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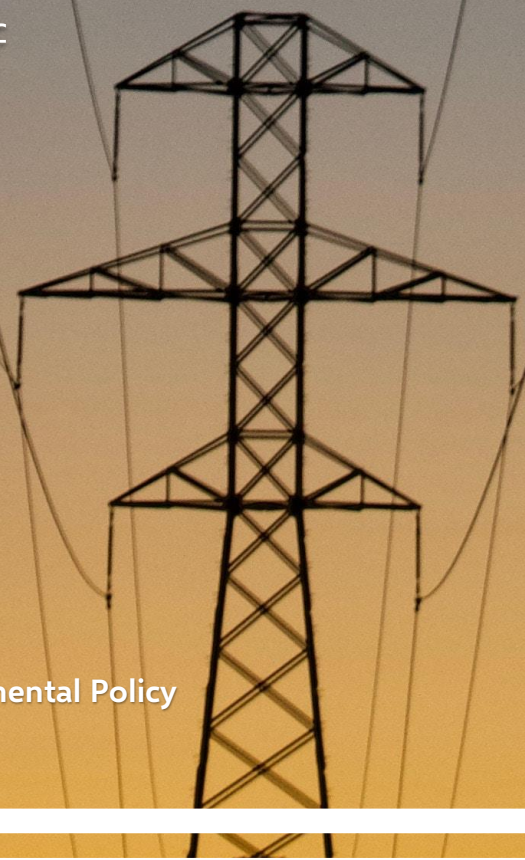
Report

Who took the burden of the energy crisis?

A distributional analysis of energy prices shocks



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CORRESPONDING AUTHORS

Claudia Dias Soares (cdias-soares@ieep.eu)

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IEEP office
Rue Joseph II 36-38,
1000 Brussels, Belgium
Tel: +32 (0) 2738 7482
Fax: +32 (0) 2732 4004

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EXECUTIVE SUMMARY

To mitigate the impact of the surge in prices following the 2022 energy crisis and shield both energy intensive industries and families, several measures were taken both at the EU and national levels. At the EU level, the European Commission delivered several legislative initiatives that created the appropriate legislative framework for Member States (MS) to tackle the crisis. This enabling framework allowed EU MS to allocate 657 billion euros to finance market price support measures. Though the action taken by MS are similar given their contextualisation within the framework agreed at the EU level, they differ between MS, according to their national, budgetary, and governmental realities, and span from reductions of energy taxes, including reductions in excise duties on petrol and diesel and in VAT, to direct transfers to vulnerable groups in the form of expanding social tariffs or one-time payments to households.

Despite the complexity involved in the distributional impact assessment of the 2022 energy crisis, our model provides a general picture of the impacts on the welfare of households across the EU derived from this crisis.We have used the data available in the Household Budget Survey of each MS to develop a microsimulation model that allows us to simulate the distributional and social impact of the energy prices spike at a household level, both vertically (by income level) and horizontally (by other sociodemographic characteristics of the households).

Altogether our results underpin a broad call for an improvement of the policy toolbox against energy poverty at MS level, not only by strengthening with empirical evidence arguments already voiced by the literature, but also by emphasising the current importance and urgency of policy improvements in this field.

The main conclusion from this assessment is the confirmation of the regressive distributional impact of the energy crisis, which is mainly attributed to the impact of the rise of electricity prices. Another insight is that the impact on welfare varies across MS. Western European countries show a clear regressive pattern, though with different configurations, due to their national energy consumption pattern. Eastern European countries have a progressive distributional impact. Some other countries, such as France and Sweden, follow a moderate regressive pattern. These differences are explained not only by MS own energy mixes and consumption structures, but also by the differences in how each MS managed to contain the rise of energy prices. MS that have managed to control electricity prices show a smaller impact on the overall welfare, and in those cases, the middle-income deciles have been more affected due to the rise in fuel prices. In

countries where electricity prices have significantly increased, the welfare loss is higher in the poorest households, which are those more exposed to such price variations.

Our results indicate that energy consumption patterns and impacts tend to be not only income-dependant, but also gender-, age-, and location-dependant. From a gender perspective, we see that, although the EU average male households have been more affected by the energy crisis due to the increase in transport fuel prices, this is not the case in those countries where electricity prices dominate the energy price shocks, which shows that, in terms of gender inequality, it is key to monitor prices related to residential energy. Our results also indicate that while urban households show a clear regressive tendency, rural ones have a mixed tendency, with middle-income households in rural areas being the most affected of the overall comparison probably because of higher levels of expenditure on fuels. Additionally, our results confirm the literature on energy consumption being age-dependant. In all income groups, the welfare of elderly people is more affected than the average, and in most income brackets they are the most affected group followed by middle-aged adults following energy price spikes.

In the sensitivity analysis we carried out to gain insights on the impact on household's welfare of some of the measures MS have taken to mitigate the price increases and alleviate both consumers and targeted economic sectors, we mainly investigated three scenarios which we then compared with the reference scenario to contrast the effectiveness of these measures. In Policy Scenario 1, we analysed the welfare impact on households if MS wouldn't have applied VAT reductions on electricity prices. Our results denote that reducing VAT on electricity had clear progressive effects across the income distribution, especially on the lower income deciles. In Policy Scenario 2, we analysed the welfare impact on households if the MS wouldn't have applied excise duties reductions on fuels. The results here are mixed but one observation was a tendency for excise duties reductions on fuels to be regressive, helping mostly the middle-income deciles, and the high-income deciles in eastern European countries. Finally, in Policy Scenario 3, we analysed the welfare impact on households if the MS had applied the revenues used to finance the measures from Policy Scenario 2 to make direct transfers to the 50% poorest households instead. We observed that in all cases, direct transfers to low-income segments of the population have a clear progressive impact with respect to the reference scenario.

Hence, when the objective is to alleviate energy poverty in a crisis context, our results support the argument that among the three types of intervention analysed in this paper, the most efficient use of public revenues comes from targeted

support measures in the form of direct transfers to those in need. This is in line with the recommendations of the International Monetary Fund and the most recent requests of the European Central Bank addressed at national governments. Broad support measures through electricity tax reductions or other measures to control electricity prices might still be preferred to doing nothing, since they reduce the regressivity of the energy crisis. Whereas broad support measures provided through reductions in fuel excise taxes might be a worse policy tool than inaction, since this kind of public expenditure does not reach its target, i.e., the most vulnerable groups, diverts public resources from other public needs, and tends to aggravate social inequalities between lower income groups and middle- and high-income groups, or in eastern European countries between high-income deciles and all the others.

From a public interest perspective, it is difficult to justify reductions in fuel excise taxes, since they contradict the terms of a just and sustainable transition, whereas electricity price reductions are an effective way to stimulate a sustainable energy transition and alleviate energy poverty.

Our main recommendations are the following.

- Policy measures to address energy poverty should account for national particularities, and consider income, gender, age, and location of the targeted groups.
- Governments should prioritise interventions to control rises in electricity prices vis-à-vis measures to address rises in fuel prices.
- To alleviate energy poverty in an energy crisis context, support measures in the form of direct transfers to most vulnerable groups should take precedence over broad support measures operated through tax reductions.

1. INTRODUCTION

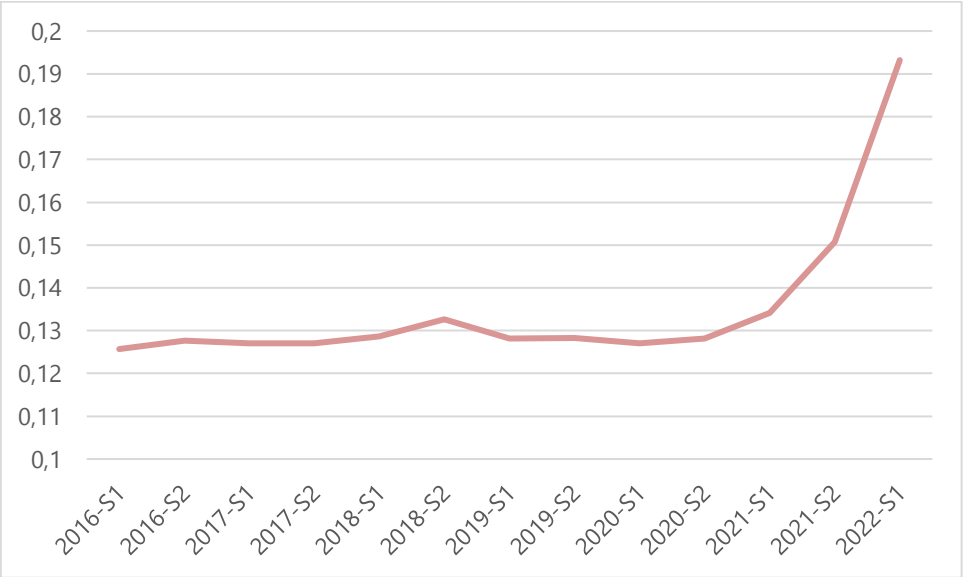
1.1 Context

Europe is amidst the worst energy crisis seen in decades. Energy prices in Europe soared in 2021, in the aftermath of the COVID-19 pandemic. This rise in prices can initially be attributed to the mismatch between supply and demand at a time when governments eased restrictions imposed during the pandemic, alongside a tight supply of gas on the global markets.

