Welfare and Distributional Impact of Soaring Prices in Europe

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LUXEMBOURG INSTITUTE OF SOCIO-ECONOMIC RESEARCH

INFLATION

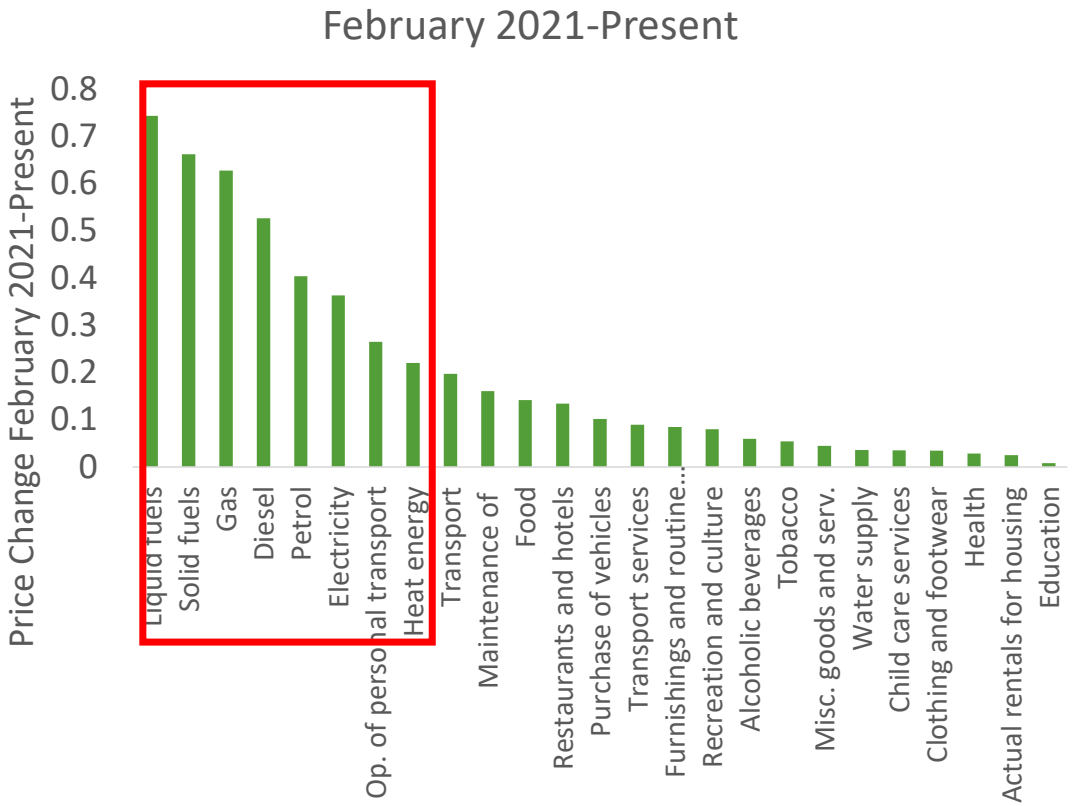
- Outbreak of the COVID-19 crisis & war in Ukraine
- EU: annual inflation was almost 10% in July 2022
- Largest price increase for decades
- Driven initially by freights costs and supply-chain disruptions, subsequently by a surge in energy prices, followed by price increases for food, services and goods
- Brings **financial pressure** and **uncertainty** for everyone

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

Source: Eurostat (accessed on 24 October 2022).

Price Inflation for different Goods

- **Return of Inflation**
  - Supply chain issues that resulted from BREXIT and COVID relation disruptions,
  - Economic recovery post COVID lock-down
  - Mainly fuel price inflation that has resulted from the Ukraine conflict has seen inflation return



Different for Different Countries

- Highest Price Rise in Eastern Europe, lowest in the Nordic countries
- Aim:
  - welfare and distributional consequences of the prices changes in Europe over the period 2021 – 2022
  - subset of European countries that reflect different welfare regimes and spread across different average price changes
  - improve knowledge and understanding about the cost of living across Europe

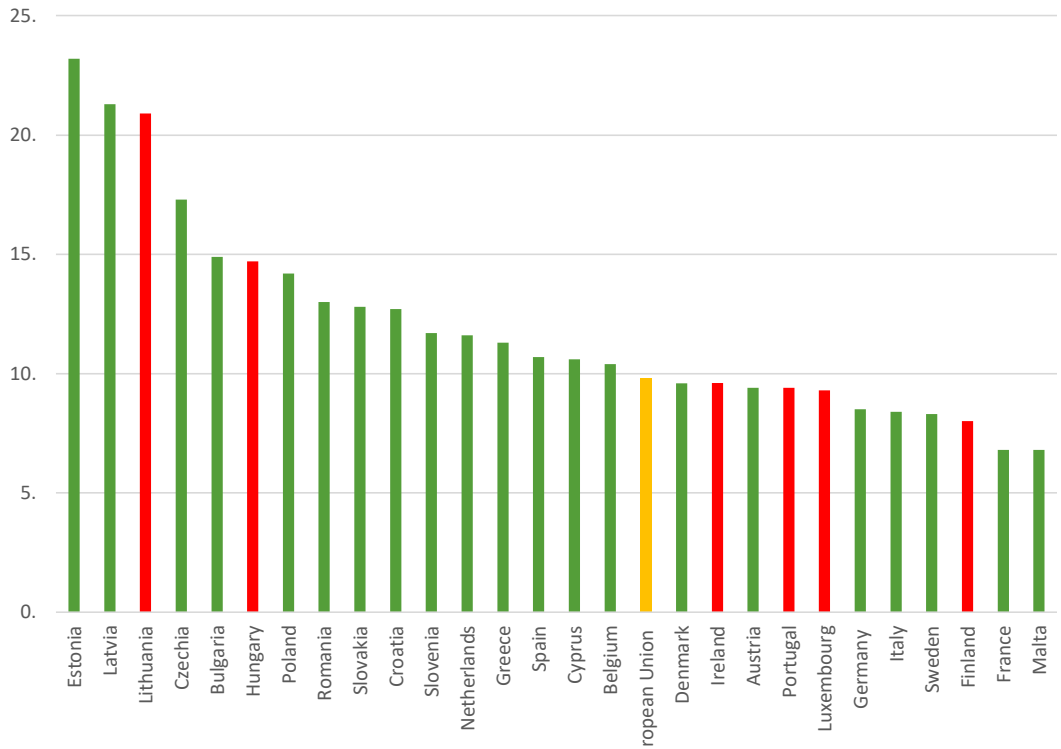


Figure 2. HICP by country (July 2021 – July 2022)

Source: Eurostat (accessed on 24 October 2022).

