation rate and disproportionality components.

The average inflation rate is obtained from the inflation rates for disaggregated commodity items i. Therefore, K or the progression of inflation along the income distribution can be further decomposed into the contribution of each commodity group:

$$K = \frac{r_1}{r} * K_{C_1} + \frac{r_2}{r} * K_2 + \cdots + \frac{r_i}{r} * K_{C_i} \quad (32)$$

where each K_{C_i} denotes the disproportionality of the price changes in each of the commodity item group i and r_i refers to the average inflation rate for each commodity group. K_{C_i} is calculated as:

$$K_{C_i} = CI_{C_i} - CI_X \quad (33)$$

where CI_{C_i} captures the income-related inequality in the changes in expenditure of commodity item i (C_i) due to price changes in item i. If the distribution of the price changes for commodity i is located disproportionately in the lower end of the income distribution, K_{C_i} will be negative.

2.3. Data section

The analysis is based on the most recent available Household Budget Survey data for each country. For Lithuania, Finland, Ireland, Hungary and Portugal, we use the 2015 wave of the European Union Households Budget (EU-HBS) Survey; for Luxembourg, we use the 2020 wave of the Household Budget Survey (LU-HBS). Both, the EU-HBS and the LU-HBS are similar in structure and contain detailed information on household expenditure by expenditure item, household composition, demographic and socio-economic characteristics of household members, and household disposable incomes. Using the high level of detail on households' expenditure, we compute changes in the cost of living for each household by applying price changes to expenditure items and updating the cost of households' consumption baskets in accordance with recent price changes. The number of expenditure items is 298 in the EU-HBS and 423 in the LU-HBS. The unit of observation across datasets is the household. The sample size varies between countries. The largest sample is available for Portugal (11,398 households), followed by Hungary (7,169 households), Ireland (6,839 households), Finland (3,673 households), Lithuania (3,443 households) and Luxembourg (586 households).

The HBS is a cross-sectional dataset, but some countries combine multiple survey years to generate sufficiently large datasets (HU 2015/16, IE 2015/16). To ensure comparability across datasets, expenditure and income are adjusted using household level price coefficients where the collection year does not match the survey reference year (Eurostat, 2020). The resulting samples are representative of the population. Sampling strategy, survey strategy and implementation arrangements may however differ across countries, because collection of household budget surveys is voluntary and has no legal basis (only the 2026 round and subsequent will be implemented under a legal basis). Nonetheless, national statistical offices and Eurostat made great efforts to harmonize the HBS and improve data comparability (for a detailed description of differences across countries see Eurostat (2020)).

We update the cost of living for each household using the Harmonized Consumer Price Index (HCPI) published by Eurostat. Eurostat publishes monthly HCPI data for each EU country, disaggregated to the 4-digit COICOP level. HCPI data is however not available at the 4-digit level for all items and countries. We follow a pragmatic approach, applying 4-digit COICOP categories for items subject to the largest price changes. For example, we split COICOP categories *CP04 Electricity Gas and other Fuels* and *CP07 Transport* to account for high price growth of some expenditure items (e.g. Natural Gas). Using the HCIP, we compute price changes for the period April 2021 to July 2022 for each item and country. The CPI growth rates for each expenditure item and country are shown in Table 1. After applying item-specific inflation rates, we organize items in expenditure groups reflecting the fulfilment of specific needs (i.e. Heating fuels for home heating and Motor fuels for transport) or to assess a specific social or health component (e.g. childcare costs and tobacco). The final number of expenditure groups is 19. The allocation of expenditure items into expenditure groups is described in Table 2.

To allow for heterogeneity in welfare effects, we construct 10 household types based on demographic characteristics and disposable income. We construct five household types based on demographic characteristics; 1) singles, 2) singles with children, 3) couples, 4) couples with children, 5) other households. Each household type is further split by disposable income levels: above and below the median equivalised household disposable income. Table 7 (Annex) shows the unweighted sample size for each household type and country.

Table 1 Price changes from April 2021 to July 2022 (in %)

COICOP Heading	Expenditure item	HCPI Price change (in %)					
		FI	HU	IE	LT	LU	PT
All-items HICP		8,20	16,50	10,30	22,70	9,70	9,60
CP01	Food and non-alcoholic beverages	11,10	30,50	8,50	29,00	8,20	15,30
CP021	Alcoholic Beverages	1,80	13,00	7,90	12,10	2,40	3,70
CP023	Tobacco	8,70	9,60	6,70	8,30	5,10	1,80
CP03	Clothing and footwear	-1,30	4,80	-2,70	-2,40	-11,40	-13,30
CP041, CP042	Rents	1,10	12,50	11,60	18,70	2,10	3,20
CP0451	Electricity	39,90	0,00	42,10	72,20	2,60	36,30
CP0452	Natural Gas	31,70	0,90	62,40	103,30	47,10	39,10
CP0453	Liquid fuels	98,70	11,00	72,60	91,30	36,10	2,00
CP0454	Solid fuels	31,70	11,00	34,00	137,00	28,90	12,20
CP0455	Heat energy	4,70	0,00	34,00	81,20	57,20	2,00
CP06	Health	-0,10	8,20	0,20	10,00	4,30	-3,40
CP072 (except CP07221, CP07222)	Private Transport	24,00	20,90	36,50	41,00	40,90	19,50
CP07221	Diesel	51,20	21,90	53,40	69,90	63,10	41,20
CP07222	Petrol	41,00	20,10	42,50	55,80	43,70	26,00
CP073	Public Transport	10,10	11,80	28,90	14,90	11,60	21,00
CP08	Communication	7,20	-0,60	3,90	4,10	1,30	2,90
CP09 (except CP091, CP0921, CP0922)	Recreation and culture	4,60	14,40	3,20	12,40	7,70	5,90
CP10	Education	1,20	6,90	-0,80	8,30	0,90	1,40
CP11	Restaurants and hotels	7,70	23,00	8,90	21,30	8,50	18,80
CP12 (except CP12401)	Miscellaneous goods and services	0,80	9,30	0,00	13,70	5,70	2,60
CP12401	Childcare services	0,80	0,10	1,00	3,80	5,10	2,00
CP05 (except repair), CP071, CP091, CP0921, CP0922	Durable goods	6,20	17,20	3,50	14,90	5,60	9,90

Table 2 Allocation of COICOP into Expenditure groups

	Expenditure groups	COICOP Headings	Items with individualized CPI
1	Food and non-alcoholic beverages	CP01	NA
2	Alcoholic Beverages	CP021	NA
3	Tobacco	CP023	NA
4	Clothing and footwear	CP03	NA
5	Heating fuels	CP0452, CP0453, CP0454, CP0455	CP0452 - Natural Gas, CP0453 - Liquid fuels, CP0454 - Solid fuels CP0455 - Heat Energy
6	Electricity	CP0451	NA
7	Rents	CP041, CP042	NA
8	Household goods and services	CP043, CP05 (repair only)	NA
9	Health	CP06	NA
10	Private Transport	CP072 (except CP07221 Diesel, CP07222 Petrol)	NA
11	Public Transport	CP073	NA
12	Communication	CP08	NA
13	Recreation and culture	CP09 (except CP091, CP0921, CP0922)	NA
14	Education	CP10	NA
15	Restaurants and hotels	CP11	NA
16	Miscellaneous goods and services	CP12 (except CP12401)	NA
17	Childcare services	CP12401	NA
18	Motor Fuels	CP07221, CP07222	CP07221 – Diesel, CP07222 - Petrol
98	Durable goods	CP05 (except repair), CP071, CP091, CP0921, CP0922	NA

3. Results

3.1. Decomposition of average headline inflation

The composition of the average household consumption basket of goods varies across countries. Some expenditure categories are associated with necessities including food, electricity, light and heat. In line with Engle's law (Engel 1857), there is a basic expectation that the richer the country, the lower the share of necessities in total expenditure, which is one of the most established empirical regularities observed in economic data (Houthakker, 1957). A substantial literature has confirmed this econometric relationship (Chai and Moneta, 2010; Chakrabarty and Hildenbrand, 2016). While the relationship is widely found, Kaus (2013) finds variability in the shape of Engel curves and budget shares with different income elasticities of demand between countries.

Figure 3 shows the budget shares of the main commodity sub-components for the average household across the six countries under analysis (see detailed budget shares in Table 8 in the Annex). Food, heating, electricity and motor fuels vary in relative importance between countries in terms of the average budget share. Finland, Luxembourg and Ireland have lower budget shares relative to Hungary, Lithuania and Portugal, with richer the countries, having lower the shares of necessities in total expenditure.

Motor fuel budget shares vary between countries with relatively high average shares in Hungary (5.1 per cent) and Portugal (6.2 per cent) relative to Luxembourg (1.4 per cent) and Finland (3 per cent). Some of this variation may be attributed to the more urbanised population in Luxembourg and Finland relative to the other four countries (World Bank 2022). Average budget shares for food range from 9.1 per cent in Luxembourg to 25 per cent in Lithuania and these shares appear to be related to the variation of income between countries. The average budget share for heating and electricity is highest in Hungary (10.4 per cent) and lowest in Luxembourg (2.5 per cent). Pais-Magalhães, et al. (2021) identify Luxembourg as having better electricity use efficiency when compared with the other countries, except Finland. Along with the variation in weather conditions, income and demographics, this factor could form part of the explanation. In summary, Figure 3 shows that the average income household in Hungary and Lithuania is much more exposed to the impact of a rise in the price for necessities such as food, heating and electricity when compared with the average income household in Finland, Ireland and Luxembourg.

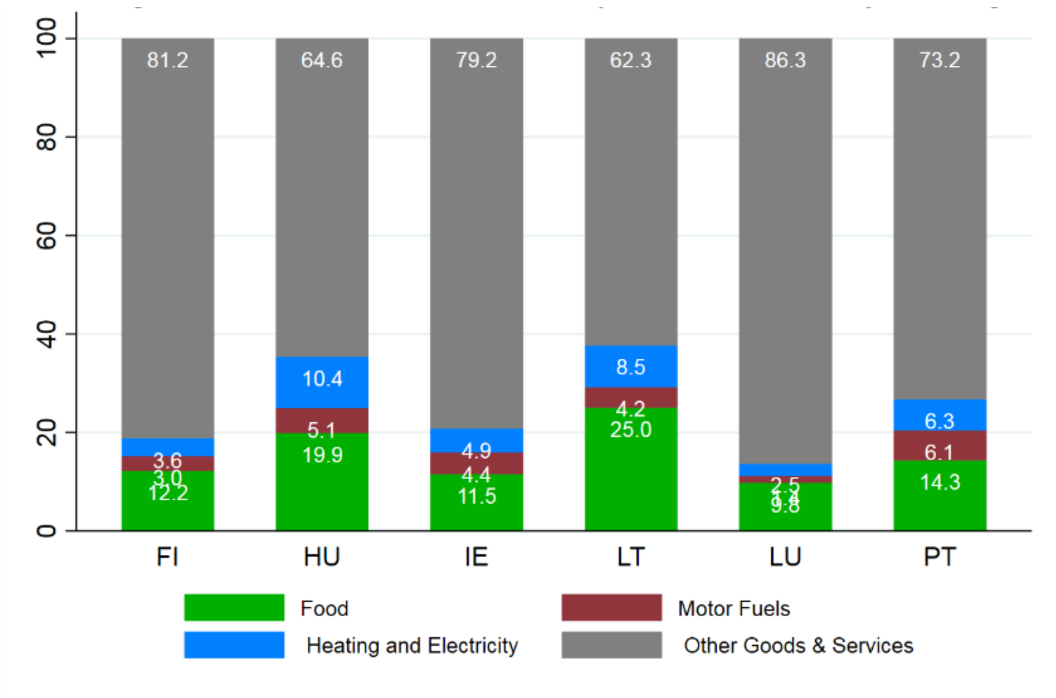

Figure 3. Aggregate Budget Shares

In Figure 4 we report inflation in July 2022 for the average household, built on both the budget shares and good commodity price change. Headline inflation was the highest in Lithuania and Hungary, and the lowest in Luxembourg.

The drivers of inflation vary across countries, with increases in energy and food prices being the main drivers of cross-national differences. Rising food prices contributed much more significantly towards inflation in Hungary (6.1 per cent) and Lithuania (7.2 per cent) relative to Luxembourg (0.9 per cent). Food prices have increased rapidly in Hungary and particularly for bread, dairy products and some meat products (Hungarian CSO, 2022). The contribution of increasing food prices towards overall CPI inflation is largest in the case of Lithuania (7.2 per cent) where rising prices for bread and dairy products are contributing heavily (Statistics Lithuania, 2022a).

The largest contribution towards inflation in Lithuania emerges from heating and electricity, contributing to a 9.8 per cent increase. Lithuania has experienced high inflation previously during the 2007/2008 commodity price spike. However, the inflation rate in the region of 30 per cent has not occurred since the transition to independence in the early 1990s (Nath and Tochkov, 2013).

In all six countries, rising prices are very evident for other goods and services with these expenditures raising inflation by a minimum of 4.5 per cent in the case of Luxembourg. In the case of Lithuania, the price increases for these expenditures raise inflation by 10.1 per cent with contribution from rising transport prices, alcohol and tobacco and prices for other goods and services (Statistics Lithuania, 2022b). In Ireland, it is established that rising prices for rented housing is a major problem for many low-income households but is partly alleviated through state supports (Doolan et al., 2021).