The Russian invasion of Ukraine on 24 February 2022 exacerbated the situation, given Russia's importance in international energy markets and for the EU's energy reality: in 2020, Russia was the main EU supplier of crude oil (29%), natural gas (43%) and solid fossil fuels (54%).[1]

Geopolitical tensions and uncertainty derived from the war translated into historic growth of energy prices in Europe, as shown in Figure 1.

Figure 1: Electrical prices for household consumers in kWh excluding taxes and levies (EUR)



Source: Eurostat[2]

[1] Eurostat. Shedding light on energy - 2023 edition. https://ec.europa.eu/eurostat/web/interactive-publications/energy-2023

2 Eurostat. Electricity prices for household consumers - bi annual data (from 2007 onwards). NAG_pc_204

These enormous price increases were mainly due to the deliberate reduction of gas supplies by Russia via pipelines as a weapon of war, pushing the price upwards.[3] In addition, the EU agreed to reduce as quickly as possible its energy dependence on Russia, looking elsewhere for alternatives, often more expensive than pipeline gas from Russia (such as liquefied natural gas (LNG) imports from the US and Qatar) or Norwegian gas. Since the end of 2021, the EU's monthly gross LNG imports increased substantially due to the exceptional gas market situation. From the beginning of 2022, the EU imported 98 billion cubic meters (bcm) of LNG, 39 bcm more than at the same point in 2021. Between January and September 2022, the EU imported more than in the entire 2019 all-time record year.[4] Overall, European countries' (including the UK) imports increased by 60% compared to 2021.[5]

Electricity production in the EU is heavily linked to combustible fuels (41.9%), including generation from natural gas.[6] The natural gas shortage also spilled over into the oil and coal markets, with industrial consumers depending on gas switching to alternative fossil fuel sources.[7] This explains the great surge in energy prices, which inevitably spread to the overall economy. Consequently, it has led to inflationary pressures not seen in Europe in decades, squeezing household budgets and increasing the cost of living, especially of those more vulnerable.

High inflation rates have important distributional implications, disproportionally affecting vulnerable households. Low-income households consume a larger share of their income, have less saving potential and often are more liquidity-constrained than high-income households. This leaves them with less room for

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https://ec.europa.eu/eurostat/databrowser/view/NRG_PC_204__custom_5252399/default/table?lang=en

[3] European Council. Infographic - Energy crisis: Three EU-coordinated measures to cut down bills https://www.consilium.europa.eu/en/infographics/eu-measures-to-cut-down-energy-bills/#:~:text=The%20deliberate%20reduction%20of%20gas,and%20affected%20electricity%20prices%20overall.

[4] European Commission. Liquefied natural gas https://energy.ec.europa.eu/topics/oil-gas-and-coal/liquefied-natural-gas_en

[5] Shell Global. European LNG demand to drive competition for new supply and dominate trade in the long term https://www.shell.com/media/news-and-media-releases/2023/european-lng-demand-to-drive-competition-for-new-supply.html#:~:text=European%20countries%2C%20including%20the%20UK,following%20its%20invasion%20of%20Ukraine.

[6] Eurostat. Electricity production, consumption and market overview https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Electricity_production,_consumption_and_market_overview#Electricity_generation

[7] J.P. Morgan. Europe's Energy Crisis: A Harsh Winter Ahead for Commodities. October 26, 2022 https://www.jpmorgan.com/insights/research/europe-energy-crisis

manoeuvre to face sharp increases in their cost of living. Also, low-income households spend a higher proportion of their total consumption expenditures on food, electricity, gas and heating than high-income households. Hence, they are far more vulnerable to energy price shifts.[8]

1.2 Tackling the energy crisis

To mitigate the impact of the surge in prices due to the energy crisis and shield the most exposed economic sectors and protect consumers, several measures were taken both at the EU and national levels.

1.2.1 EU measures

At the EU level, the European Commission (EC) has delivered several legislative initiatives. The intention was two-fold: to create the appropriate legislative framework for Member States (MS) to tackle the crisis, and to act on those areas where the EU has competence to do so. These include those that affect the internal energy market, energy efficiency and improving security of energy supply.[9]

Prior to the Russian invasion, in October 2021 the EC published a communication on 'Tackling rising energy prices: a toolbox for action and support'[10], offering a toolkit of measures for MS to ease price pressure. These include measures to authorise temporary deferrals of bill payments, provide aid to companies in line with EU state aid rules, or provide emergency support for energy-poor consumers.[11]

On 23 March 2022, the EC published a proposal to amend the Security of Gas Supply Regulation, including measures to ensure well-filled gas storage in the EU: underground gas storage on EU countries' territory must be filled to at least 80% of their capacity before the winter of 2022/2023 and to 90% before the following

[8] European Central Bank. The impact of the recent rise any inflation on low-income households. ECB Economic Bulletin. Issue 7/2022 https://www.ecb.europa.eu/pub/economic-bulletin/focus/2022/html/ecb.ebbox202207_04~a89ec1a6fe.en.html

[9] European Parliament. Energy policy: general principles. Fact Sheets on the European Union https://www.europarl.europa.eu/factsheets/en/sheet/68/energy-policy-general-principles

[10] European Commission. Tackling rising energy prices: a toolbox for action and support. COM 2021 660 final, 13.10.2021 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021DC0660&from=EN

[11] European Commission. Energy prices: Commission presents a toolbox of measures two tackle exceptional situation and its impacts. 13 October 2021 https://ec.europa.eu/commission/presscorner/detail/en/IP_21_5204

winter periods.[12] In parallel, the EC also published a communication on 'Security of supply and affordable energy price',[13] further clarifying the benefits and drawbacks of the different short-term policies to mitigate price spikes and how to prepare for the following winters.

On 18 May 2022, the EC presented the REPowerEU Plan[14] with the objective of ending EU dependence on Russian fossil fuels as soon as possible, as mentioned above, via diversification of energy sources, energy savings and fostering renewable energy deployment.[15]

In July 2022, the EC proposed a 'Regulation on coordinated demand reduction measures for gas',[16] with MS agreeing to reduce their gas demand by 15% compared to their average consumption in the five past years.[17] Finally, in September 2022, the EC proposed a new emergency regulation to address high gas prices in the EU and ensure security of winter supply by aggregation of EU demand and joint gas purchasing to negotiate better prices on the global market.[18]

With all these measures, the EU has created a framework to enable different actors to alleviate (to an extent) the impact on those affected by the energy crisis and has taken action to reduce its dependency on Russia. In addition, during the

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[12] https://energy.ec.europa.eu/topics/energy-security/secure-gas-supplies_en

[13] European Commission. Secure gas supplies https://eur-lex.europa.eu/resource.html?uri=cellar:22b6b0f8-aac5-11ec-83e1-01aa75ed71a1.0001.02/DOC_1&format=PDF

[14] European Commission. Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. Security of supply and affordable energy prices options for immediate measures and preparing for next winter. COM(2022) 138 final 23.03.2022 https://eur-lex.europa.eu/resource.html?uri=cellar:fc930f14-d7ae-11ec-a95f-01aa75ed71a1.0001.02/DOC_1&format=PDF

[15] European Commission. Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. REPowerEU Plan. COM(2002) 230 final https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en

[16] Council Regulation (EU) 2022/1369, 05.08.2022. On coordinated demand reduction measures for gas https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022R1369&from=EN

[17] European Council. Council adopts regulation on reducing gas demand by 15% this winter. 05.08.2022 https://www.consilium.europa.eu/en/press/press-releases/2022/08/05/council-adopts-regulation-on-reducing-gas-demand-by-15-this-winter/

[18] European Commission. Commission makes additional proposals to fight high energy prices and ensure security of supply. 18.10.2022 https://ec.europa.eu/commission/presscorner/detail/en/ip_22_6225

crisis there has been a debate on possible ways to reform the internal energy market, which is still ongoing.

1.2.2 National measures

In coordination with EU action, MS have taken various measures to limit the impact of the energy crisis on citizens and different economic sectors.