METHOD AND DATA (1)

- 2-step methodology:

(1) Distributional impact of inflation

- the composition of expenditure varies across countries and how this translates into the overall CPI inflation.
- examine the composition of expenditure and the composition of inflation across the income distribution & quantify the progressive/regressive effects of inflation using distributional measures inspired by the taxation literature
- adapt the Pfahler (1990) approach in taxation (Lambert (2001), Decoster et al. (2002)) to decompose the overall distributional effect of inflation (progressive/regressive) into an inflation rate effect and an inflation structure effect

METHOD AND DATA (2)

(2) Microsimulation modelling approach

- to assess the welfare impact of price changes (Creedy 2000, O'Donoghue, 2021)
  - estimate a demand system to model household expenditure patterns on groups of goods
    - Parametric Engel curve estimation - LES
    - Expenditures grouped into 19 categories
  - estimate income and price elasticities
  - assess consumer welfare.

- **Data**
  - Expenditure information Household Budget Survey (HBS)
  - CPI changes (Eurostat)
  - Price changes relative to a base level (ref. prices = 2021 April)

METHOD AND DATA (4)

- **Welfare effects**
  - obtain a money measure of the change in welfare experienced by individuals which result from a change in prices (Creedy 2000)
  - Expenditure function E(p, U) – minimum cost needed to reach utilitv level U for a set of prices p
  - We use LES which has additive utility functions:

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

  - xi = consumption of each good; γ_i= committed consumption
- Maximizing utility subject to budget constraint $y = \sum p_i x_i$, we obtain the linear expenditure function for each good i.

$$p_i x_i = p_i \gamma_i + \Phi_i \left(y_h - \sum_j p_j \gamma_j \right).$$

- Budget and price elasticities
- $e_i = \frac{\Phi_i y}{p_i x_i} => \Phi_i = e_i w_i;$ $e_{ii} = \frac{\gamma_i (1-\Phi_i)}{x_i} - 1 => \gamma_i = \frac{(e_{ii}+1) x_i}{(1-\Phi_i)}.$

METHOD AND DATA (5)

- Estimating budget and price elasticities
  - estimate a full expenditure system on cross-sectional HBS
  - estimate the LES parameters for each commodity group using Engel functions: $w_i^h = \alpha_i + \beta_i lny^h + \varphi_i \left(lny^h\right)^2 + \delta_i \mathrm{X^h}$
  - *wi* = budget share of commodity group i of household h in total expenditure
  - We obtain budget elasticities $e_i = 1 + \frac{dw_i}{dy}\frac{lny}{w_i} = 1 + \frac{\beta_i + 2\varphi_i lny}{w_i}$
  - For own-price elasticities (e_{ii}), we use an approximate method based on Frisch parameter following Creedy and Dixon (1998) and Lluch et al. (1977)

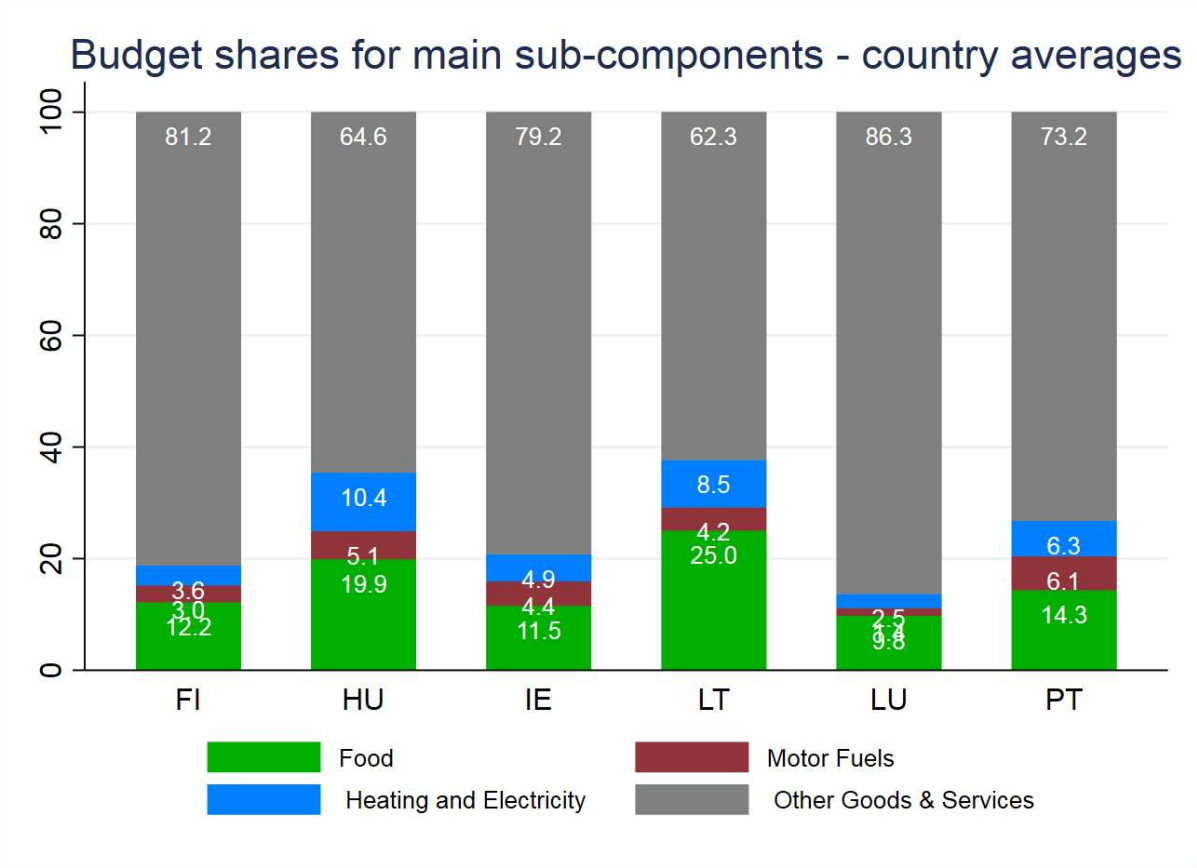
METHOD AND DATA (6)