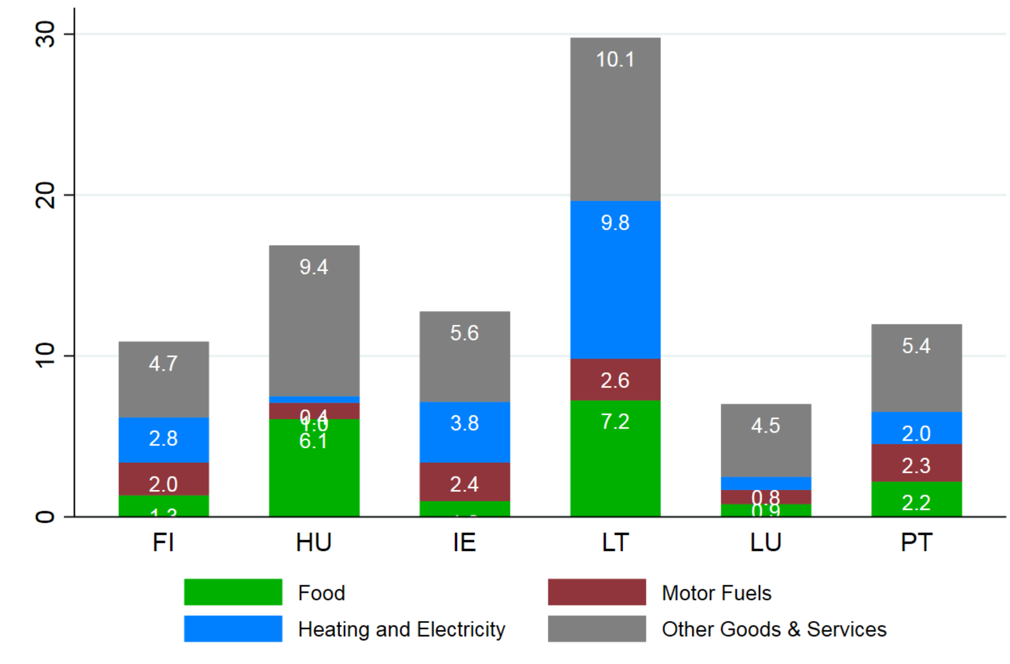

Figure 4. Estimated inflation by main sub-components

3.2. Distributional impact of inflation

In order to understand the distributional impact of inflation, we examine first the composition of expenditure across the income distribution (quintiles) within each country (Figure 5). The composition substantially; shares of food and energy (necessities) are higher for low-income households and decline with income. Thus, large swings in necessity prices will affect low-income households more than higher income households. We find a lower gradient, both in levels and distributional pattern in richer countries (Finland and Luxembourg), which also have similar shares of heating along the distribution. The lower gradient in Finland corresponds with the findings of Karonen and Niemelä (2021), which identified a narrowing in the expenditure gap, in terms of necessities between low- and high-income households in Finland. Budget shares for motor fuels tend to increase with income and this is most evident in Hungary.

Figure 5 is largely concerned with within-country variation in budget shares for a particular set of commodity groups. However, the cross-country differences remain striking. For instance, there appears to be no overlap in the food budget share between the lowest income quintile in Luxembourg and the highest income quintiles in either Hungary or Lithuania. The food budget share for the lowest income quintiles in Ireland and Portugal appear similar to the highest income quintile in Hungary. In terms of the budget share for these three commodity groups, the gradient appears higher in Lithuania and Portugal. In the case of Finland, there appears to be little difference in the budget shares across the distribution.

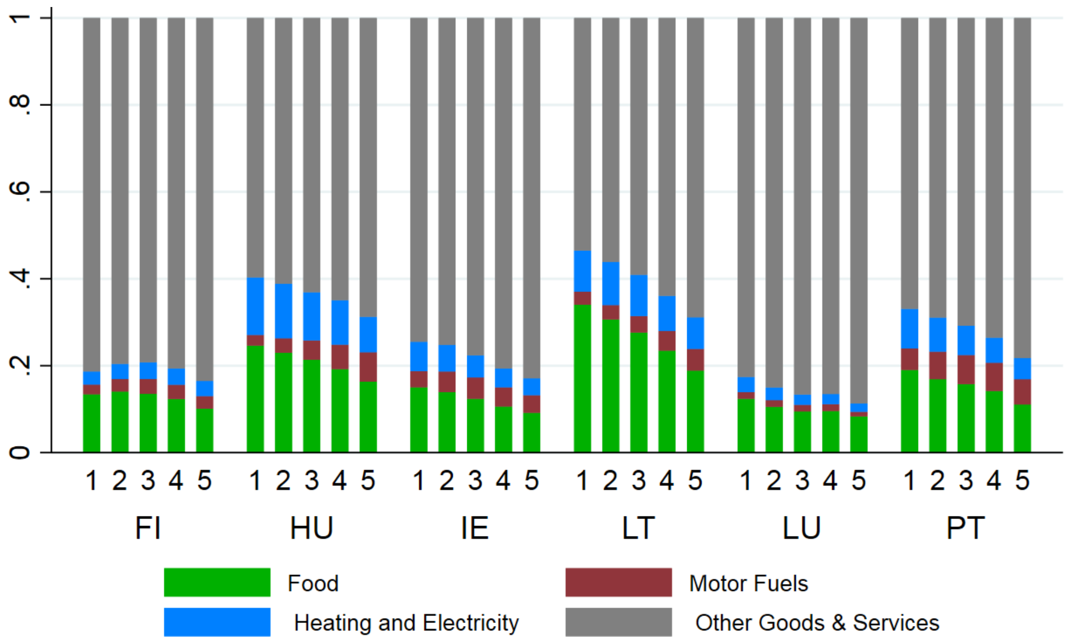

Figure 5. Budget Shares of expenditure components across equivalised disposable income quintiles

Given our focus on inflation, it is informative to investigate the shares of expenditure groups in total expenditure. However, expenditure and savings as shares of household income are also relevant. Figure 6 shows the relative contribution of main expenditure sub-components and savings in total income across quintiles of household equivalised disposable income. The income shares of food and energy are higher for lower income households, which implies that in the absence of changes in income, large variations in energy prices will impact low income households more.

We can expect that low-income households have a reduced ability to tap into savings. In all six countries, the savings rates are negative in the bottom quintile of the income distribution and highest in the highest quintile of the distribution, a pattern that is found in previous studies of savings and income distribution (Browning and Lusardi, 1996). Rich households save more than poor households and have the option to maintain their expenditure by reducing their savings. Low and middle income households may reduce their savings rates to maintain their basic welfare and social standing (Wisman, 2013). Some interesting comparisons can be made between the six countries. The savings rates appear highest in Ireland and lowest in Luxembourg. In Finland, Hungary and Ireland, saving rates are positive in the top four quintiles, whereas, in the case of Luxembourg, the saving rates are only positive in the top two quintiles of the distribution. Expressing budget shares relative to income alters the picture somewhat. In relative terms, the households in Lithuania appear even more exposed to rising prices for food, heating and electricity. This is due to the relatively low saving rates and high budget shares for necessities as a share of total expenditure.

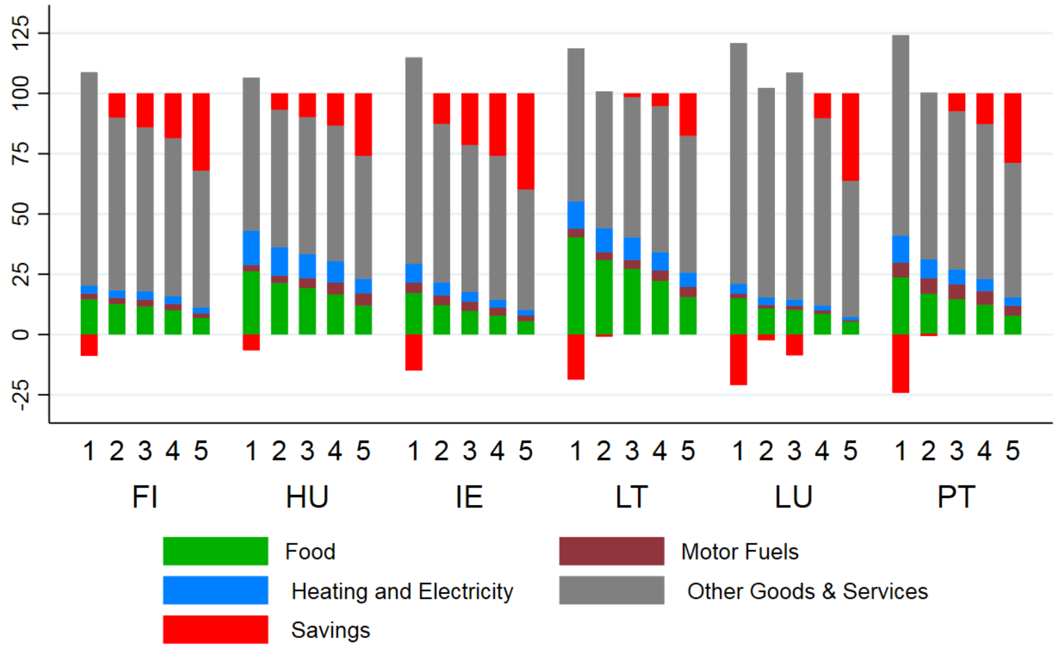

Figure 6. Budget and savings shares in household income across equivalised disposable income quintiles

These details help us understand the distributional impact of inflation. Figure 7 shows inflation in July 2022 relative to April 2021 along quintiles of household disposable income, built up from main commodity sub-components. The distributional impact varies across countries. We find a regressive impact of inflation in Lithuania and Ireland, a progressive impact in Finland, and a relatively flat effect in the other countries. We find a regressive impact of food inflation in most countries, however more pronounced in Hungary and Lithuania, meaning a larger percentage of inflation is driven by food for low-income households than for high-income households. For heating and electricity, we find a regressive impact, more pronounced in Lithuania and Ireland, which recorded higher price increases than the other countries: in Lithuania, liquid and solid fuels increased by 91% and 137%, gas by 103% and electricity by 72%; in Ireland liquid and solid fuels increased by 72% and 34%, gas by 62% and electricity by 42%.

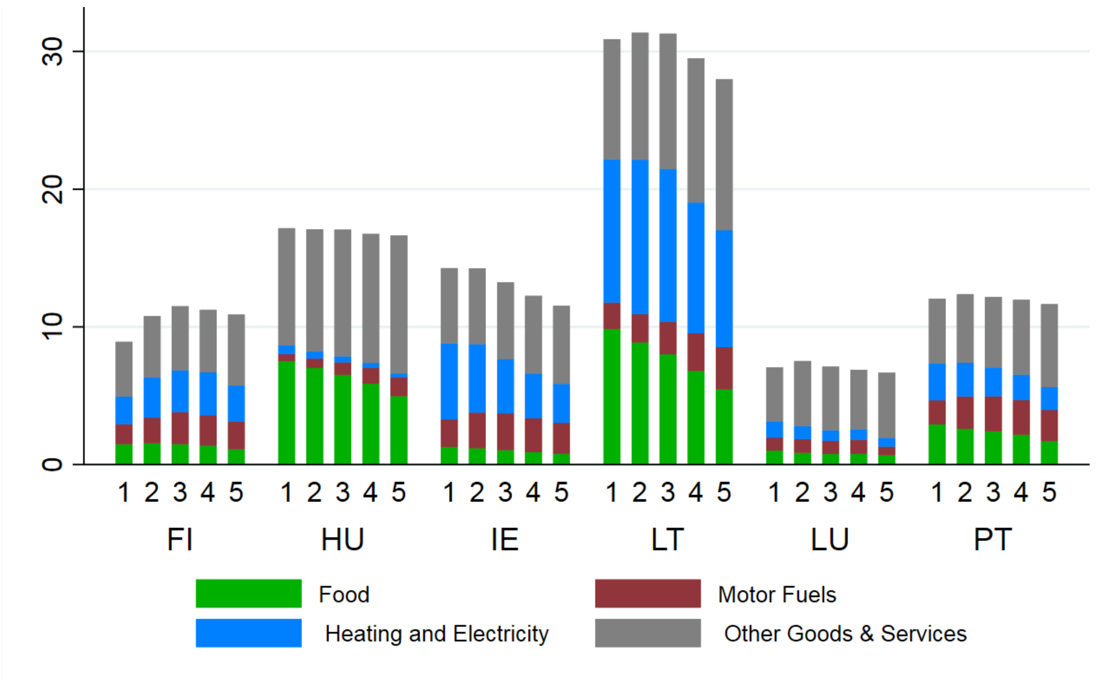

Figure 7. Distributional impact of inflation across equivalised disposable income quintiles

We find a low impact of heating and electricity in Hungary, which is surprising given the large shares in consumption. A closer look at price changes, however, reveal that the price of energy changed little in Hungary compared with the other countries. For example, the price of electricity stagnated, gas increased by 0.9%, and liquid and solid fuels increased by 11%. These differences may be influenced by policy decisions with price capping and reductions in indirect taxation having direct effects on inflation indices. This contrasts with the influence of ex-post subsidies, which may have no direct impact on inflation.