Since the start of the crisis in September 2021, 657 billion euros have been allocated so far by EU MS to finance these measures.[19] The actions taken by MS are similar given their contextualisation within the framework agreed at the EU level. However, they differ between MS, according to their national, budgetary, and governmental realities. For instance, most MS have introduced some reduction of energy taxes[20], including VAT (e.g., Belgium, Germany, the Netherlands, Poland, Spain, and Portugal)[21]. Direct transfers to vulnerable groups were also widespread among countries, often in the form of expanding social tariffs or providing one-time payments to households (e.g., Denmark, France, Germany, and Italy)[22]. Companies also had access to exceptional aid from the state and in some instances, governments intervened in some energy companies in some way (e.g., Germany and Sweden)[23]. Furthermore, several MS have modified their excise duties on petrol and diesel, including rebates in some cases (e.g., Belgium, Bulgaria, and Sweden).[24]

To raise additional revenues to cover part of the cost of these measures and to ensure fairness, most MS have also taken steps to tax windfall profits produced by unexpected high prices (e.g., Greece, Italy, Romania, and Spain)[25]. The form

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[19] Sgaravatti, Giovanni, Simone Tagliapietra, Cecilia Trasi, Georg Zachmann. National fiscal policy responses two the energy crisis. 24.03.2023. Brugel https://www.bruegel.org/dataset/national-policies-shield-consumers-rising-energy-prices

[20] Transport & Environment. Cuts to fuel taxes https://www.transportenvironment.org/challenges/climate-tools/fuel-taxes/cuts-to-fuel-taxes/

[21] Carbonaro, Julia, Natalie Huet. Energy bills are soaring in Europe. This is what countries are doing to help you pay them. Euronews. 26.10.2022 https://www.euronews.com/next/2022/10/26/energy-bills-are-soaring-in-europe-what-are-countries-doing-to-help-you-pay-them

[22] Idem.

[23] World Economic Forum. Which European country spent the most supporting people through the energy crisis? 16.02.2023 https://www.weforum.org/agenda/2023/02/europe-spent-800-billion-shielding-citizens-energy-crisis/

[24] Carbonaro, Julia, Natalie Huet. Energy bills are soaring in Europe. This is what countries are doing to help you pay them. Euronews. 26.10.2022 https://www.euronews.com/next/2022/10/26/energy-bills-are-soaring-in-europe-what-are-countries-doing-to-help-you-pay-them

[25] Idem; Enache, Cristina. What European Countries Are Doing about Windfall Profit Taxes. 04.10.2022. Tax Foundation https://taxfoundation.org/windfall-tax-europe/

and magnitude of this last measure varies substantially among MS[26]. In some cases, these are one-time measures but that will apply retroactively (e.g., the Netherlands).[27] In some cases the approval of such a tax came after some political hesitation (e.g., French lawmakers initially voted down a windfall tax proposal[28] but towards the end of 2022 backed a special tax on dividends from windfall profits[29], and ended up adopting a temporary solidarity contribution applicable from January 2023).[30]

However, in some cases the adopted windfall tax also covers renewable energy companies (e.g., the Germany's Bundestag has approved the introduction of a windfall levy on excessive earnings from renewable energy generation as part of a package of measures meant to cap gas and electricity prices through April 2024).[31]

1.3 Objectives and structure of this report

This report analyses the impact of the energy price spike on the welfare of European households. In addition, it provides a granular analysis of the socio-economic impact of energy prices in 2022. Finally, it includes a sensitivity analysis that explores the distributional impact of some policies adopted by governments to mitigate the consequences of high energy prices for households.

[26] Idem.

[27] BD0 Tax News. One time windfall tax to be levied on fossil fuel companies for 2022. Netherlands https://www.bdo.global/en-gb/microsites/tax-newsletters/corporate-tax-news/issue-64-november-2022/netherlands-one-time-windfall-tax-to-be-levied-on-fossil-fuel-companies-for-2022

[28] Tax Notes. French National Assembly rejects energy windfall profits tax. 26.07.2022 https://www.taxnotes.com/tax-notes-today-international/profits-taxation/french-national-assembly-rejects-energy-windfall-profits-tax/2022/07/26/7dt9s

[29] REUTERS. French lawmakers back special tax on dividends from windfall profits. 13.10.2022 https://www.reuters.com/markets/europe/french-lawmakers-vote-special-tax-dividends-large-companies-making-windfall-2022-10-13/

[30] Ernst & Young Global. France implements measures to address high energy prices. 17.01.2023. https://www.ey.com/en_gl/tax-alerts/france-implements-measures-to-address-high-energy-prices

[31] Ivanova, Anna. German parliament approves windfall. Renewables Now. 19.12.2022 https://renewablesnow.com/news/german-parliament-approves-windfall-tax-808677/#:~:text=The%20tax%20will%20apply%20to,extended%20to%20April%2030%2C%202024

2. METHODOLOGY

2.1 Modelling

We have developed a microsimulation model that allows us to simulate the distributional and social impact of the energy prices spike at a household level. This model has been developed using the large amount of household data available in the Household Budget Survey (HBS) of each Member State (MS). The rich representation of households in these surveys allows us to develop vertical distributional impact analysis, i.e., by income level, as well as horizontal distributional impact analysis, i.e. by other socio-demographic characteristics of the households.

This micro-data source is the latest harmonised data wave of Eurostat's HBS. This survey collects data on household consumption expenditure on goods and services in monetary units (for all items) and in physical units (only for food categories in some countries) following the classification of individual consumption by purpose (COICOP) and includes different socio-demographic variables of households and individuals. The most recent information available covers most EU countries for 2015 (except Austria, Malta, Portugal and Slovenia)[32]. Although the data are not fully comparable across countries due to differences in data collection approaches, Eurostat's joint framework enhances comparability and allows us to utilise harmonised and consistent data[33]. Despite being country-level surveys, whose classification and coding system of the essential variables have already been harmonized, several adjustments have been made to have a single database for the simulation[34].

Likewise, two other adjustments have been made to the expenditure variables.[35] First, since the survey data are from 2015, it has been necessary to carry out a temporary adjustment, scaling prices from 2015 to 2021 by applying the change in the Harmonized Index of Consumer Prices to each of the COICOP categories by country. Then, a micro-macro adjustment is also made, because although the

[32] For Malta, Portugal and Slovenia we use the 2010 HBS provided by EUROSTAT.

[33] Eurostat. Household budget survey. 2015 Wave. EU Quality Report (Version 1). DOC HBS/2020/01/EN https://ec.europa.eu/eurostat/documents/54431/1966394/HBS_EU_QualityReport_2015.pdf/72d7e310-c415-7806-93cc-e3bc7a49b596

[34] The following document contains all the details about the adjustments carried out: OTEA. Modelling the direct socioeconomic impacts of the New Energy Taxation Directive and the extension of the ETS on transport and building sectors. March 2022 https://api.otea.info/storage/2022/06/06/ff2c5dc97f2cda8d3ea2812cb0e34e576100920a.pdf

[35] The same adjustments are made in the 2010 database.

use of the HBS allows a very detailed analysis of the impact of the proposed scenarios on the different types of European households, the consumption data provided by the survey does not match the data provided by the National Accounts (NA). To adjust the database developed to the macro-aggregates, the consumption data by type of good from the HBS has therefore been scaled to the consumption levels reported in the NA.

Once the database was prepared, we simulated the distributional impacts of the energy prices spike in 2022. To analyse the distributional impacts in each MS, the change in expenditure level has been calculated by deciles (vertical inequality) and based on certain sociodemographic characteristics (horizontal inequality).

Table 1 offers an overview of the different energy products included in our model and also provides the COICOP categories for each of them.

Table 1: Energy product used in the micro model by COICOP category

Variable	HBS COICOP Code(s)	Description
Total	**HE00**	**Total consumption expenditure**
Total energy	HE045	Expenditure on electricity, natural gas, liquefied petroleum gas (LPG), liquid fuels, solid fuels and heat energy
Electricity	HE0451	Expenditure on electricity from all sources
Natural gas	HE04521	Expenditure on natural gas and town gas
Liquefied Petroleum Gas	HE04522	Expenditure on LPG
Liquid fuels	HE0453	Expenditure on liquid fuels for domestic heating
Solid fuels	HE0454	Expenditure on solid fuels for domestic heating
District Heat energy	HE0455	Expenditure on hot water and steam purchased from district heating plants and ice used for cooling and refrigeration purposes.
Fuels	EUR_HE0722	Expenditure on fuels for personal transport equipment
Diesel	EUR_HE07221	Expenditure on diesel fuel for transport
Petrol	EUR_HE07222	Expenditure on petrol/gasoline for transport

2.2 Limitations

Our microsimulation model does not capture the "behaviour" of households, i.e., it does not reflect the reaction of different types of households to expected changes in prices. In this sense, the results only reflect the change in relative prices applied to household consumption structures before the price impact. A "behavioural" impact study would require the use of a more sophisticated tool that would capture direct reactions (through price elasticities of demand for goods) as well as induced reactions (through cross-elasticities and income elasticities).