Welfare effects:

- **Compensating Variation** $CV^h = E(p_1, U_0^h) - E(p_0, U_0^h)$
  - A money metric of the change in welfare - monetary compensation that households should receive after the price increases given the initial total expenditure in order to maintain their utility
- **Equivalent incomes**: the value of income, y_e, which at some reference set of prices, p_r, gives the same utility as the actual income level
- The distributions of y_e can be used to calculate values of a social welfare function for the whole population: $W(e) = y_{ede}(e) = \overline{y_e} * \big(1 - A(e)\big)$
- Y_{ede} = equally distributed equivalent income value

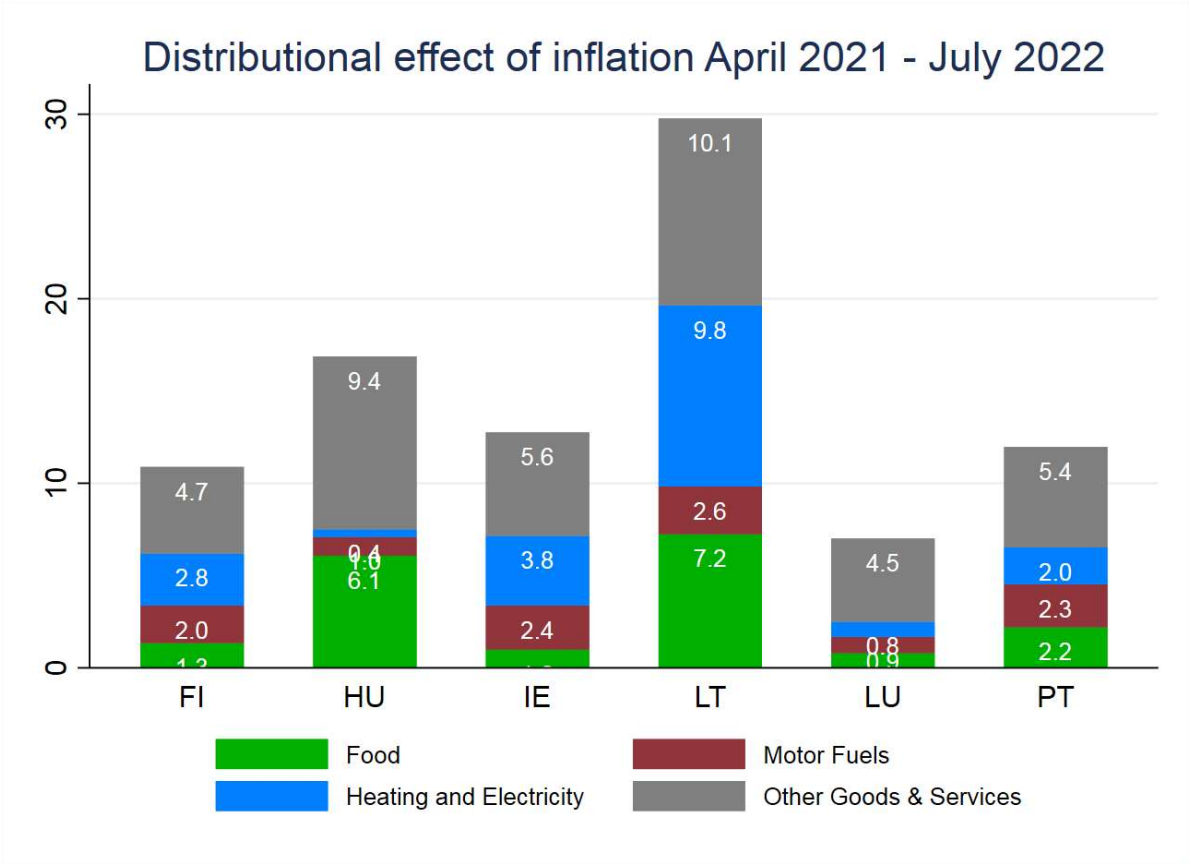
Budget Shares – Composition of Expenditure

- Food, heating, electricity and fuels vary in relative importance in the average basket of goods
- The richer the country the lower the share of necessities
  - Average income households in HU and LT are more exposed to the impact of a rise in the price of necessities