In Finland, the distributional pattern of energy inflation is inverted-U shaped, which can be explained by the composition of the energy basket and the price changes: the bottom of the distribution has higher shares of electricity in home heating, whereas the top has higher shares in liquid fuels. The price of liquid fuels, which are cheaper than electricity, increase by 99%, whereas for electricity the price increased by 34%. Thus in Finland, the bottom of the distribution was less affected because it relies more on electricity, which increased much less compared with liquid fuels. Luxembourg has a much smaller inflation impact compared to Finland, despite having similar expenditure shares. This is due to lower price increases in Luxembourg, where liquid fuels increased by 36% and electricity by 2.6%. Gas and solid fuel prices increased by similar amounts in both countries (29-48%)

For motor fuels, we find a progressive inflation impact, except in Luxembourg where the effect is homogenous except the top quintile (lower). For other goods and services, we find a progressive impact, except in Ireland where the pattern is flat along the distribution of income and this may be connected to the rising prices for private rented accommodation (Waldron, 2022).

In order to quantify the effects observed in Figure 7 and to deepen our understanding of the distributional impact of inflation and how this differs across the six countries, in Table 3 we calculate several distributional measures inspired by the taxation literature (see Lambert 2001).

The Reynolds-Smolensky index (RS) (column 4) confirms that inflation had a *progressive impact* (higher at the top) in Finland and a regressive impact in the other countries. The strongest *regressive impacts* are found in Lithuania and Ireland, followed by Luxembourg, Portugal and Hungary. These quantify the effects observed in Figure 7 in the headline inflation bars across quintiles.

The Kakwani index (column 5) shows that a *progressive inflation rate structure* is found in Finland, whereas a *regressive inflation rate structure* is found in the other countries, stronger in Ireland and Lithuania, followed by Luxembourg, Hungary and Portugal. The average inflation rate r is calculated based on equation (31) in which we know RS and K. These values are consistent with the average inflation rates calculated in Figure 4.

Table 3. Decomposition on distributional impact into base and rate effects

	CI pre-change (X)	CI_{C_i}	CI_{X+C_i}	RS_{C_i}	K_{C_i}	*Avg. r*
	(1)	(2)	(3)	(4)	(5)	(6)
FI						
Total expenditure	**0.2243**	**0.2420**	**0.2261**	**0.0017**	**0.0177**	**0.1089**
Food		0.1643	0.2235	-0.0008	-0.0600	0.0135
Heating and Electricity		0.2382	0.2247	0.0004	0.0139	0.0280
Heating		0.2508	0.2248	0.0005	0.0265	0.0178
Electricity		0.2163	0.2242	-0.0001	-0.008	0.0102
Motor fuels		0.2551	0.2249	0.0006	0.0308	0.0204
Other goods and services		0.261	0.226	0.0016	0.0366	0.047
HU						
Total expenditure	**0.1951**	**0.1886**	**0.1941**	**-0.0009**	**-0.0065**	**0.1687**
Food		0.1154	0.1905	-0.0046	-0.0796	0.0607
Heating and Electricity		0.0268	0.1944	-0.0007	-0.1683	0.0040
Heating		0.0268	0.1944	-0.0007	-0.1683	0.0040
Electricity		0	0.1951	0.0000	-0.1951	0.0000
Motor fuels		0.3587	0.1967	0.0017	0.1637	0.0103
Other goods and services		0.2243	0.1976	0.0025	0.0293	0.0937
IE						
Total expenditure	**0.1864**	**0.1421**	**0.1814**	**-0.0050**	**-0.0443**	**0.1276**
Food		0.0905	0.1855	-0.0009	-0.0959	0.0098
Heating and Electricity		0.0532	0.1816	-0.0048	-0.1332	0.0377
Heating		0.0482	0.1827	-0.0038	-0.1382	0.0280
Electricity		0.0677	0.1853	-0.0011	-0.1188	0.0097
Motor fuels		0.1832	0.1864	-0.0001	-0.0032	0.024
Other goods and services		0.1935	0.1868	0.0004	0.007	0.056
LT						
Total expenditure	**0.2036**	**0.1808**	**0.1984**	**-0.0052**	**-0.0227**	**0.2977**
Food		0.0892	0.1959	-0.0077	-0.1144	0.0724
Heating and Electricity		0.1528	0.199	-0.0045	-0.0508	0.0982
Heating		0.166	0.2007	-0.0028	-0.0376	0.0818
Electricity		0.0867	0.2017	-0.0019	-0.1169	0.0164
Motor fuels		0.291	0.2058	0.0022	0.0874	0.0258
Other goods and services		0.2455	0.2074	0.0039	0.0419	0.1013
LU						
Total expenditure	**0.1417**	**0.1242**	**0.1406**	**-0.0011**	**-0.0175**	**0.0700**
Food		0.0758	0.1412	-0.0005	-0.0659	0.0080
Heating and Electricity		0.0316	0.1408	-0.0009	-0.1101	0.0081
Heating		0.0314	0.1408	-0.0009	-0.1103	0.0078
Electricity		0.035	0.1417	-0.0000	-0.1067	0.0003
Motor fuels		0.0776	0.1411	-0.0006	-0.0641	0.0089
Other goods and services		0.1587	0.1424	0.0007	0.017	0.0450
PT						
Total expenditure	**0.2188**	**0.2092**	**0.2178**	**-0.0010**	**-0.0096**	**0.1197**
Food		0.1186	0.2167	-0.0022	-0.1003	0.0220
Heating and Electricity		0.1237	0.2170	-0.0019	-0.0951	0.0199
Heating		0.1504	0.2184	-0.0005	-0.0684	0.0066
Electricity		0.1104	0.2174	-0.0014	-0.1084	0.0133
Motor fuels		0.2395	0.2193	0.0005	0.0207	0.0234
Other goods and services		0.2643	0.2212	0.0023	0.0455	0.0544

Note: X = initial expenditure; CI_{C_i} = concentration index of the cost increase in item i, C_i; CI_{X+C_i}= CI of the increase in total expenditure due to the cost increase in item i, C_i; RS_{C_i}, K_{C_i}= Reynolds-Smolensky and Kakwani of C_i; r = average inflation rate; RS = (3)-(1); K =(2)-(1)

Equation (31) provides the first step in the decomposition of the distributive effect of inflation: the interplay between the average inflation rate and the progression of inflation along the income distribution (or the disproportionality effect of price changes). Based on the estimates for RS, K and r from Table 3, we are able to assess the role of this interplay in explaining cross-national differences. Figure 8 (based on estimates from Table 4) shows there is no “one size fits all” explanation. Similar high levels of regressivity of inflation (Lithuania and Ireland) are driven by different levels of disproportionality and inflation rate: Lithuania records the highest average inflation, but has a moderate distributional impact due to a smaller disproportionality compared to Ireland, which has a much lower inflation rate. The same holds for Luxembourg, Hungary and Portugal: similar regressive impacts of inflation result from different driving factors. In Luxembourg, the inflation level is roughly half that of Portugal, whereas its disproportionality component is almost twice the size of Portugal; Hungary has a much higher inflation than Luxembourg and Portugal, but a much lower disproportionality component, which limits the regressive impact of inflation.

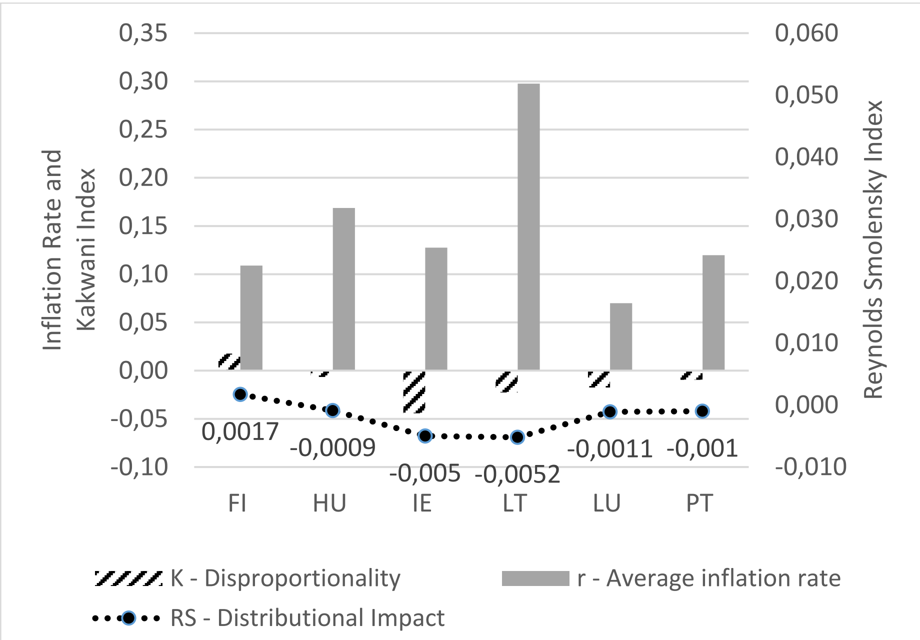

Figure 8. Overall distributive effect, disproportionality and average inflation rate

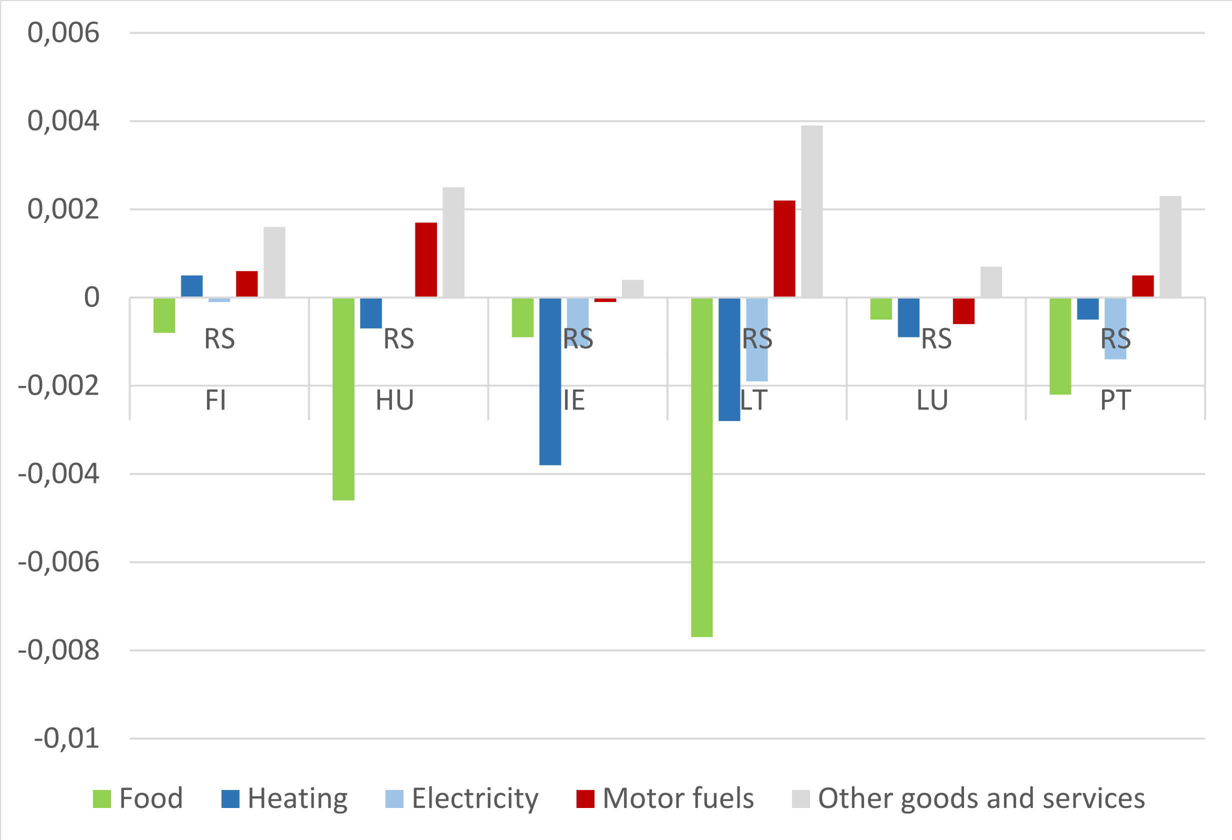

Figure 9. Direct redistributive effect of each commodity group

Figure 10. Disproportionality and average inflation rates by main commodity group

By subcomponents, Figure 9 shows the *direct redistributive effect* (RS) of inflation in each commodity group, *ceteris paribus* (based on Table 3 column 4). *Food inflation* is regressive in all countries, stronger in Lithuania, Hungary and Portugal. Richer countries have a lesser regressivity, due to their relatively lower food budget shares. *Heating inflation* has a regressive impact, stronger in Ireland and Lithuania; Finland is an exception with a progressive impact. *Electricity inflation* is regressive, stronger in Lithuania, Portugal and Ireland; exceptions are Hungary and Luxembourg with stagnating prices. *Motor fuels inflation* has a progressive impact, stronger in Lithuania and Hungary; exceptions are Luxembourg and Ireland. *Other goods and services inflation* is progressive in all countries, stronger in Lithuania, Hungary and Portugal.

The *redistributive effect* of each commodity group is decomposed into disproportionality (K) and average inflation rates (r) components in Figure 10 (based on Table 3 columns 5 and 6). Consistent with the overall effect, the decomposition by subcomponents confirms the "no one size fits all" lesson: similar levels or regressivity/progressivity (Figure 9) can result from varying interplays between disproportionality and inflation rates (Figure 10).

The high *food inflation* regressivity in Lithuania, Hungary and Portugal (Figure 9) is determined by a high inflation rate and a strong disproportionality (Figure 10). The countries with the lowest food inflation regressivity (Luxembourg and Finland) (Figure 9), have similar disproportionality levels; the Finish average food inflation rate is however slightly higher, resulting in a higher regressivity than in Luxembourg (Figure 10).