Furthermore, there are some data gaps in some countries' HBS microdata, mainly due to the lack of disaggregation of some categories of consumption. Several of these data gaps have been corrected in the study but there are still some goods for which data are not available in those countries, either because they are not included in the survey, because they are aggregated in other goods, or because they are not consumed in the country. In the HBS of some countries, anomalies have also been detected regarding socioeconomic variables: there are countries in which some of these variables are not collected and/or variables that have missing labels[36].

In addition, the modelling carried out in this study analyses the energy price shock and its impact on the expenditure of different types of households, but it does not consider other governmental measures taken on the income side (e.g., lump sums or direct transfers). It also does not differentiate between the different prices or tariffs consumers might have access to (e.g., social bonus/tariffs). However, to provide some clues on the impacts of the policy implemented to control energy prices, in section 4 we provide a sensitivity analysis of the distributional impacts that some of the policies had in some member states.

Finally, this report does not analyse the environmental impact the energy crisis might have had. Throughout the crisis, several countries have readapted their energy policies and even turned back to more polluting sources of energy that were deemed as obsolete. This is the case for coal, which has been used as a short-term fix for potential energy shortages.[37] We also did not address any potential regress in energy efficiency following from the kind of price support governments engaged in during the energy crisis. These potential impacts should be further researched.

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[36] See Alonso-Epelde et all (2022) for an overview of the modelling and adjustment needs and realised.

[37] International Energy Agency. The world's coal consumption is set to reach a new high in 2022 as the energy crisis shakes markets. 16.12.2022 https://www.iea.org/news/the-world-s-coal-consumption-is-set-to-reach-a-new-high-in-2022-as-the-energy-crisis-shakes-markets

3. RESULTS

This section focuses on the results derived from the modelling of the impact on households' welfare caused by the rise of energy prices during the year 2022.

Table 2 represents the annual energy price increment in 2022 for households of the main energy sources. To calculate the price change, we have used the Harmonised Index of Consumer Prices (HICP) provided by Eurostat, which is the main tool to measure consumer price inflation[38]. These will serve as the basis for our welfare impact analysis throughout the rest of the section.

Table 2: Price impacts (%) of the main energy commodities by MS[39] in 2022

Country	Electricity	Natural gas	Liquid fuel (heating)	Diesel	Petrol
BE	57.0	113.1	70.5	26.7	20.3
BG	3.9	131.9	22.5	39.3	30.8
CZ	15.9	66.6	24.4	38.9	27.4
DK	63.9	106.5	39.7	38.4	25.3
DE	20.1	46.9	70.3	39.6	21.7
EE	94.4	132.0	47.8	45.9	30.0
IE	41.7	62.7	78.3	33.8	21.8
EL	43.1	127.0	45.1	36.9	24.6
ES	26.8	16.5	72.5	28.5	14.9
FR	7.4	40.9	66.0	28.9	15.8
HR	8.6	13.0	76.1	29.6	17.0
IT	110.3	73.7	38.5	22.0	11.8
CY	41.5	22.0	57.5	36.0	23.4
LV	36.2	126.9	56.3	43.7	32.3
LT	46.2	75.9	84.5	47.2	32.8
LU	2.1	50.7	69.9	43.1	27.8
HU	10.1	49.0	26.0	14.1	13.3
NL	118.0	123.2	114.0	34.0	14.7
PL	4.9	33.7	77.9	33.0	21.8
PT	22.2	62.3	42.3	25.7	14.0
RO	17.5	59.5	9.8	43.4	28.6
SI	4.6	42.1	33.3	28.8	24.5
SK	11.7	19.7	16.6	38.7	22.1
FI	40.8	31.2	66.3	40.7	26.5
SE	36.0	5.7	43.3	44.5	27.1

[38] See: https://ec.europa.eu/eurostat/web/hicp

[39] The price impacts of other energy products, such as coal and solid fuels, have also been assessed. However, for the sake of simplicity, they are not shown in Table 1, since the welfare impact due to the prices of these products is almost negligible for most Member States, as many households do not spend on these energy products.

As can be seen, the impact of prices in 2022 varies depending on the country and the energy product analysed. Thus, electricity seems to be the energy product whose prices have varied the most by country. The reason behind the heterogeneity in price impacts across member states is that some member states have been able to manage electricity prices better, either because their energy mix has been more resilient to the energy crisis, or because the government has been able to introduce policies that control the final prices paid by households.

The most significant price changes resulting from the energy crisis in electricity are on western MS, such as Belgium, Italy or the Netherlands. Whereas the Central and Eastern MS have been able to control better the electricity prices. On the other side, the price impacts on fossil fuels for transport seems to be more homogenous in all MS, and although they differ depending on the country the variability is lower than in the case of the electricity. Finally, the fossil fuels for heating, as the case of electricity, diver depending on the MS. However, the welfare impacts expected from heating fuels are lower than in the case of electricity and transport fuel, as they represent a lower proportion of household's expenditure.

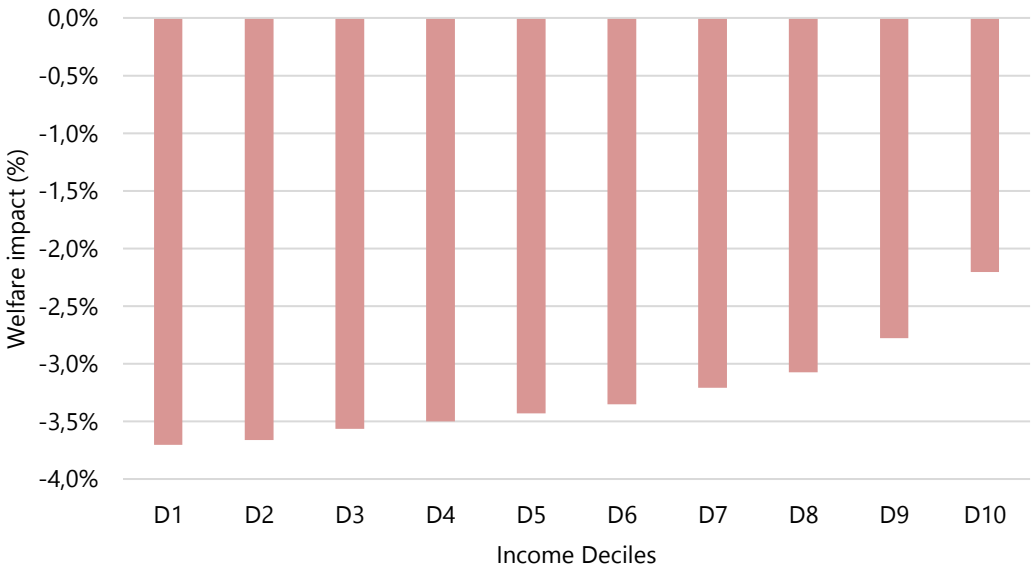
Price change is one of the main factors explaining the following welfare outcomes, along with the consumption pattern of households. Therefore, households that experience a larger change in the prices of energy products that account for a larger share of their shopping basket will be more affected by energy price shocks. Results are presented below in terms of the welfare impact, reflecting price differences for households as a share of total current household expenditure[40]. A 1% welfare gain thus indicates that the household will save the equivalent of 1% of its current total expenditure; conversely a 1% welfare loss indicates that the household will face additional costs equivalent to 1% of its current total expenditure.

[40] We use total expenditure as proxy of the income of the households, since it is considered a better proxy for the permanent income of families as it undergoes a lower fluctuation than income both in the medium and long term (Goodman y Oldfield, 2004).

3.1 EU-wide results

Error! Reference source not found.2 shows the welfare impact – as a share of household expenditure – that European households have experienced during 2022. The graph shows the impact on the welfare of households distributed by income deciles. Each decile represents the average household of each EU country within their national income distribution reality. That is, for instance D1 shows the 10% poorest households of each MS aggregated (i.e., D1 shows the 10% poorest households of Bulgaria, plus those of Germany, plus those of Sweden and so on).

Figure 2: Welfare impact (% of total expenditure) in the EU due to energy prices.



The main conclusion we extract is the confirmation of the regressive distributional impact of the energy crisis. The lowest income households are the most affected, whereas the households in the highest income decile are the least affected. This tendency is replicated throughout the whole income distribution. The scale of the welfare impact across deciles is also significant, ranging from -2.2% for the wealthiest, to -3.7% for the poorest decile.