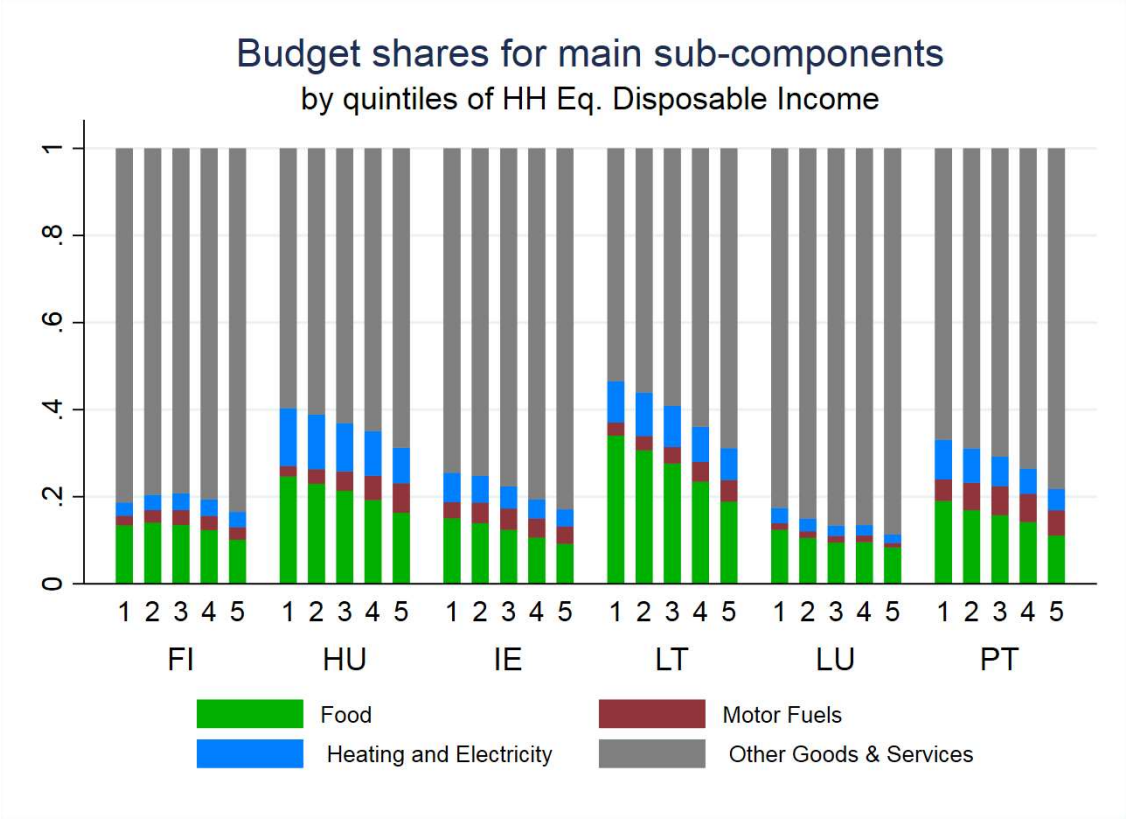
Composition of Inflation

- Inflation highest in Lithuania and Hungary, lowest in Luxembourg
- Drivers vary: increases in energy and food prices - main drivers of country differences
  - Heating very high in LT
  - Food high in LT and HU
  - Motor fuels low LU and HU
  - Rising prices – evident for other goods and services
- A complex story – influenced by compositions of expenditure, tax rates on goods, sourcing of energy, national policies



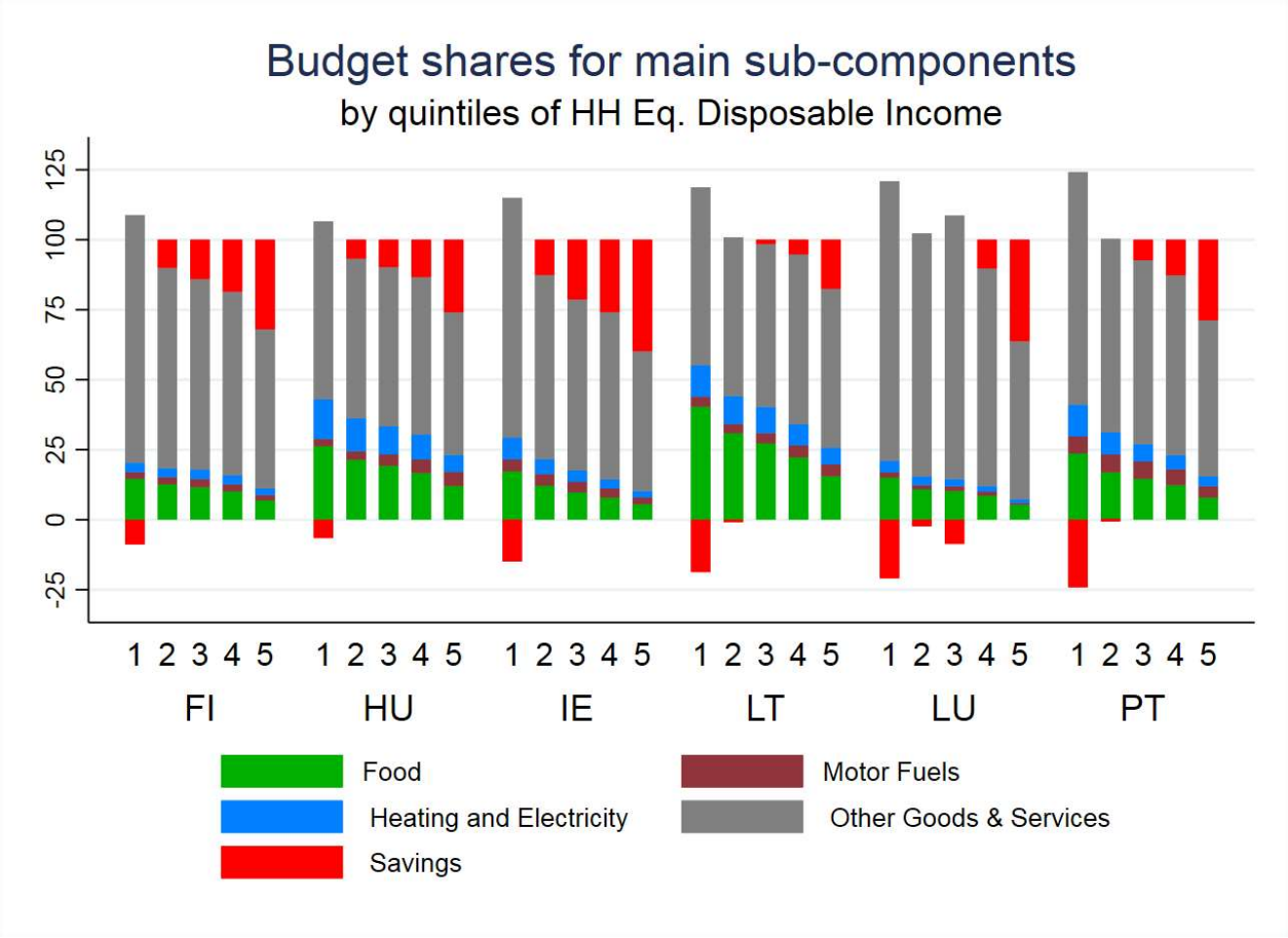
Composition of Expenditure across the Income Distribution