The high *heating inflation* regressivity in Ireland and Lithuania (Figure 9) is determined by a differing interplay between drivers (Figure 10). Ireland has a higher regressivity due to a larger disproportionality, despite having a lower average inflation rate than Lithuania. The larger degree of disproportionality also explains why heating inflation is more regressive in Luxemburg than in Portugal. A sufficiently low average inflation rate, however, has the potential to dampen the regressive impact of a high disproportionality component, illustrated by Hungary, which ranks between Luxembourg and Portugal.

Only Finland has a *progressive heating inflation*, coupled with the least regressive electricity inflation (Figure 9). Average inflation rates are higher for heating than for electricity in Finland. Their disproportionality components go in opposite directions showing that increases in heating expenditure are concentrated more at the top of the income distribution, whereas increases in electricity expenditure are concentrated more at the bottom (Figure 10). This is linked to their budget shares (see Annex, Figure 15).

Lithuania displays the most *regressive electricity inflation* (Figure 9), which is driven by the highest average inflation rate coupled with second highest disproportionality (Figure 10). Ireland has a slightly higher disproportionality, but the smallest average inflation rate, which places Ireland as the second lowest in terms of regressivity of electricity (Figure 10).

Lithuania and Hungary are the most progressive in *motor fuels inflation* (Figure 9), driven by the proportionality component (Figure 10). Between them however, the average inflation rates explain their ranking in progressivity. Lithuania has a higher average inflation rate than Hungary; this is distributed less progressively than in Hungary, but not sufficiently to place Lithuania below Hungary in motor fuel inflation progressivity (Figure 10). Portugal and Finland have similar levels of motor fuel progressivity (Figure 9), which result from a divergent interplay between the two drivers (Figure 10): Finland has a stronger proportionality component than Portugal, but a lower average inflation rate. The regressivity of motor fuels inflation is much stronger in Luxembourg than in Ireland due to the proportionality component: average inflation rate is almost 3 times larger in Ireland than in Luxembourg, but is distributed 20 times less regressively, reducing the distributional impact.

The strong *progressive inflation from other goods and services* in Lithuania, Hungary and Portugal (Figure 9) is explained both by high average inflation rates and their strong progression along the distribution (Figure 10). Ireland has a similarly high average inflation rate as Portugal, however distributed much less progressively (Figure 10), resulting in the smallest progressive impact among the 6 countries (Figure 9). The second lowest is Luxembourg, which has a lower average inflation rate than Ireland, but a much stronger progression along the distribution than Ireland.

The varied outcomes that emerge from the interplay between average inflation rates and their progression along the distribution due to the (dis)proportionality component or the base underlie once again the main lesson of this decomposition: "no one size fits all". Similar distributive outcomes can result from diverging interplays between the components.

Table 4 summarizes the main findings of our decomposition, by expressing the contribution of each commodity component as a percentage of the progressivity / regressivity of inflation. The average inflation rate is obtained from the inflation rates for food (1), heating (2), electricity (3), motor fuels (4) and other goods and services (5). Therefore, K or the progression of inflation along the income distribution can be further decomposed into the contribution of the five commodity groups, following equation (32).

Remember the values for K from Table 3 (also Figure 8). In Finland, overall inflation was progressive (K>0), for the others it was regressive (K<0). In *Finland*, 24.5% of *inflation progressivity* is due to heating, 32.6% due to motor fuels and 89.2% due to other goods and services. The regressivity of food counteracts this effect by -42.0%, whereas the regressivity of electricity reduces it further by 4.2%.

In the other countries, the regressivity of inflation is explained by a differential mix:

- *Food regressivity* contributes in proportion of 440.6% in Hungary, 192% in Portugal, 122.6% in Lithuania, 43% in Luxembourg and 16% in Ireland;
- *Heating regressivity* contributes 70.2% of overall inflation regressivity in Luxembourg, 68.5% in Ireland, 61.4% in Hungary, 45.5% in Lithuania, and 39.3% in Portugal;
- *Electricity regressivity* contributes 125.5% of overall regressivity in Portugal, 28.4% in Lithuania, 20.4% in Ireland and 2.6% in Luxembourg;

- *Motor fuels regressivity* contributes 46.6% of overall regressivity in Luxembourg and 1.4% in Ireland; *motor fuel progressivity* reduces overall regressivity by 153.8% in Hungary, by 42.2% in Portugal and by 33.4% in Lithuania;
- *Other goods and services progressivity* reduces overall regressivity by 250.4% in Hungary, 215.4% in Portugal, 62.8% in Lithuania, 62.4% in Luxembourg and 6.9% in Ireland.

Table 4. Percentage contributions of the commodity groups to the progressivity / regressivity of inflation

		FI	HU	IE	LT	LU	PT
Component	Formula						
Food	$\frac{r_1}{r} * K_{C_1}$	-42.0	440.6	16.6	122.6	43.0	192.0
Heating	$\frac{r_2}{r} * K_2$	24.5	61.4	68.5	45.5	70.2	39.3
Electricity	$\frac{r_3}{r} * K_{C_3}$	-4.2	0.0	20.4	28.4	2.6	125.5
Motor fuels	$\frac{r_4}{r} * K_{C_4}$	32.6	-153.8	1.4	-33.4	46.6	-42.2
Other goods and services	$\frac{r_5}{r} * K_{C_5}$	89.2	-250.4	-6.9	-62.8	-62.4	-215.4
Total	K	100.0	100.0	100.0	100.0	100.0	100.0

3.2. Welfare losses of inflation

We evaluate next how the cost of living was affected by the price increases and the contribution of prices changes towards overall social welfare.

3.2.1. Budget and Price elasticities

Table 5 presents budget share and price elasticities of demand. As expected, the price elasticities of demand are overwhelmingly negative in value and indicating a negative relationship between price and quantity demanded thereby ruling out the presence of Giffen behaviour (Jensen and Miller, 2008).

In all six countries, the budget share elasticity for food and non-alcoholic beverages is less than one thereby showing that the food budget share declines in response to changes in total expenditure. These budget share elasticities range from 0.433 in the case of Ireland to 0.767 in the case of Hungary. Similarly, the budget share elasticities are less than one for other necessities including electricity and home fuels. In contrast, the budget share elasticities exceed one for some commodity groups including recreation and culture and the restaurants and hotels (with the exception of Luxembourg where the value is slightly less than one). In the case of motor fuels, the budget share elasticities are similar across countries with the exception of Hungary where the value exceeds one.

The results for the alcohol group indicate an inelastic price elasticity of demand, which is in accordance with the findings elsewhere in the literature (Fogarty, 2006). A low budget share elasticity does not always indicate that the commodity group is a necessity for much of the population and this appears relevant for the results in relation to alcohol and tobacco expenditures. The budget share elasticities for clothing and footwear are either close to one (Finland and Luxembourg) or exceeding one (other four countries). This finding may be due to the possible postponement of these expenditures by households with temporarily low income (Browning and Crossley, 2009).

Table 5. Budget and Price Elasticities

Expenditure Category	FI		HU		IE		LT		LU		PT	
	Budget	Price	Budget	Price	Budget	Price	Budget	Price	Budget	Price	Budget	Price
Food and Non-alcoholic beverages	0.524	-0.421	0.767	-0.539	0.433	-0.339	0.642	-0.484	0.609	-0.537	0.628	-0.453
Alcoholic Beverages	0.536	-0.393	0.522	-0.314	0.498	-0.354	0.524	-0.32	0.782	-0.655	0.554	-0.354
Tobacco	0.337	-0.247	0.802	-0.484	0.662	-0.469	0.544	-0.33	0.434	-0.363	0.281	-0.181
Clothing and Footwear	0.99	-0.73	1.167	-0.706	1.113	-0.793	1.737	-1.039	1.001	-0.841	1.212	-0.779
Home fuels	0.308	-0.227	0.633	-0.404	0.261	-0.189	0.574	-0.368	0.42	-0.353	0.608	-0.396
Electricity	0.474	-0.353	0.608	-0.375	0.083	-0.06	0.391	-0.242	0.183	-0.154	0.35	-0.232
Rents	0.437	-0.385	0.626	-0.457	0.632	-0.532	0.446	-0.344	0.621	-0.6	0.681	-0.52
Household services	0.809	-0.609	0.942	-0.586	1.31	-0.924	0.81	-0.501	1.182	-0.986	1.231	-0.796
Health	0.881	-0.653	1.062	-0.648	1.414	-0.994	1.2	-0.738	0.328	-0.279	0.733	-0.487
Private transport	1.744	-1.249	1.087	-0.651	1.5	-1.053	0.466	-0.285	0.947	-0.795	1.358	-0.868
Public Transport	1.051	-0.771	0.6	-0.361	0.333	-0.237	0.672	-0.407	0.659	-0.554	0.486	-0.313
Information & Communication	0.382	-0.285	0.86	-0.535	0.333	-0.243	0.485	-0.303	0.432	-0.367	0.403	-0.265
Recreation and culture	1.44	-1.044	1.452	-0.872	1.237	-0.88	1.532	-0.924	1.025	-0.861	1.207	-0.776
Education	0.71	-0.518	0.899	-0.538	1.508	-1.058	0.16	-0.097	0.099	-0.082	1.002	-0.644
Restaurants and hotels	1.147	-0.845	1.271	-0.765	1.176	-0.839	1.102	-0.672	0.948	-0.804	1.148	-0.756
Other goods and services	0.832	-0.636	1.195	-0.724	0.96	-0.698	1.272	-0.767	1.196	-0.997	0.88	-0.575
Childcare costs	0.363	-0.266	0	0	1.163	-0.82	0.799	-0.48	0	0	0.852	-0.543
Motor fuels	0.447	-0.334	1.067	-0.654	0.432	-0.317	0.554	-0.348	0.605	-0.508	0.687	-0.46
Durables	1.8	-1.23	1.8	-1.063	1.8	-1.207	1.662	-0.998	1.723	-1.312	1.8	-1.122

3.2.1 Compensating variation

The compensating variation measures the change in welfare attributable to changes in the cost of living due to price increases. It represents the monetary compensation that households should receive in order to maintain their initial well-being (utility) after the price increases. In Figure 11, we express the compensating variation relative to total initial expenditure for households along quintiles of household equivalised disposable income in order to approximate the percentage change in the cost of living for households with different means. The picture of welfare losses along the distribution of income follows the same distributional pattern of inflation in Figure 7. The richer the country the lower the welfare loss. In general, losses are greater at the bottom than at the top in Lithuania and Ireland, lower at the bottom than at the top in Finland and similar across quintiles in the other countries.

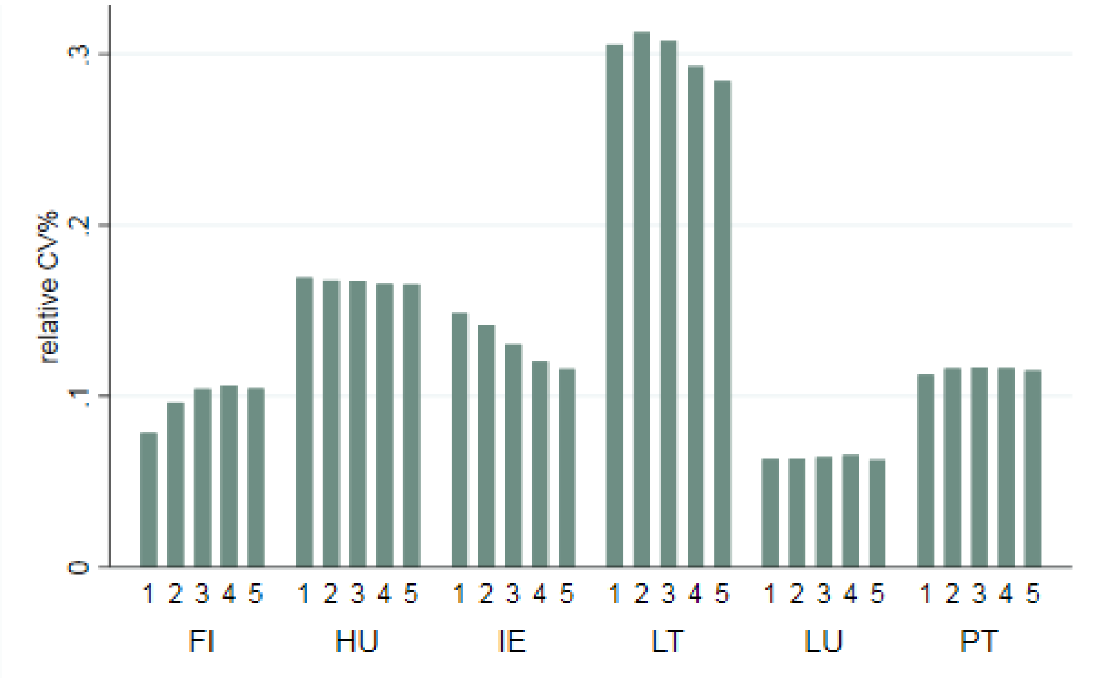

Figure 11. Relative changes in welfare measured by the compensating variation by equivalised disposable income quintile

Whereas the relative increase in costs due to inflation illustrated in Figure 7 captures the increase in expenditure that households face due to price increases given their current consumption pattern, relative CV (welfare losses) illustrated in Figure 11 captures the relative increase in income that households would need in order to maintain their *utility* under the new prices. The difference between them represents the adjustment that households do in their consumption behaviour (due to changes in the relative prices between different commodity groups) in order to maintain their utility under the price increases. In other words, how much would the price increase cost households without a behavioural adjustment minus how much it would cost taking into account that households can modify their behaviour.