This comes as no surprise. This regressivity is attributed to the impact of the rise of electricity prices. Low-income households generally spend a higher share of their expenditure on electricity, gas and heating than high income households.[41]

[41] European Central Bank. The impact of the recent rise any inflation on low-income households. ECB Economic Bulletin. Issue 7/2022 https://www.ecb.europa.eu/pub/economic-bulletin/focus/2022/html/ecb.ebbox202207_04~a89ec1a6fe.en.html

Hence the poorest households are the most affected. This aligns with our modelling of the structure of energy expenditure: households belonging to D1 dedicate on average 4.17% of their total expenditure on electricity. Whereas households in D10 the figure is 1.57%, and the European average is 2.41%. The rise of prices for heating purposes follows a similar regressive pattern, but its impact on welfare is more limited given the seasonality of heating. According to our data, households in D1 dedicate 2.12% of their total expenditure on heating versus those in D10 that the expenditure share is 1.13%, while the European average sits at 1.6%.

On the other hand, price rise for fuel has had a higher impact on the middle and middle-high income households than on low-income ones, given their more frequent use of private transport. Accordingly, our data of energy expenditure indicates that both households in D1 and D10 expend less of their income (3.03% and 3.28% respectively) than the European average (4.11%), whereas households in D6 spend 4.67%. However, the more progressive effect due to the price increase for fuel is not enough to compensate the regressive impact of the rise of electricity prices. Hence the regressive pattern shown in Figure 2.

3.2 Results among selected Member States

This report has also analysed the distributional impact of the crisis at the national level. This provides us with further insights on the effect of the crisis in different MS. The selection aims to represent the different geographical and socioeconomic situations, as well as the individual energy reality structure of different MS.[42] Hence, Figures 3 to 5 show the impact of the energy crisis on welfare according to whether the Western MS are more affected by electricity prices (Belgium, Netherlands and Italy) or fuel prices (France, Germany and Sweden), or Central and Eastern European MS (Bulgaria, Poland and Romania).

[42] Results for other individual countries are available under request.

Figure 3: Welfare impacts on Western countries affected more for electricity prices

Figure 3.1: Belgium

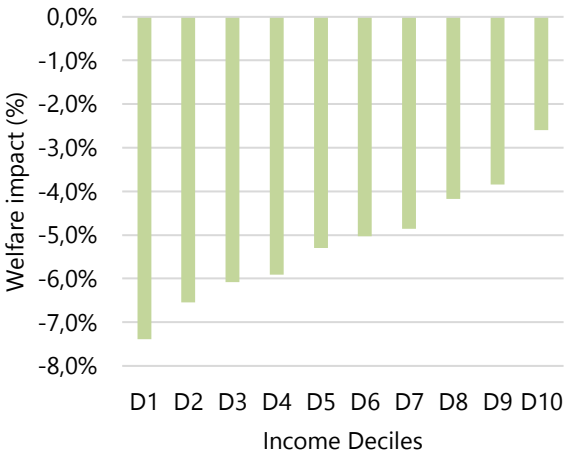


Figure 3.2: Netherlands

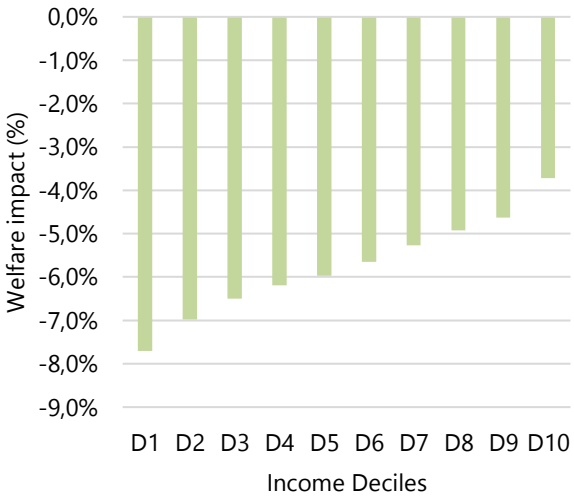
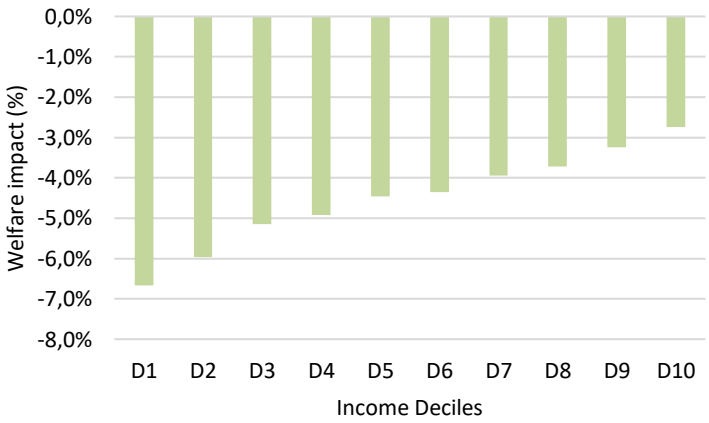


Figure 3.3: Italy



As shown by Figures 3.1, 3.2 and 3.3, not all countries follow the same pattern. In fact, MS can be grouped into those which show a regressive distributional impact and those which show a progressive one, although most of them show regressivity, as Figure 2 depicts. There are two reasons for these differences. Firstly, results vary according to the extent of the impact of the energy price crisis for households. This largely depends on how each MS managed to contain the rise of energy prices (Table 2) and its own energy mix (e.g., exposure to electricity being produced by natural gas vs. nuclear energy or renewables, measures taken to protect consumers). Secondly, results are also affected by the consumption structure of each MS. Countries have different levels of income, therefore a middle-class household in a wealthy country have not the same energy expenditures as the equivalent middle-class household in a low-income country.

Therefore, western European countries, including Belgium, the Netherlands and Italy show a clear regressive pattern. We observe in Table 2 that Belgium, the Netherlands and Italy experienced some of the highest increases in consumer electricity prices during 2022 (57.05%, 118% and 110.34% respectively) (i.e., they were not able to control electricity prices with respect to other EU countries). Since increases in electricity prices particularly affect the low-income deciles of the distribution, these countries show a clear regressive pattern. Hence, we can conclude that in those countries that have not been able to control electricity prices the energy crisis has hit more on the lower income brackets due to the higher dependency of this income groups on electricity.

Figure 4: Welfare impacts on Western countries affected more for fuel prices

Figure 4.1: France

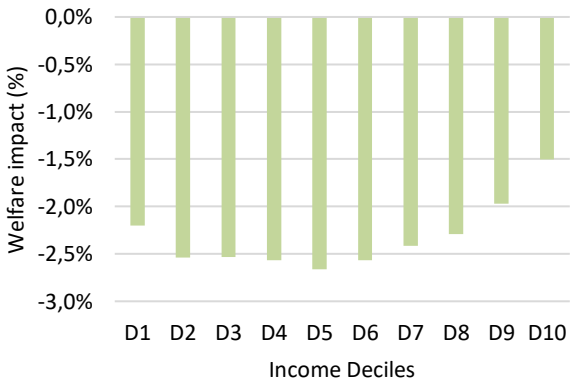


Figure 4.2: Germany

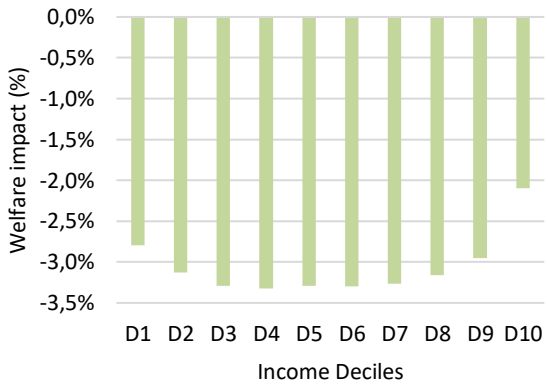
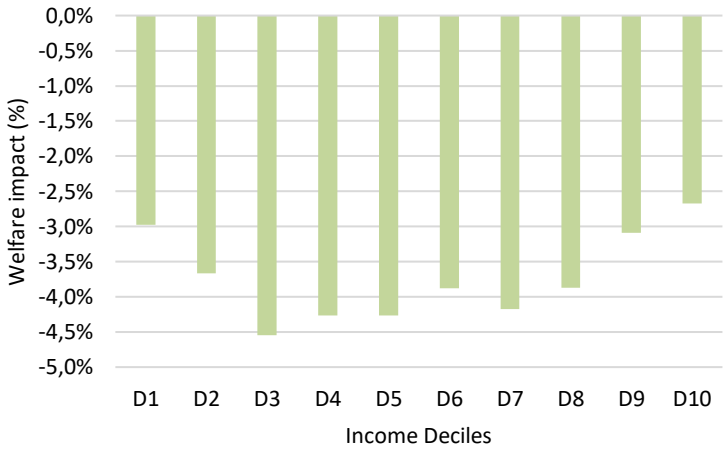


Figure 4.3: Sweden



On the other side, in those western MS that have not been so hit by electricity prices but experiment higher fuel prices, the energy prices increase has affected more on the middle-income groups. This is the case of France, Germany, or Sweden (Figure 4). On average, households in these countries suffer less welfare losses than households in countries with higher electricity prices (Figure 3). Looking at the French case, given the importance of nuclear energy generation[43] and different measures applied by the government to moderate electricity tariffs,[44] the increase of electricity prices was more limited, which explain that the regressive impacts are lower than in the previous countries. However, the higher fuel prices in France, Germany and Sweden involve greater welfare losses on the middle-low-income groups. In these countries, the middle-income groups dedicate a larger proportion of their income to private transports, which explains why they are more affected by the higher fuel prices.