- Composition of expenditure across the income distribution varies substantially
- Food and energy (necessities) shares are higher for low income households and decline with income
  - Large swings in (energy) prices will affect low income households more
- Lower gradient in richer countries (FI, LU), both in terms of level and distributional pattern
- Motor fuels shares increase with income
- Distributional impact of price depends upon
  - Pattern of expenditure
  - The level of price growth



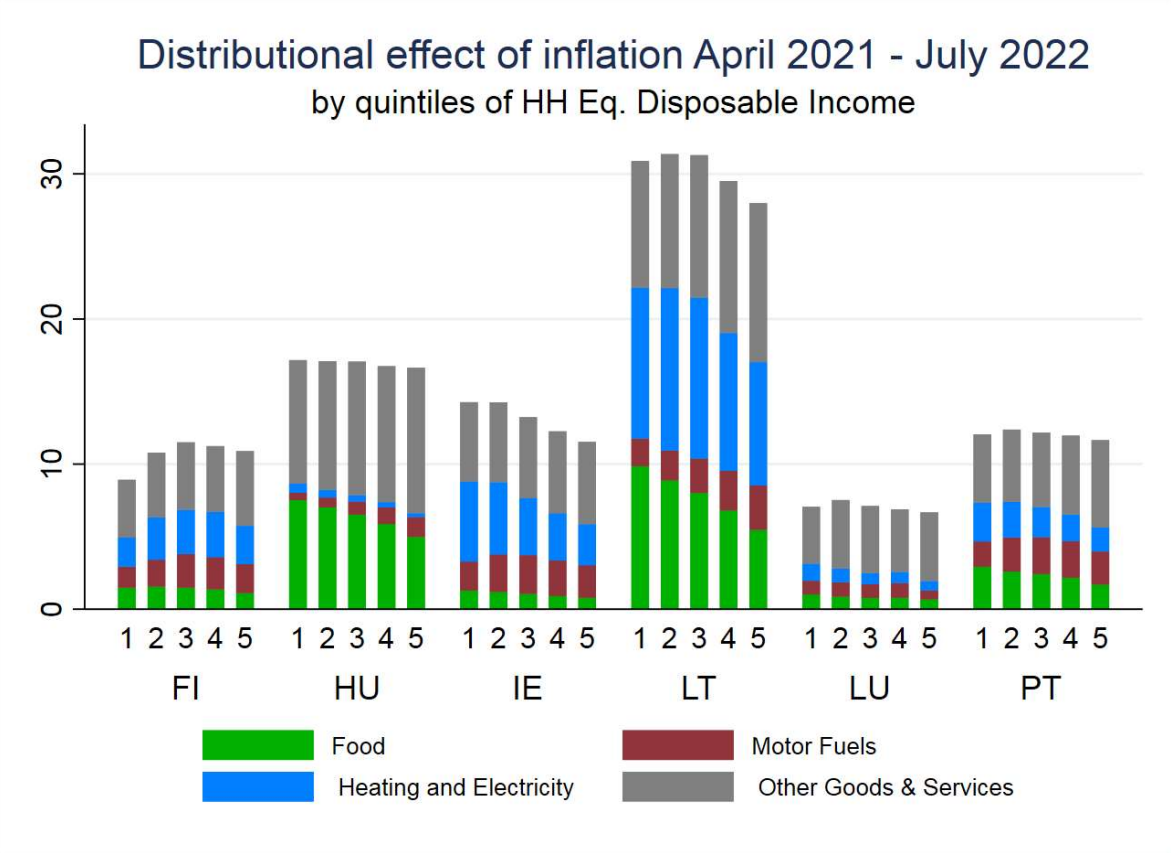
EXPENDITURE AND SAVINGS SHARES ACROSS THE INCOME DISTRIBUTION

- Expenditure and savings shares in income are also relevant
- Food and energy (necessities) shares are higher for low income households
- Reduced ability to tap into savings
  - Negative at bottom quintile; low in bottom half
  - Rich save more than poor, they can maintain expenditure by reducing savings