Overall, it appears that the behavioural response component has very limited effects on welfare in all six countries. This is expected given that the highest price changes are recorded for necessities (energy and food), leaving little space for household to adjust their consumption.

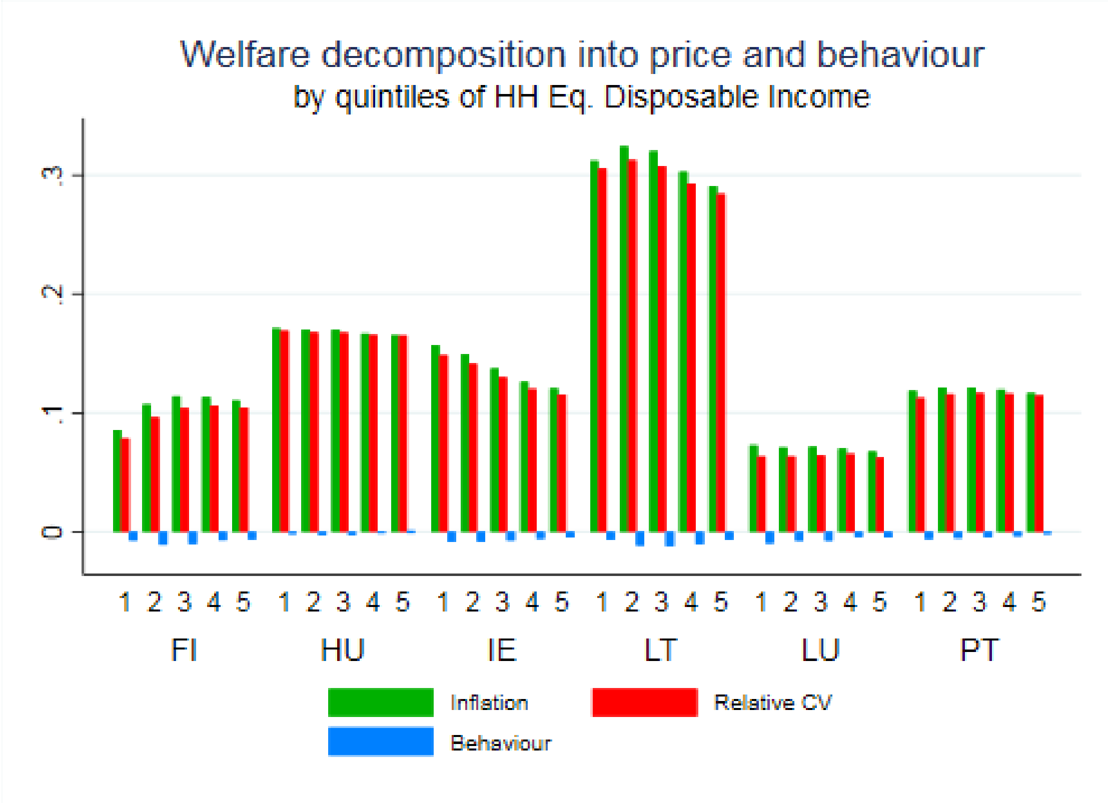

Figure 12. Welfare losses decomposition into price and behavioural adjustment

In order to evaluate the change in welfare due to price changes in terms of their overall effect for the population as a whole, we use the social welfare function associated with the Atkinson index based on the distribution of equivalent incomes before and after the price changes (Table 6).

Table 6. Welfare Changes as measured by $Y_{ede}(2)$

	Atkinson Index(2)			Mean Y_e			$Y_{ede}(2)$		
	Pre -change	Post -change	Relative change	Pre -change	Post -change	Relative change	Pre -change	Post -change	Relative change
FI	0.202	0.198	-1.9%	25590.4	23223.9	-9.2%	20423.1	18623.1	-8.8%
HU	0.183	0.183	0.4%	6245.7	5354.4	-14.3%	5104.1	4371.8	-14.3%
IE	0.226	0.24	6.2%	25751.1	22802.6	-11.5%	19930.9	17326.8	-13.1%
LT	0.212	0.217	2.5%	6808.6	5198.9	-23.6%	5366.4	4070.5	-24.1%
LU	0.224	0.223	-0.3%	46079.8	43301.3	-6.0%	35754.9	33626.0	-6.0%
PT	0.254	0.254	0.0%	13082.7	11718.1	-10.4%	9759.2	8742.2	-10.4%

According to the Atkinson Index, the rise in consumer prices increases the inequality in Ireland and Lithuania, reduces the inequality in Finland, with very little effect on inequality in the cases of Hungary, Luxembourg and Portugal. These results correspond well with the earlier findings based on the RS index. The largest drops in welfare as measured by the equally distributed equivalent income are recorded in Lithuania (24.1%), followed by Hungary (14.3%), Ireland (13.1%) and Portugal (10.4%). Luxembourg and Finland recorded lower welfare losses of 6.0% and 8.8% respectively.

The decomposition of the welfare losses into their efficiency and equity components in Figure 13 (based on Table 6), reveal that the main driver of the welfare loss was due to a decrease in efficiency (decrease in mean equivalent income). The small changes in consumption inequality reveal that price increases affected all households, with a similar relative impact. In Ireland and Lithuania the drop in welfare due to the increase on inequality was larger, consistent with the larger losses found for low-income household than for high-income households.

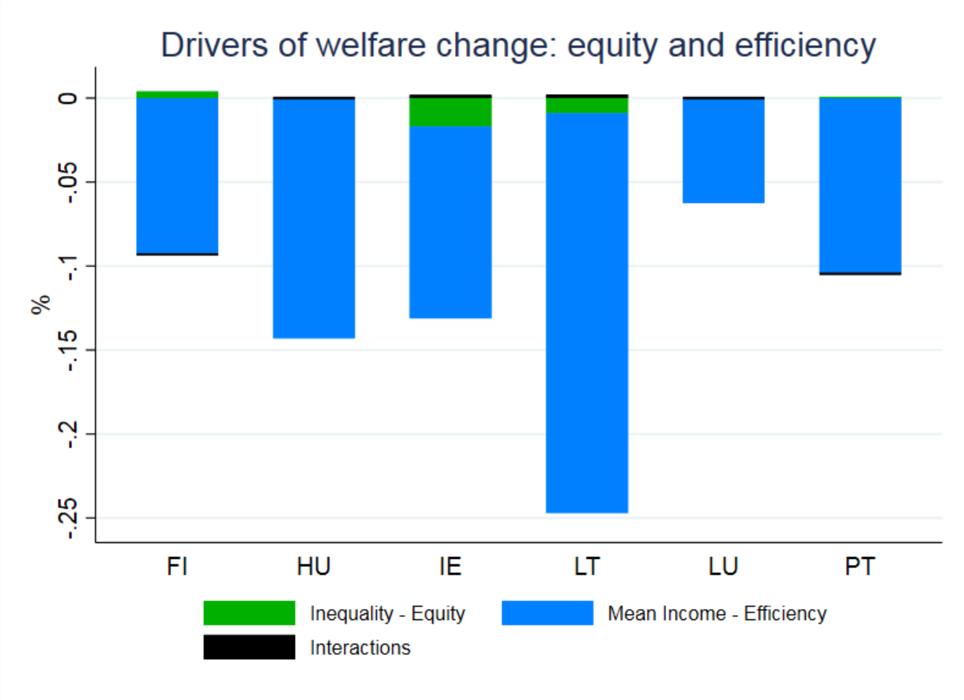

Figure 13. Decomposition of the welfare changes

4. Discussion and Conclusions

This paper analyses the distributional pattern of price changes since the start of the cost of living crisis in early-2021 and mid-2022 in Europe, contributing to the literature on consumption inequalities during times of economic crisis. The average inflation rate across Europe during this period rose at an unprecedented rate since the 1980's, with an increase in prices equivalent to 10 years prices growth over this period. Price growth was predominately driven by increases in fuels as a result of the Ukraine conflict, although most goods and services have seen price growth, especially food. Price inflation has been impacted by a number of other macro-economic changes including the impact of BREXIT, supply chain constraints post COVID-19 and an accumulation of building house price pressures since the recovery from the Financial Crisis of 2008-2009. In particular, we note that the price growth varies substantially across countries, reflecting different consumption patterns, mitigating policies and import origins. Eastern European countries tend to have the highest price growth, while the Nordics have the lowest price growth.

The *comparative advantage* of our paper lies in combining a detailed decomposition of the impact of inflation with welfare changes measured using the compensating variation and equivalent incomes in a cross-national comparative perspective in relation to the cost of living crisis. The way in which we decompose the impact of inflation and by looking cross-country we learn some key lessons. Our paper disentangles the impact of inflation between 2021 and 2022 across the income distribution for a subset of European countries that reflect different welfare regimes and spread across different average price changes.

We propose two methodological innovations in order to improve our understanding and knowledge about the cost of living crisis across Europe. First, in evaluating the distributional impact of inflation, we go one step further than existing studies and adapt a technique usually applied to assess progressivity/regressivity of tax-benefit systems. Building upon Pfhaler (1990), we examine the interaction between the inflation rates of different commodity groups and the structure of expenditure in determining the overall levels of progressivity or regressivity of inflation in each country and assess its drivers by components. Second, in evaluating the welfare impact of price changes we build upon Creedy (2000) and develop a comparative microsimulation infrastructure aimed to obtain a money-metric measure of the change in welfare experienced by individuals due to price changes across Europe. We examine the way compensating variations resulting from prices changes vary with household income. The approach consists of estimating a demand system to model household expenditure patterns on groups of goods in each country, estimate income and price elasticities and assess consumer welfare comparatively across Europe.

The impact of inflation depends on a combination of the good-specific price increase and its budget share. Typically, budget shares for necessities such as food, domestic fuels and electricity are higher in poorer countries such as Lithuania, Hungary and Portugal. Combined with a higher price growth in these necessities, this has resulted in higher inflation in poorer countries, with very significant cross-country variability. Lithuania has the highest contribution toward inflation from food and fuels. Hungary is exceptional with the second highest food inflation, but the lowest fuel price inflation due to the price cap.

Counter to the media narrative, the distributional impact is not as substantial as expected. However, there exists a significant variation across countries, both in terms of the level, composition and the relative rate of inflation across the distribution. In Lithuania and Ireland the distributional impact of inflation is the most regressive, with the poor having the highest impact. A lesser regressivity (almost flat) is found in Hungary, Luxembourg and Portugal, while in Finland the impact is progressive. The progressive impact of inflation in Finland is driven by heating, motor fuels and other goods and services, whereas the regressive impact of inflation is driven by food and heating in Hungary; food, heating and electricity in Lithuania and Portugal; food, heating, electricity and motor fuels in Ireland and Luxembourg.

The key conclusion is that distributional impacts differ across countries and there is no "one size fits all" explanation: similar levels of regressivity of inflation can result from a different interplay between the level and the disproportionality of inflation along the income distribution. It would be useful in further work to consider the policy drivers of these differences, such as mitigation measures: for example, price caps on fuels, subsidies for services such as public transport, social transfers, technological changes to electricity production and trade policy decisions in relation to the sourcing of fossil fuels.

Utilising a Linear Expenditure System, this paper has quantified the compensating variation of these price losses as a measure of welfare change. Overall, the distributional impact of the price changes is similar to the raw price changes with the behavioural component relatively small due to the preponderance of necessities in the goods with the highest price changes. Furthermore in decomposing the change in aggregate welfare as measured by the “equally distributed equivalent income”, we find that the change in social welfare is driven by the direct impact of the price change rather than the change in inequality, reflecting the relatively flat impact of the price changes.

While the distributional impact of price changes is not substantial, an important factor in relation to the potential impact on households is the savings rate. Richer households have higher savings rates, with the bottom of the distribution having low or even negative savings rates. As a result, richer households can maintain expenditure levels by reducing savings or by tapping into accumulated savings. Poorer households have less capacity to absorb the price changes and therefore are more likely to have to reduce their expenditure volume than richer households. Households in some countries accumulated savings during the COVID-19 crisis; this accumulation was greater for high-income households (Dossche et al 2021; Lydon and McIndoe-Calder 2021). These additional savings are likely to have been eroded for some groups, particularly poorer households. As a result, these households are disproportionally feeling the impact on their current expenditure, albeit reduced savings now for poorer households will see a reduction in future expenditures for richer households.

Central Banks are responding to the inflationary environment by increasing interest rates. It is likely that these responses will affect households in different ways. The resulting lower expenditure and investment is likely to hit the middle of the distribution hardest, where many service sector and construction sector jobs are located. Higher interest rates on mortgages will increase housing costs, which will have a higher impact in the middle of the distribution where savings rates are lower. Meanwhile the top of the distribution with higher capital incomes are likely to gain, while those with fixed incomes, and thus less able to manage exceptional price increases, at the bottom of the distribution will gain through a more stable price environment.

Looking back to recent crises (O’Donoghue et al., 2022), we know that a solidarity-focused policy response during the COVID-19 crisis protected living standards and enhanced trust in institutions in many countries. This was facilitated by lower interest rates from ECB. An austerity-focused response during the Financial Crisis saw the poorest lose and a reduced trust in government. With rising interest rates and cost of debt, the pressures during the current Cost of Living Crisis is starting to look more like the Financial Crisis. There is a need therefore, to focus on maintaining living standards of the poorest and the squeezed middle, who as we saw during the Financial Crisis reduced expenditure when under financial strain with consequential public trust implications.