Figure 5: Welfare impacts on Central and Eastern countries affected more for fuel prices

Figure 5.1: Bulgaria

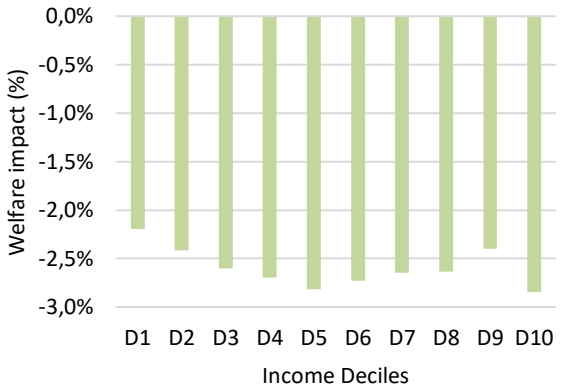
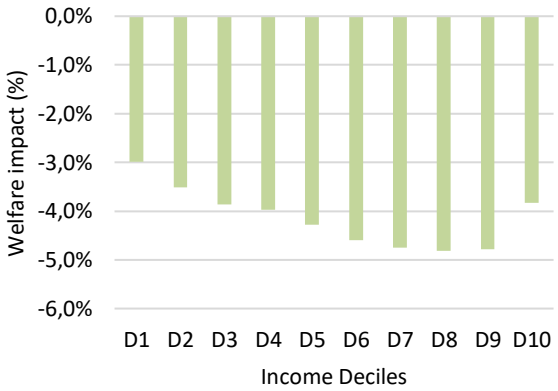


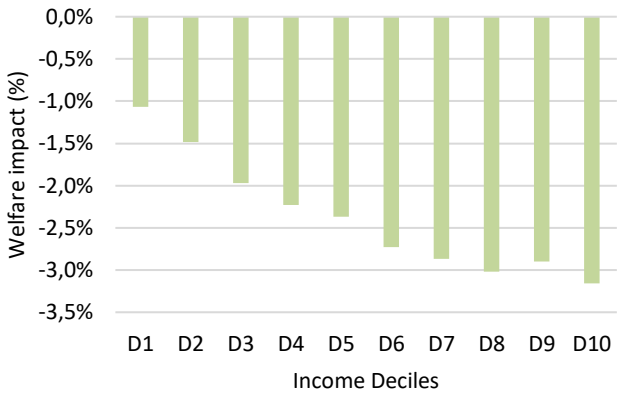
Figure 5.2: Poland



[43] International Energy Agency. France https://www.iea.org/countries/france

[44] Foucart, Renaud. Energy crisis: why French households are largely protected from soaring costs while British families struggle. The Conversation. 12.08.2022 https://theconversation.com/energy-crisis-why-french-households-are-largely-protected-from-soaring-costs-while-british-families-struggle-188417

Figure 5.3: Romania



Similar to the previous group of countries, in Table 2 we observe that also other central and eastern Member state such as Romania, Poland and Bulgaria also managed to contain the increase of electricity prices (electricity prices increase 17.49%, 4.91% and 3.89% respectively), whereas they have been more affected by the fuel prices for private transport (Gasoline and Diesel) and for heating (natural gas and liquid fuel for heating). The lower electricity prices explains again the fact that low-income deciles of the distribution are less affected. However, the rise of fuel prices has had an impact on the middle- and high-income deciles of these countries. In CEE MSs, the higher income groups are the one that dedicate a larger proportion of their total consumption to fuel for private transport, since there are many households on low- and middle-income groups that are not car owners or that they use less private transport. Moreover, although the higher heating prices could also conduct to more regressive impacts, the effect of the price shock on these commodities on household's budget is lower as they represent a lower proportion of the total expenditure than electricity or fuel for private transport. These factors explain the progressive tendency we observe in their income distributions.

3.3 Results from a gender perspective

Mobility and energy use have a gender component that leads to different consumption patterns. Therefore, this report has also analysed the impacts of the rise of energy prices according to gender differences. The modelling and framework employed in this report allows to differentiate between genders (figure 6).

Women are potentially more exposed to energy poverty, given already existing inequalities between men and women such as gender pay gap or gender pension gap. In addition, women are overrepresented in low-paying sectors and in part-time jobs. Moreover, women households tend to dedicate larger proportion of

their income to cover the cost of housing energy bills (electricity and heating), which also explain why they are more related with energy poverty[45]. Caring activities also explain the higher energy consumption (e.g., more time spent at home, more energy needed for cooking, bathing, etc.). For these reasons, women overall suffer disproportionally from rising energy prices at home (electricity and heating).

However, concerning private mobility, women tend to use public transport and walk substantially more than men, who tend to drive more. If men were to travel as women do today, emissions would drop by 18%.[46] Women are also less likely to own a car[47] and in the EU 59% of women and 66% of men use a car every day.[48] This implies that women should be affected less than men by the rise of fuel prices and also they are lower related with the affordability dimension of the mobility poverty (see Alonso et al.)

Hence, we can observe in Figure 6, that women are overall less affected than men by the energy prices shock analysed, as they are higher affected by electricity and heating prices, but much less by fuel for private transport. Electricity and heating price shocks shows larger difference between countries (Table 2), since some countries have been able to control the electricity prices, whereas the price impact on fuel for private transport have been relevant and more homogenous in all MS. This explains why the EU-wide gender analysis shows that men have been more hit by the energy prices, since car use is clearly more related to men households.

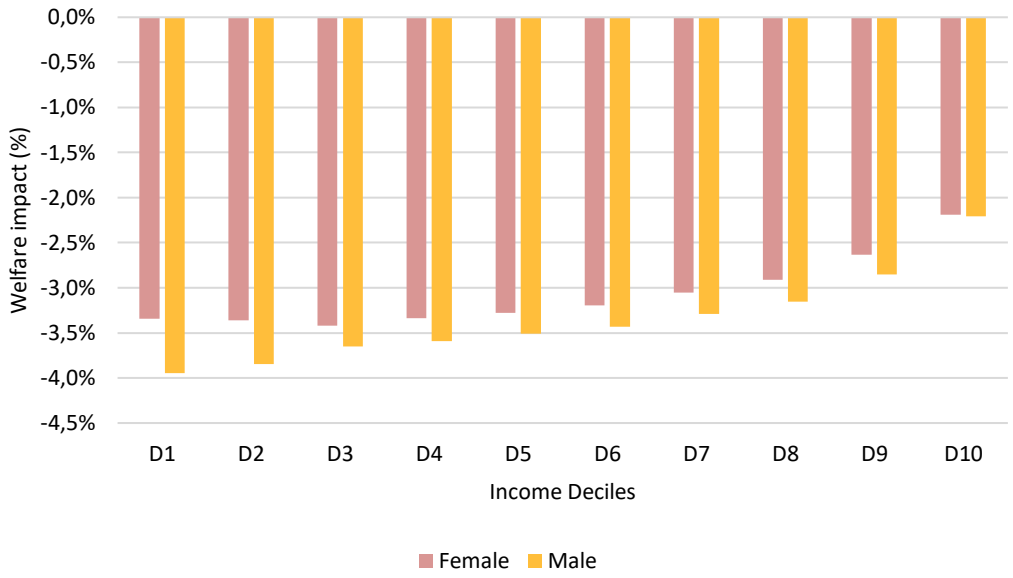
[45] Zamfir, Ionel. Gender aspects of energy poverty. European Parliamentary Research Service (EPRS). European Parliament https://www.europarl.europa.eu/RegData/etudes/ATAG/2023/739349/EPRS_ATA(2023)739349_EN.pdf

[46] Prättalä, Nea; Maja Roginska; Carmen Niethammer, IEB Climate Survey: the case for making transport solutions work for women, 29.07.2022 https://www.eib.org/en/stories/women-transport-climate

[47] Duchéne C. (2011). Gender and transport. International Transport Forum Discussion Papers, No. 2011/11, OECD Publishing.