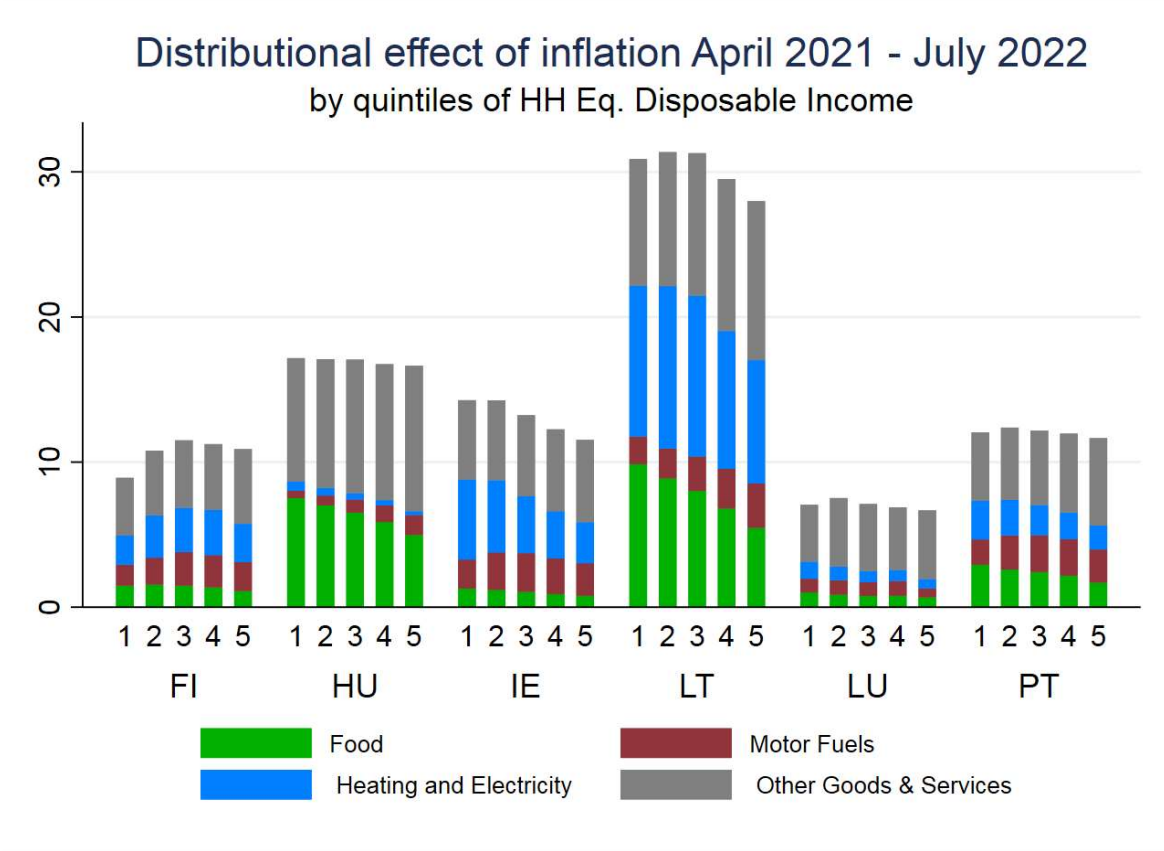
Distributional Impact of Inflation

- Distributional impact varies across countries:
  - Regressive in LT and IE
  - Progressive in FI
  - Relatively flat in others
- **Regressive** impact of **food inflation**, more pronounced in HU and LT
- **Regressive** impact of **heating and electricity**, more pronounced in LT and IE
  - Low impact in HU
- FI – inverted-U shape of energy inflation
  - Composition of energy basket:
    - bottom has higher % of electricity in home heating; top has higher % of liquid fuels
  - Price changes: liquid fuels increased by 99%; electricity by 34%;
    - **Bottom** less affected as it relies more on electricity



Distributional Impact of Inflation

- Progressive impact for motor fuels (except LU)
- Progressive impact of other goods and services, except IE (flat)



DRIVERS OF INFLATION REGRESSIVITY/PROGRESSIVITY

- In order to quantify inflation regressivity/progressivity
  - Reynolds-Smolensky index $RS = CI_{X+C} - CI_X$
    - RS>0 => progressive impact of inflation (higher at the top)
  - Kakwani index $K = CI_C - CI_X$
    - the disproportionality between the structure of initial expenditure and the increase in expenditure due to price changes
  - Pfhaler (1990) $RS = \frac{r}{1+r} * K$
    - to decompose the distributional impact of price changes into inflation rate and disproportionality components

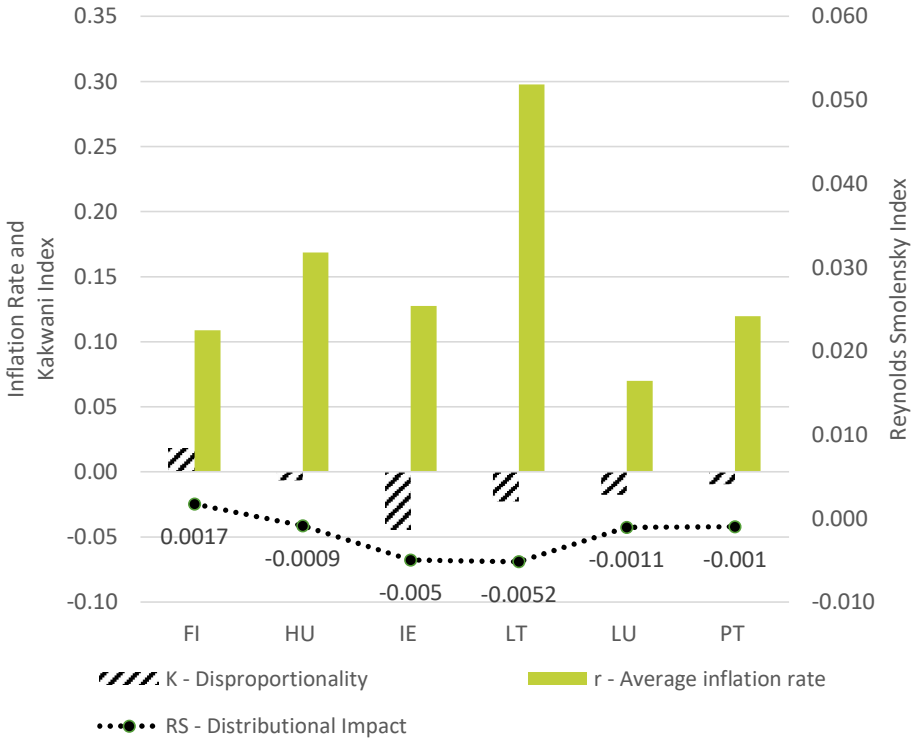


Figure 8. Overall distributive effect, disproportionality and average inflation rate

DRIVERS OF INFLATION REGRESSIVITY/PROGRESSIVITY

- Interplay between the average inflation rate and the progression of inflation along the income distribution

- No “one size fits all” : Similar high levels of regressivity of inflation - driven by different levels of disproportionality and inflation rate:
  - Lithuania and Ireland:
    - Lithuania - the highest average inflation, but a moderate distributional impact due to a smaller disproportionality compared to Ireland, which has a much lower inflation rate.
  - Luxembourg, Hungary and Portugal:
    - Luxembourg: inflation level is roughly half that of Portugal, whereas its disproportionality component is almost twice;
    - Hungary has a higher inflation than Luxembourg and Portugal, but a much lower disproportionality component - limits the regressive impact