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Annex

A.1. Methodology: Equivalent variation

The welfare change can also be expressed in terms of *equivalent variation*, which is the difference between the *post-change total expenditure* and the *minimum expenditure* required to achieve *post-change utility* at *pre-change prices*. It is the monetary compensation a household would need to forgo under the old prices p_0, given the old total expenditure y_0^h, in order to be indifferent between this baseline and the post-change situation with new prices p_1 and new expenditure levels y_1^h (post-behavioural changes). Note that total expenditure levels are equal pre and post price changes $y_0^h = y_1^h$ (initial budget constraint), but their composition in volumes differs due to behavioural responses. Formally, this implies:

$$V\left(p_0, y_0^h - EV^h\right) = V(p_1, y_1^h). \tag{34}$$

Expressed as difference in expenditure functions, EV^h becomes:

$$EV^h = E\left(p_1, U_1^h\right) - E\left(p_0, U_1^h\right) = y_1^h - [A_0 + B_0 U_1^h]\, y_1^h). \tag{35}$$

Substituting U_1^h, we obtain:

$$EV^h = y_1^h - \left[A_0 + \tfrac{B_0}{B_1}\left(y_1^h - A_1\right)\right]. \tag{36}$$

The welfare effect for each household ΔW^h equals the EV^h which evaluates the pure price change from p_0 to p_1 by comparing the expenditure function for the two price vectors, evaluated at the post-change utility level while holding total expenditure constant at post-change levels. In case of a price increase, ΔW^h will capture welfare losses due to price increases (expressed as positive amounts).

$$\Delta W_{EV}^h = EV^h = y_1^h - \left[\sum_i p_{0i}\gamma_i^h + \prod_i (\tfrac{p_{0i}}{p_{1i}})^{\phi_i^{pg}} \left(y_1^h - \sum_i p_{1i}\gamma_i^h\right)\right] \tag{37}$$

Similarly with CV, EV can be expressed relative to initial expenditure levels $\frac{EV^h}{y_1^h}, total\ y_0^h = y_1^h$.

Going back to equation (23), we see that EV is in fact the difference between the new expenditure levels (post-price change) and the equivalent incomes for the post-prices changes taking pre-change prices as reference prices.

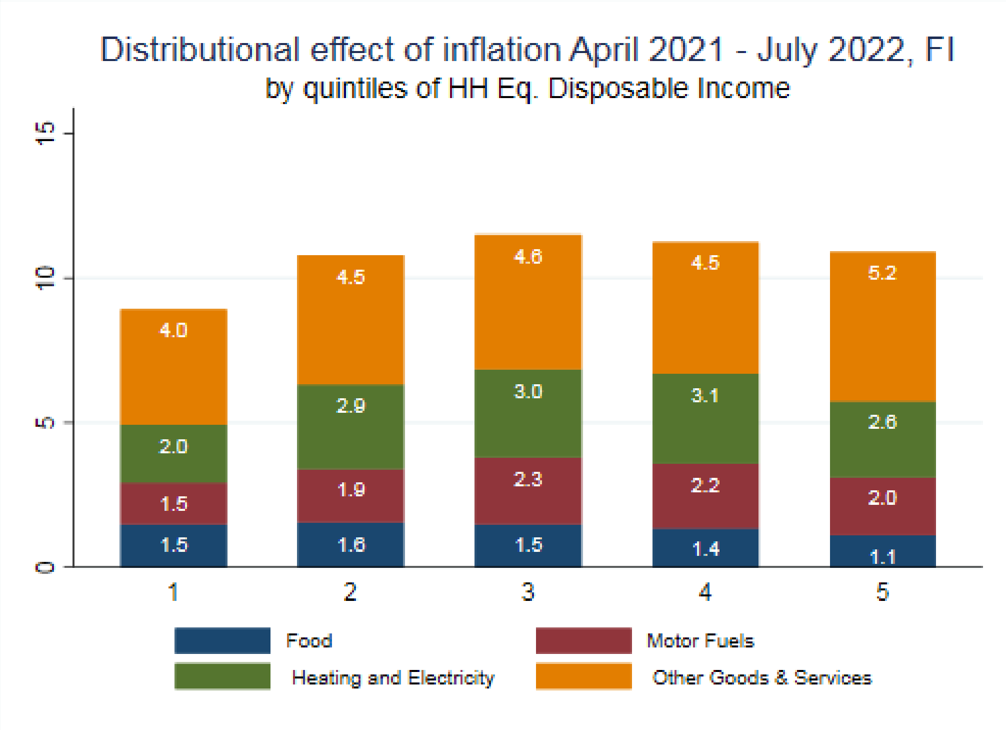
$$EV^h = y_1^h - y_{e1}^h \tag{38}$$

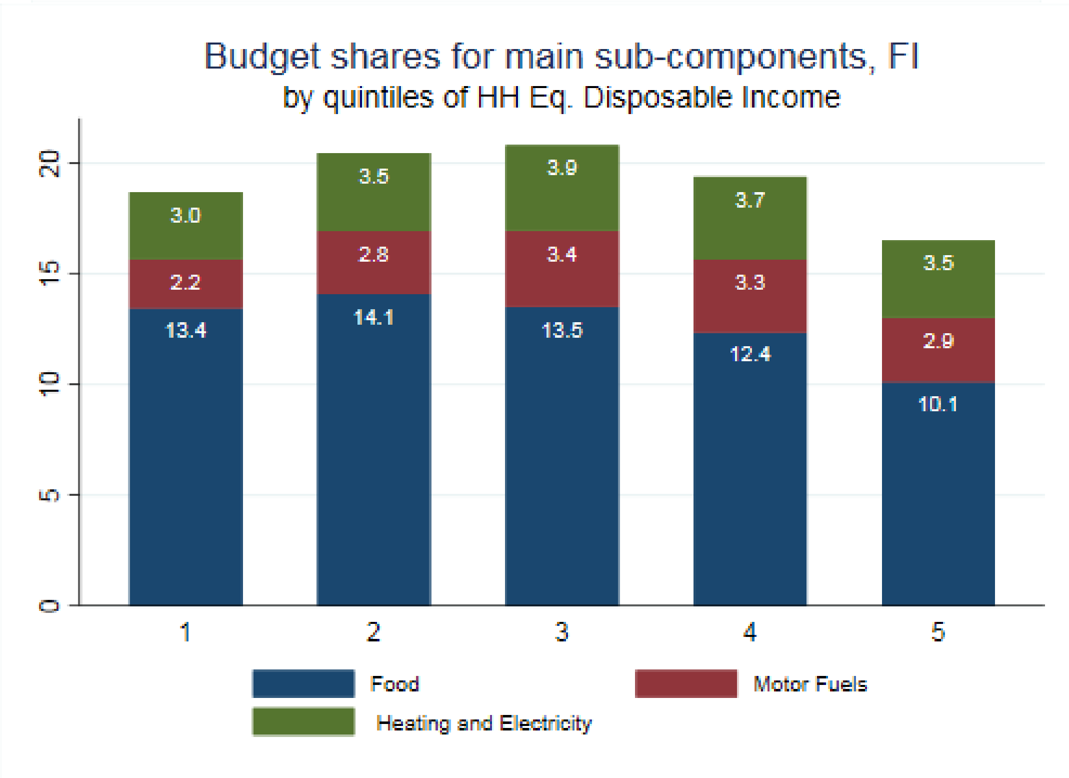
EV/y_1^h is thus the proportional change in equivalent incomes following the price changes.

A.2. Country detailed results: Decomposition of inflation into main components and budget shares

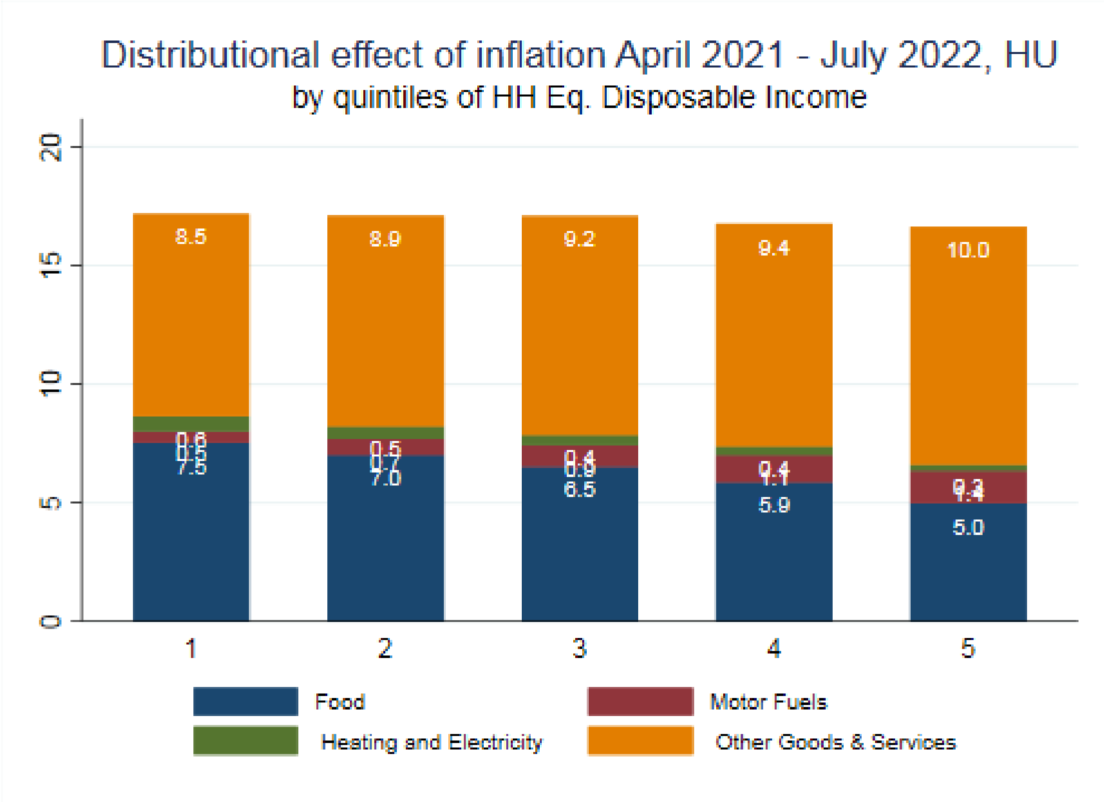
Figure 14. Distributional Effect of Inflation - Decomposition of inflation by income quintiles into components