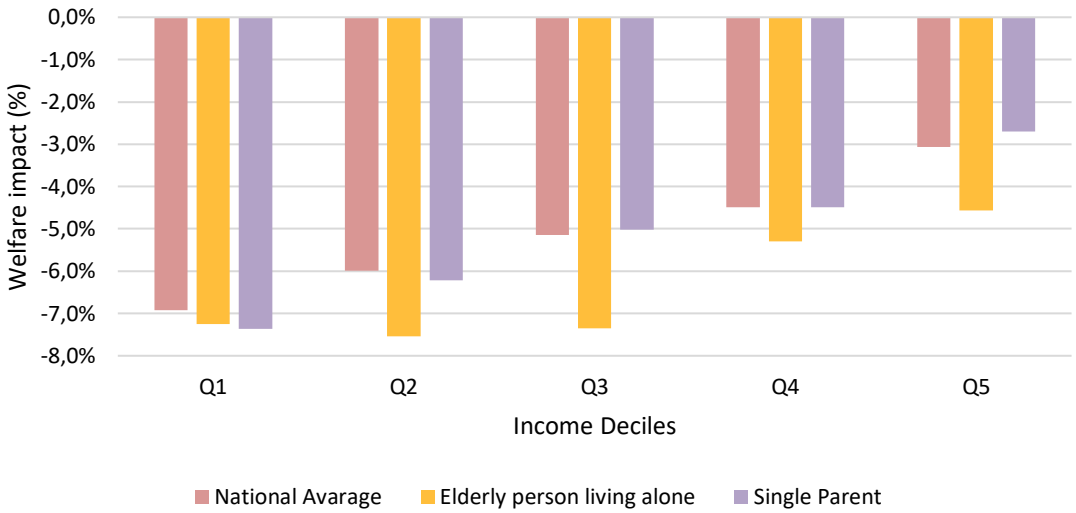
[48] Eurobarometer 2020. 'Mobility and Transport', Special Eurobarometer Report, No. 495.

Figure 6: Welfare impact (% of total expenditure) according to reference person by gender



However, the impact may vary depending on the MS analysed. Thus, we observe that in MS that have not been able to control the rise in electricity prices, such as Belgium or Italy, female households are more affected than male households. This impact is particularly relevant in those households where women are more represented, such as households with an elderly person living alone and an adult with children. Figure 7 shows the welfare impact of these households in the case of Belgium by income quintiles. Therefore, in the case of Belgium with higher electricity prices, we can see that these female-dominated categories are more affected than their respective national average, irrespective of the income group analysed. Therefore, we can conclude that, although the EU-wide analysis shows that male households have been more affected by the energy crisis due to the increase in transport fuel prices, this is not the case in those countries where electricity prices dominate the energy price shocks, which shows that, in terms of gender inequality, it is key to monitor prices related to residential energy.

Figure 7: Welfare impacts (% of total expenditure) according to huoseholds higher represented by women



3.4 Results from a location perspective

Energy consumption patterns also differ depending on location. Energy needs in rural areas are in general higher than in more densely populated urban areas.[49] There is evidence of decreasing net energy use in urban areas.[50] Several reasons are behind this: for instance, housing tends to be larger and detached in rural areas (which demands more energy for heating), rural homes can have additional uses of electricity like water pumps from private wells or for certain domestic wastewater treatment systems[51], and the temperature in cities tends to be higher than in rural areas due to the urban heat island effect.[52]

[49] We use the population density variable as a proxy for the level of rurality of the households analysed. Therefore, we assume that those in "sparsely populated" areas are rural households, while those in "densely populated" areas are urban households.

[50] O'Brien, W.T.; Kennedy, C.A.; Athienitis, A.K.; Kesik, T.J. The relationship between net energy use and the urban density of solar buildings. Environ. Plan. B Plan. Des. 2010, 37, 1002–1021

[51] WDC Insights. What do we know about electricity consumption in rural households? 13.01.2020 https://wdcinsights.wordpress.com/2020/01/13/what-do-we-know-about-electricity-consumption-in-rural-households/

[52] Mentaschi, L., Duveiller Bogdan, G.H.E., Zulian, G., Corban, C., Pesaresi, M., Maes, J., Stocchino, A. and Feyen, L., Global long-term mapping of surface temperature shows intensified intra-city urban heat island extremes, GLOBAL ENVIRONMENTAL CHANGE-HUMAN AND POLICY DIMENSIONS, ISSN 0959-3780, 72, 2022, p. 102441, JRC123644.

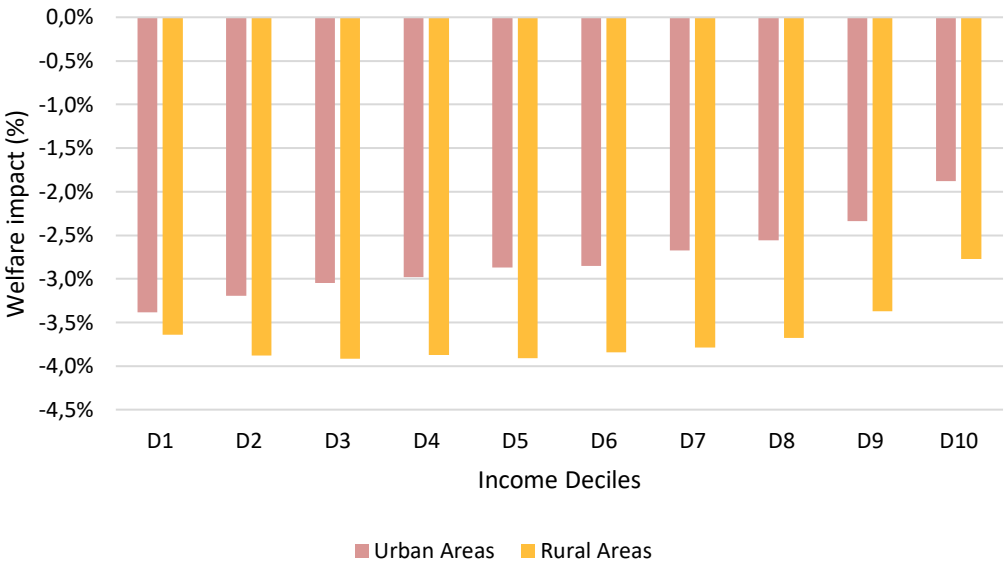
Concerning energy consumption for transportation, annual consumption of fuels is inversely proportional to population density.[53] This can be explained by more efficient transport alternatives and better connectivity in cities than in rural areas. In rural areas citizens tend to use more private transport and therefore more fuel. Similarly, the yearly average number of trips per person by public transport increases with the size of urban area. Rural areas also have the highest proportion of households owning multiple cars.[54]Hence, the welfare of households living in rural populated areas is more affected by the rise of electricity prices and fuel than that of households living in urban areas, as shown in Figure 8.

Moreover, while urban households show a clear regressive tendency, rural ones seem to be more impact on the middle-income groups. It can be observed that middle-income households (D4 to D6) in rural areas are the most affected of the overall comparison. This is due to the large proportion of expenditure that middle-income groups in rural areas spend on private transport, as they have more mobility needs than other income groups more related to elderly households or those who cannot afford a car. Therefore, our results confirm the literature on energy consumption patterns being location-dependant.

[53] Newman, P.W.G.; Kenworthy, J.R. Gasoline consumption and cities. J. Am. Plan. Assoc. 1989, 55, 24–37; Newman, P.; Kenworthy, J. Sustainability and Cities: Overcoming Automobile Dependence; Island Press: Washington, DC, USA, 1999; Norman, J.; MacLean, H.; Kennedy, C. Comparing high and low residential density: Life-cycle analysis of energy use and greenhouse gas emissions. J. Urban Plan. Dev. 2006, 132, 10–21.