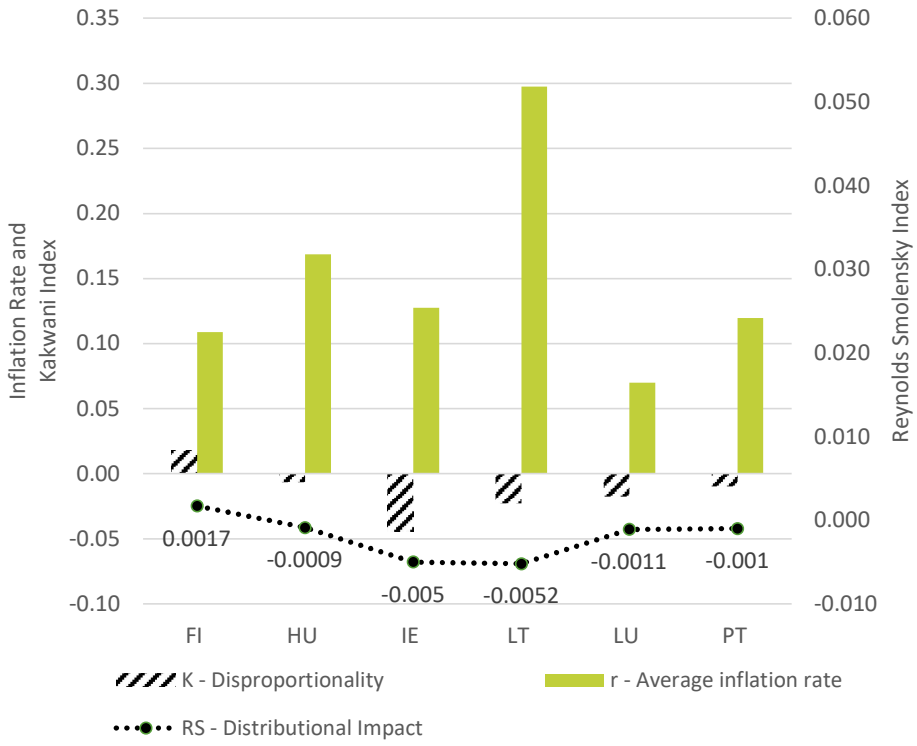


Figure 8. Overall distributive effect, disproportionality and average inflation rate

DRIVERS OF INFLATION REGRESSIVITY/PROGRESSIVITY

- K or the progression of inflation along the income distribution - decomposed into the contribution of each commodity group

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

- K_{C_i} = disproportionality of the price changes in each of the commodity item group i
- r_i = average inflation rate for each commodity group.

		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

Drivers of Inflation Regressivity/Progressivity

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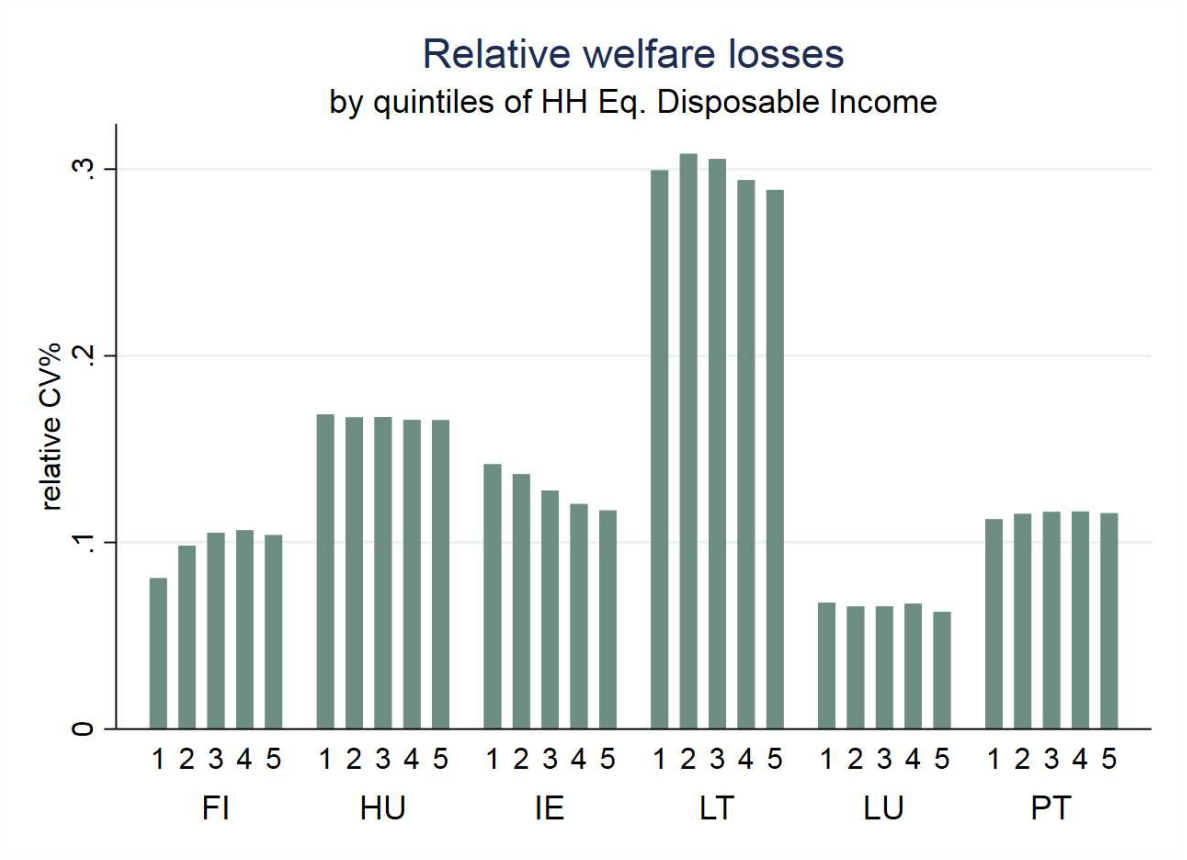
Total	K	100.0	100.0	100.0	100.0	100.0	100.0

- *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.
  - food regressivity counteracts by -42.0%, whereas the regressivity of electricity reduces it further by 4.2%.