(a) Finland

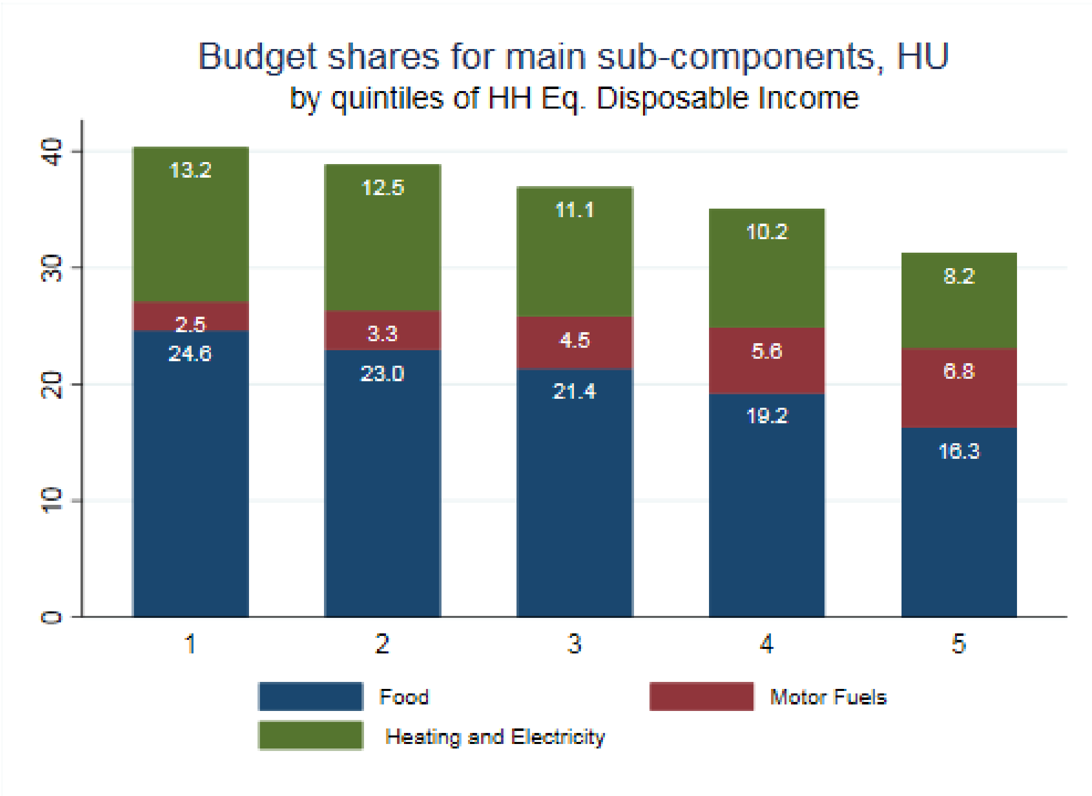




(b) Hungary

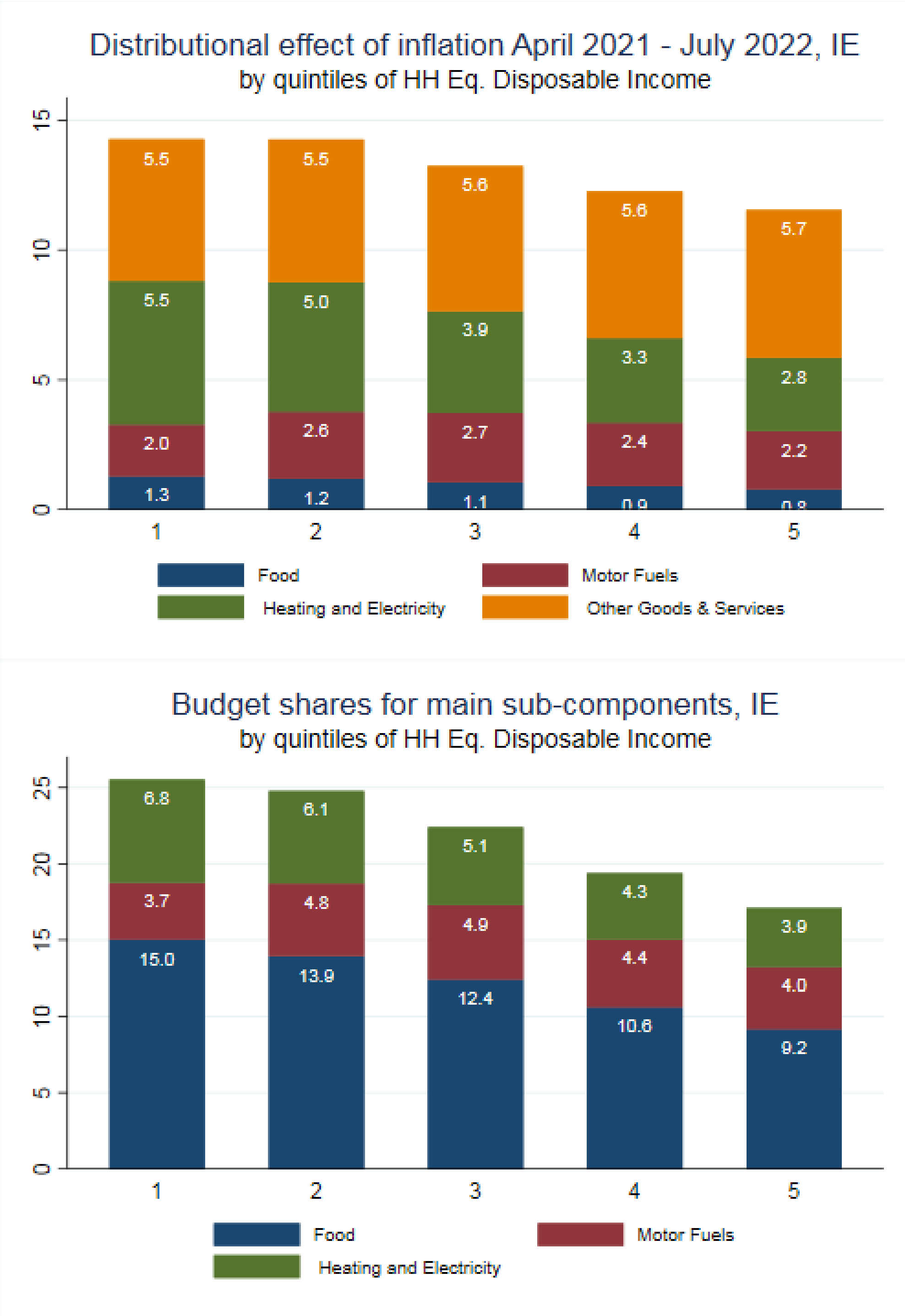


Distributional effect of inflation April 2021 - July 2022, HU
by quintiles of HH Eq. Disposable Income
0
5
10
15
20
8.5
8.9
9.2
9.4
10.0
7.5
7.0
6.5
5.9
5.0
1
2
3
4
5
Food
Motor Fuels
Heating and Electricity
Other Goods & Services



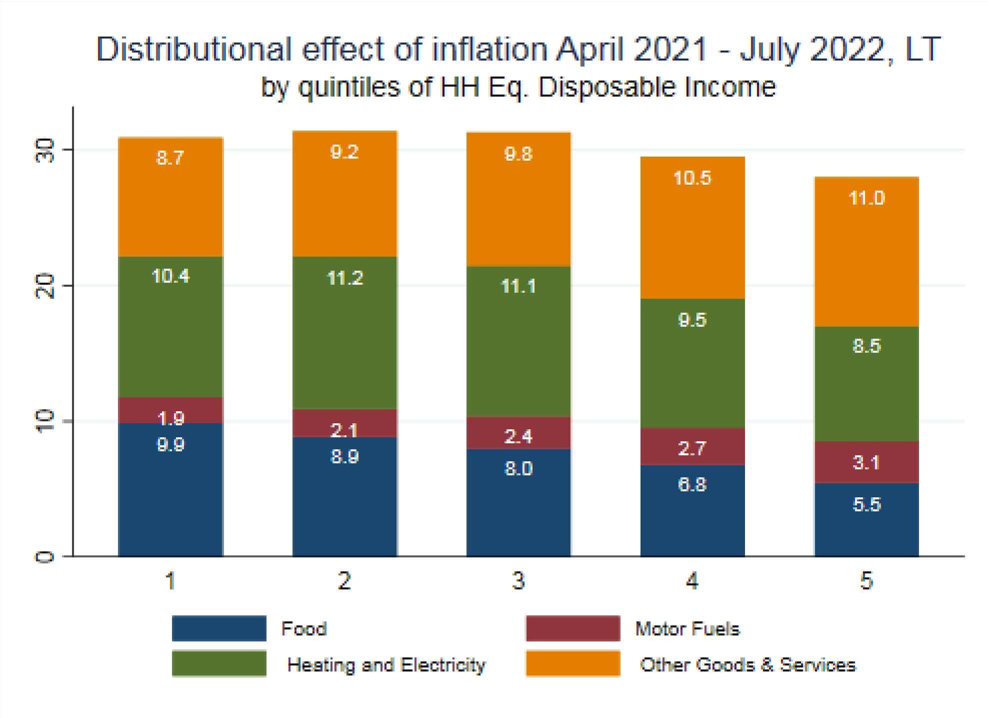
Budget shares for main sub-components, HU
by quintiles of HH Eq. Disposable Income
0
10
20
30
40
13.2
12.5
11.1
10.2
8.2
2.5
3.3
4.5
5.6
6.8
24.6
23.0
21.4
19.2
16.3
1
2
3
4
5
Food
Motor Fuels
Heating and Electricity

(c) Ireland

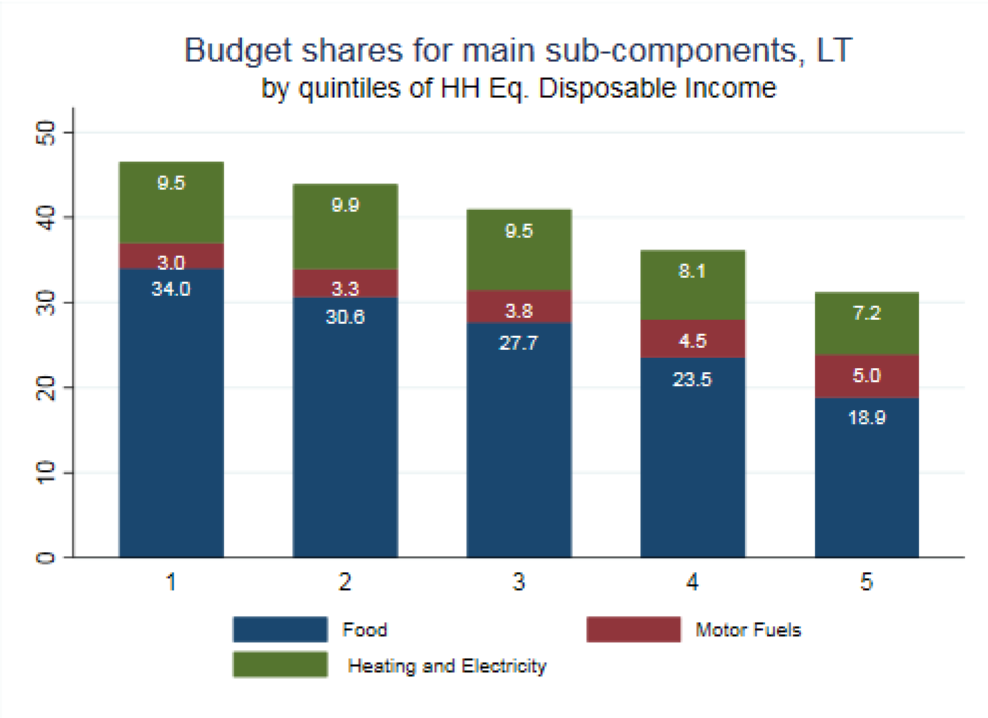


Distributional effect of inflation April 2021 - July 2022, IE
by quintiles of HH Eq. Disposable Income
0
5
10
15
5.5
5.5
5.6
5.6
5.7
5.5
5.0
3.9
3.3
2.8
2.0
2.6
2.7
2.4
2.2
1.3
1.2
1.1
0.9
1
2
3
4
5
Food
Motor Fuels
Heating and Electricity
Other Goods & Services
Budget shares for main sub-components, IE
by quintiles of HH Eq. Disposable Income
0
5
10
15
20
25
6.8
6.1
5.1
4.3
3.9
3.7
4.8
4.9
4.4
4.0
15.0
13.9
12.4
10.6
9.2
1
2
3
4
5
Food
Motor Fuels
Heating and Electricity

(d) Lithuania

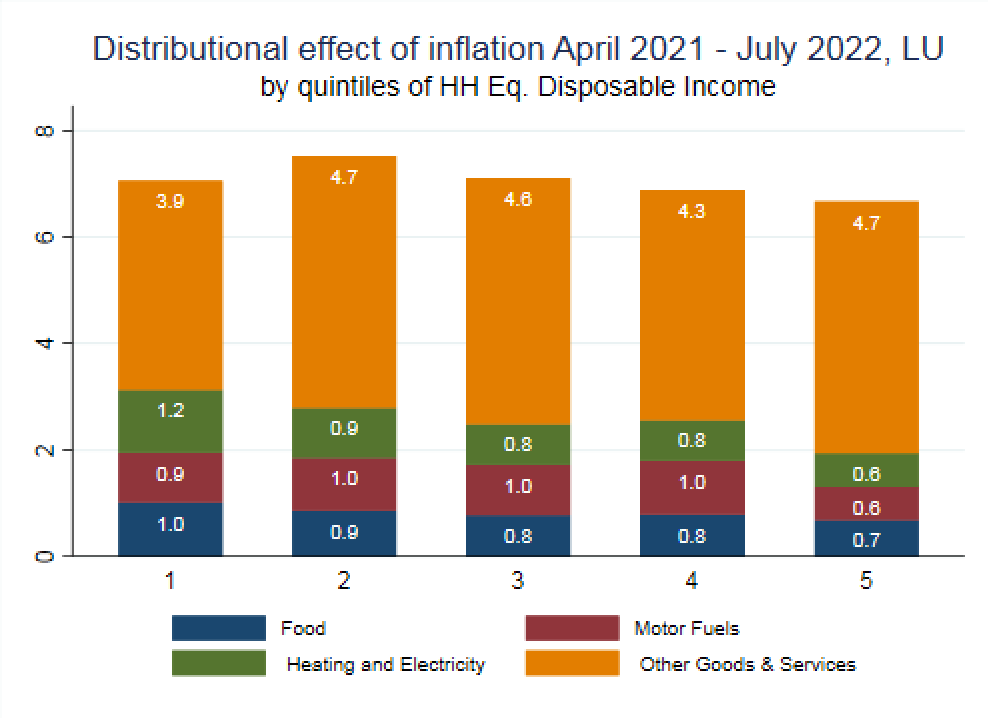


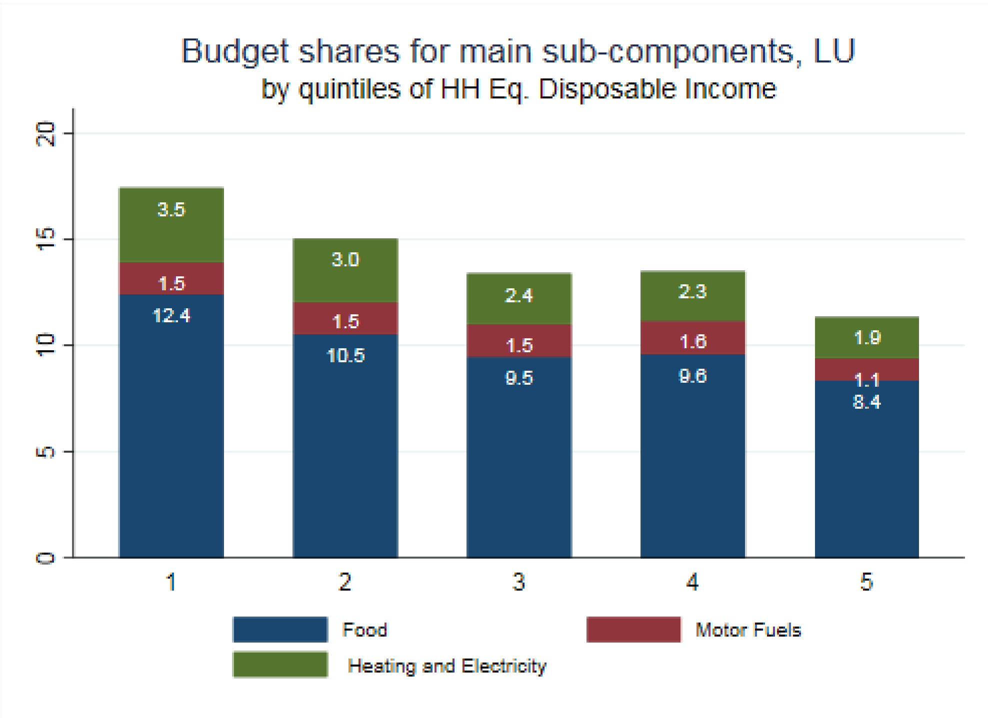
Distributional effect of inflation April 2021 - July 2022, LT
by quintiles of HH Eq. Disposable Income
0
10
20
30
8.7
10.4
1.9
9.9
9.2
11.2
2.1
8.9
9.8
11.1
2.4
8.0
10.5
9.5
2.7
6.8
11.0
8.5
3.1
5.5
1
2
3
4
5
Food
Motor Fuels
Heating and Electricity
Other Goods & Services