- *LT, IE, LU, PT, HU*:
  - Regressivity of inflation is explained by a differential mix
  - Food regressivity contributes between 16% to 440%
  - Heating regressivity: 39% - 70%
  - Electricity regressivity : 0% - 125%
  - Other progressivity : - 250% to -7%

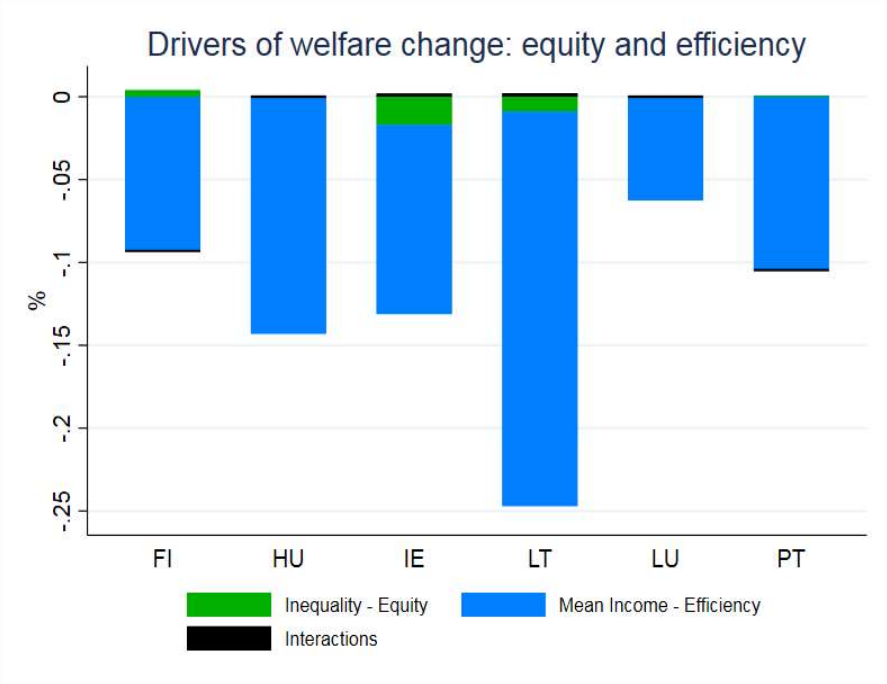
Welfare Losses

- **Compensating Variation**
  - A money metric of the change in welfare - monetary compensation that households should receive after the price increases given the initial total expenditure in order to maintain their utility
  - In general, losses are greater at the bottom than at the top due to higher budget shares of fuels and food (necessities)
    - Largest in LT ~ 30%



Drivers of Welfare Loss – the Size of the Pie or the Distribution – Equity versus Efficiency

- Atkinson Index - an analytical tool to quantitatively evaluate the equality and efficiency of household expenditure distribution.
- The Efficiency component is the biggest driver of welfare losses as price changes affect all
- The equity component of welfare is very small and varies across countries



Change in welfare is measure by change in equally distributed equivalent expenditure

$$W(e) = y_{ede}(e) = \bar{y_e} * \big(1 - A(e)\big)$$

CONCLUSIONS

- Comparative advantage - combining a detailed decomposition of the impact of inflation with welfare changes using the compensating variation and equivalent incomes in a cross-national perspective in relation to the cost of living crisis.
  - Building upon Phaler(1990), we examine the interaction between inflation rates of different commodity groups and the structure of consumption in determining the overall level of progressivity/regressivity in each country and assess its drivers by components
  - Building upon Creedy (2000) we develop a scalable comparative microsimulation infrastructure that can evaluate the welfare impact of price changes
    - Further extended by combining income and expenditure data and the EUROMOD tax-benefit model to incorporate mitigation measures

CONCLUSIONS

- Lessons:
  - Budget shares for necessities are higher in poorer countries
  - Combined with higher price growth in these necessities - higher inflation in poorer countries
  - Significant cross-country variability
    - Lithuania has the highest contribution towards inflation from food and fuels
    - Hungary is exceptional with the second highest food inflation, but the lowest fuel inflation
  - Distributional impact:
    - Lithuania and Ireland – the most regressive
    - Hungary, Luxembourg and Portugal – lesser regressivity
    - Finland – progressive (heating, motor fuels and other g&s)
  - Drivers of regressive impact:
    - Food and heating in Hungary
    - Food, heating and electricity in Lithuania and Portugal
    - Food, heating, electricity and motor fuels in Ireland and Luxembourg
  - No “One size fit all”

Policy Response

- We know that
  - Solidarity-focused response during the COVID-19 crisis protected living standards and enhanced trust in institutions in many countries, facilitated by lower interest rates from ECB
  - Austerity-focused response during the Financial crisis saw the poorest lose and reduced trust in government
- Cost of Living Crisis
  - With rising interest rates and cost of debt, the pressures during the COLC are starting to look more like the Financial Crisis
  - Need to focus on maintaining living standards of the poorest and the squeezed middle, who as we saw during the FC reduce expenditure when under financial strain with consequential public trust implications

Thank you

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METHOD AND DATA (4)

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- $e_i = \frac{\Phi_i y}{p_i x_i} => \Phi_i = e_i w_i;$ $e_{ii} = \frac{\gamma_i (1-\Phi_i)}{x_i} - 1 => \gamma_i = \frac{(e_{ii}+1) x_i}{(1-\Phi_i)}.$

METHOD AND DATA (5)

- Estimating budget and price elasticities
  - estimate a full expenditure system on cross-sectional HBS
  - estimate the LES parameters for each commodity group using Engel functions: $w_i^h = \alpha_i + \beta_i lny^h + \varphi_i \left(lny^h\right)^2 + \delta_i \mathrm{X^h}$
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  - We obtain budget elasticities $e_i = 1 + \frac{dw_i}{dy}\frac{lny}{w_i} = 1 + \frac{\beta_i + 2\varphi_i lny}{w_i}$
  - For own-price elasticities (e_{ii}), we use an approximate method based on Frisch parameter following Creedy and Dixon, 1998 and Lluch et al. (1977)