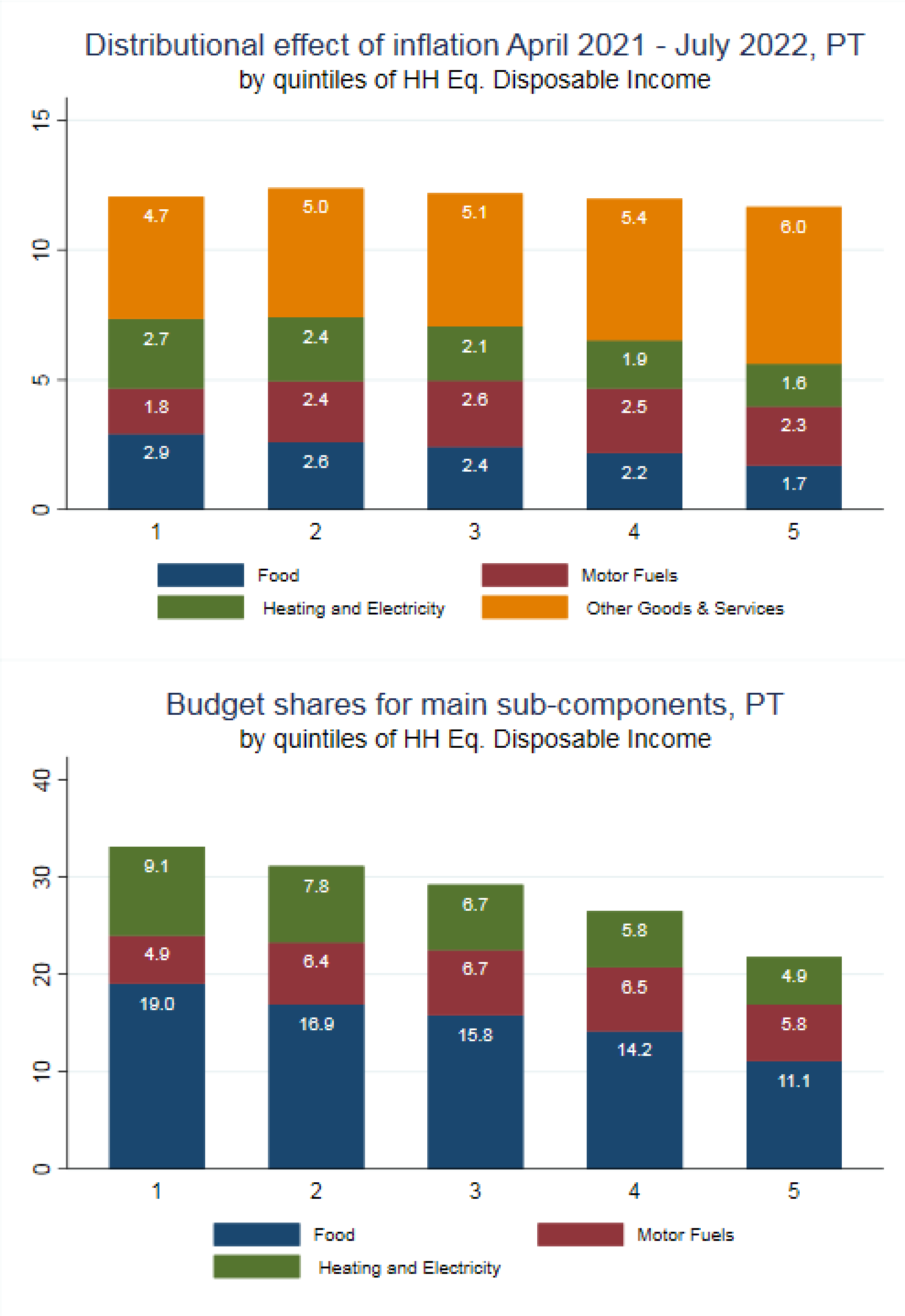
Budget shares for main sub-components, LT
by quintiles of HH Eq. Disposable Income
0
10
20
30
40
50
9.5
3.0
34.0
9.9
3.3
30.6
9.5
3.8
27.7
8.1
4.5
23.5
7.2
5.0
18.9
1
2
3
4
5
Food
Motor Fuels
Heating and Electricity

(e) Luxembourg





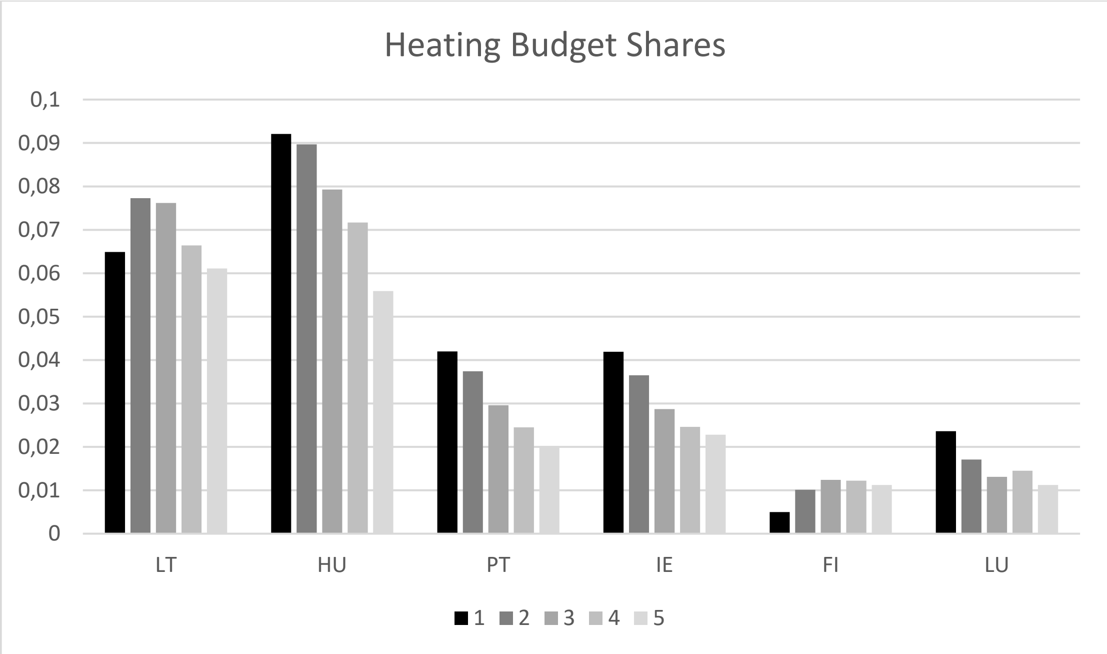
(f) Portugal


Distributional effect of inflation April 2021 - July 2022, PT
by quintiles of HH Eq. Disposable Income
0
5
10
15
1
2
3
4
5
4.7
2.7
1.8
2.9
5.0
2.4
2.4
2.6
5.1
2.1
2.6
2.4
5.4
1.9
2.5
2.2
6.0
1.6
2.3
1.7
Food
Motor Fuels
Heating and Electricity
Other Goods & Services
Budget shares for main sub-components, PT
by quintiles of HH Eq. Disposable Income
0
10
20
30
40
1
2
3
4
5
9.1
4.9
19.0
7.8
6.4
16.9
6.7
6.7
15.8
5.8
6.5
14.2
4.9
5.8
11.1
Food
Motor Fuels
Heating and Electricity

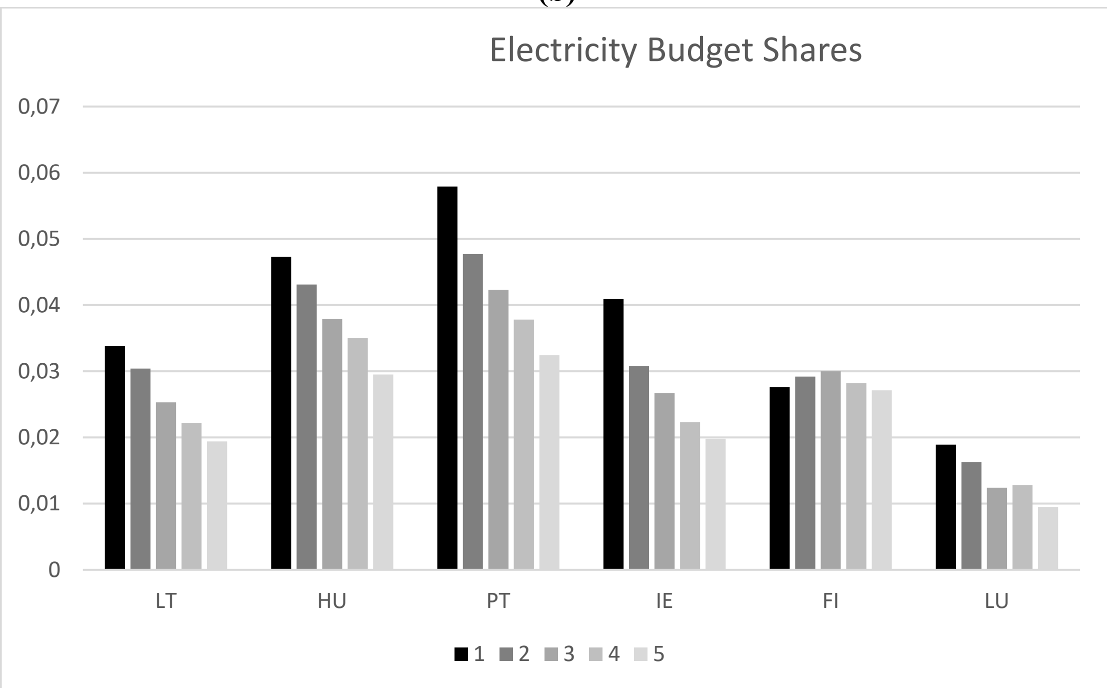
A.3. Heating and Electricity Budget Shares

Figure 15. Heating and Electricity Budget Shares

(a)



(b)



A.4. Tables underpinning Figures in Paper

Table 7 Observations per household type (unweighted)

Household Type	FI	HU	IE	LT	LU	PT
Single – Below median	613	1,295	902	472	45	1,327
Single with child – Below median	44	122	208	36	20	176
Couple - Below median	618	1,148	875	661	58	2,002
Couple with child - Below median	155	472	837	181	119	971
Other - Below median	177	935	588	393	50	1,757
Single – Above median	421	1,039	64	351	48	1,012
Single with child – Above median	18	21	32	24	10	126
Couple – Above median	966	1,125	1,137	709	91	1,1662
Couple with child – Above median	374	305	726	176	108	1,037
Other – Above median	277	717	870	440	37	1,328
Total	3,673	7,169	6,839	3,443	586	11,398

Table 8 Detailed budget shares

Expenditure Category	Average Budget Share					
	FI	HU	IE	LT	LU	PT
Food and Non-alcoholic beverages	0.122	0.199	0.115	0.25	0.098	0.143
Alcoholic Beverages	0.009	0.011	0.013	0.016	0.011	0.007
Tobacco	0.007	0.016	0.009	0.009	0.004	0.009
Clothing and Footwear	0.03	0.034	0.043	0.055	0.045	0.035
Home fuels	0.01	0.069	0.026	0.062	0.014	0.026
Electricity	0.026	0.035	0.023	0.023	0.011	0.037
Rents	0.224	0.215	0.249	0.232	0.278	0.226
Household services	0.058	0.064	0.029	0.035	0.047	0.052
Health	0.035	0.041	0.023	0.052	0.024	0.055
Private transport	0.044	0.014	0.016	0.015	0.031	0.031
Public Transport	0.023	0.012	0.01	0.01	0.014	0.012
Information & Communication	0.024	0.057	0.036	0.032	0.026	0.031
Recreation and culture	0.062	0.046	0.066	0.037	0.047	0.035
Education	0.002	0.007	0.023	0.006	0.004	0.023
Restaurants and hotels	0.051	0.029	0.064	0.029	0.072	0.088
Other goods and services	0.092	0.041	0.074	0.011	0.095	0.043
Childcare costs	0.007	0.000	0.014	0.000	0.000	0.006
Motor fuels	0.03	0.051	0.044	0.042	0.014	0.061
Durables	0.145	0.059	0.122	0.085	0.165	0.08