[54] National Travel Survey. Travel in Urban and Rural Areas. Personal Travel Factsheet. March 2010 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/230556/Travel_in_urban_and_rural_areas_personal_travel_factsheet__March_2010.pdf

Figure 8: Welfare impact (% of total expenditure) of households in rural vs. urban areas



3.5 Results from an age perspective

Residential and housing energy consumption overall increases over the course of life. A study assessing individual energy usage in the US since 1987 found that residential energy use climbs with age, starting when young adults leave the family home in their 20s and remaining somewhat stable until their 30s. Energy use then increases until it peaks in the mid-50s (most likely coinciding with the end of family caring). From 55 to 64 energy use grows slowly, with consumption increasing substantially after the age of 70.[55] A similar study in Japan arrived at similar conclusions, attributing the increase to the fact that elderly people tend to secure physical comfort at home during winter and summer and that younger cohorts tend to have less intensive energy consumption.[56]

In addition, poverty rates are higher for older people than the rest of the population. In OECD countries, on average 14.1% of individuals aged over 65 live in relative income poverty, while the rate for the overall population is 11.6%. The

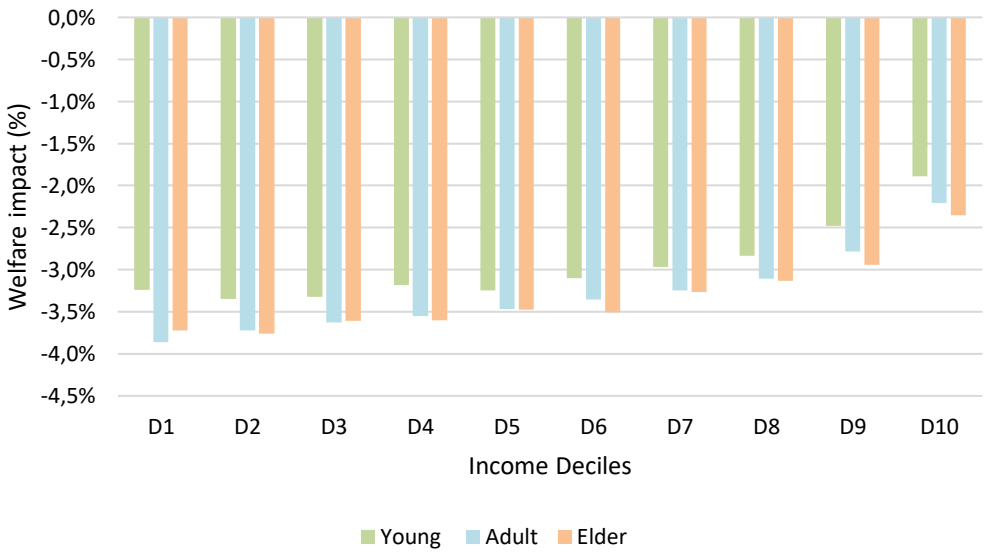
[55] Estiri, Hossein; Emilio Zagheni (2019) Age matters: Ageing and household energy demand in the United States. Energy Research & Social Science. Volume 55. 62-70. ISSN 2214-6296 https://doi.org/10.1016/j.erss.2019.05.006.

[56] Inoue, N.; S. Matsumoto; K. Mayumi (2022) Household energy consumption pattern changes in an aging society: the case of Japan between 1989 and 2014 in retrospect. IJEPS 16, 67–83. https://doi.org/10.1007/s42495-021-00069-y

situation worsens for older women, who are at greater risk of poverty than older men in most OECD countries.[57]

Thus, older people are likely to suffer most from an increase of energy prices since they dedicate a larger proportion of their income on electricity than younger people. These findings of the literature are confirmed by Figure 9, which compares the welfare loss experienced due to the energy crisis in 2022 among different age groups. It shows that in all income deciles, elderly people's welfare is more affected than young households, and in most income deciles they are the most affected group followed by middle-aged adults[58].

Figure 9: Welfare impact (% of total expenditure) depending on age of the reference person



[57] OECD (2021), Pensions at a Glance 2021: OECD and G20 Indicators, OECD Publishing, Paris, https://doi.org/10.1787/ca401ebd-en.

[58] We have aggregated households according to the age of the reference person: below 35 years is considered "young"; between 35 and 65, "adult"; and above 65, "elderly".

4. POLICY SENSITIVITY ANALYSIS

As outlined before, MS have taken different types of measures to mitigate the price increases and alleviate both consumers and targeted economic sectors. Therefore, we have also carried out a sensitivity analysis to give insights on the impact on household's welfare of some measures that can be comparable in some MS. We have investigated the next scenarios in those MS that have applied these specific measures:

- Policy scenario 1: The welfare impact on households if MS wouldn't have applied VAT reductions on electricity prices.
- Policy scenario 2: The welfare impact on households if MS wouldn't have applied excise duties reductions on fuels.
- Policy scenario 3: The welfare impact on households if MS would have applied the revenues used to finance the measures from scenario 3 to make direct transfers to the poorest households.

The range of measures introduced by the different member states have been large and diverse affecting different energy commodities, but also other taxes and direct support for households. This complicates the development of a full policy comparison at EU level. We have therefore focused on specific policies on two energy commodities, and which have been implemented in some Member States, such as VAT reductions on electricity and reductions in excise duties on fuel for private transport. Both allow us to explore the distributional impact of MS' efforts to control electricity and fuel prices and to analyse which households have benefited most from such policies. However, while the reduction of electricity taxes can be supported on the grounds that electrification is key to the energy transition and therefore it is particularly important to control electricity prices, the reduction of fuel taxes goes in the opposite direction to the objectives of the energy transition. Therefore, different international organisations, such as the IMF, have opposed this policy and recommended that direct support would be a better approach to offset possible regressive impacts due to the energy crisis (ref). Therefore, we have considered an additional policy scenario to explore the impact of a hypothetical direct aid to low-income households using the budget of excise tax reductions on fuel (Policy scenario 3).

4.1 Policy scenario 1: VAT reduction in electricity

Policy scenario 1 models the impact on the welfare of households if MS would not have applied VAT reductions to electricity during 2022. We explore the impacts on Belgium, Portugal and the Netherlands. In Belgium reduced VAT on electricity from 21% to 6% for the period March-December 2022; Portugal reduced it from 13% to 5% from October to December 2022 and the Netherlands reduced it from 21% to 9% for the period July-December 2022.[59]

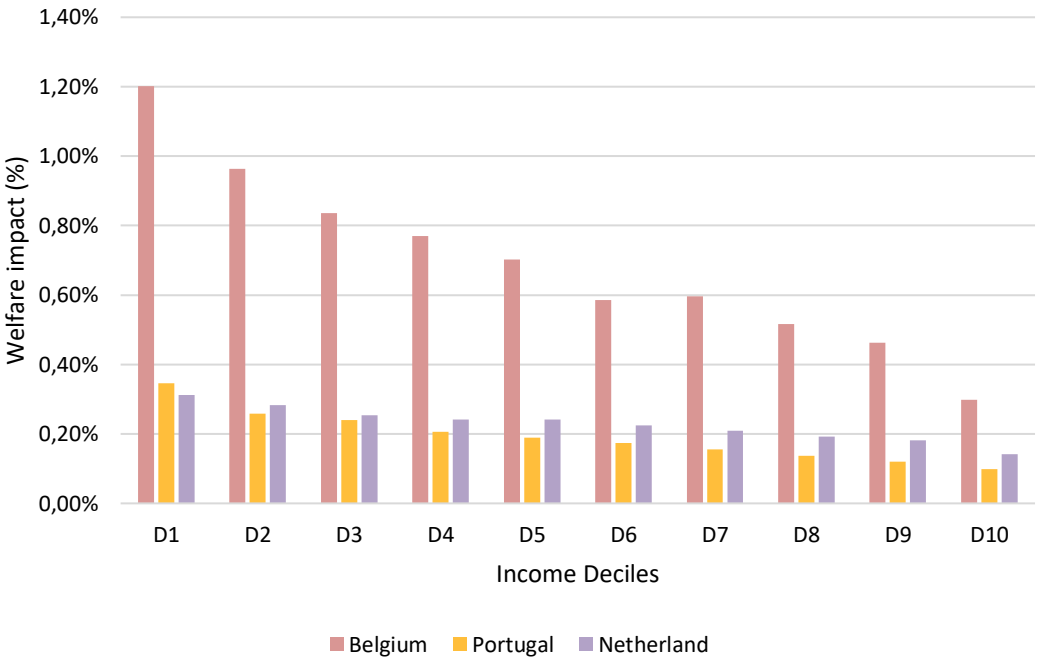
Figure 11 shows the comparative welfare impacts between the *Reference scenario* and *Policy scenario 1* in Belgium, Portugal, and the Netherlands, i.e., the figure shows who benefit more from the VAT reduction in electricity. Results denote that reducing VAT on electricity had clear progressive effects across the income distribution, especially on the lower income deciles. As mentioned before, across the MS distribution, expenditure on electricity makes up the highest share of household expenditure on energy for the lowest-income households – X% on average for the poorest 10%, whereas only in the top 10% electricity only represents 2% of the total consumption. Moreover, electricity makes up the largest share of expenditure of lower-income households across a clear majority of EU MS.[60] Therefore, poorer households benefited more from an active public social policy in the form of VAT reductions than richer ones.

In short, we can conclude that the measures taken to control electricity prices have benefited low-income groups the most, as electricity is a key energy commodity in their consumption basket. However, it should also be mentioned that the general reduction of electricity taxes is not only benefiting low-income groups, as it is also reducing the cost for high-income groups who may also consume more in absolute terms, and therefore there may be public budget transfers to support the consumption of richer households. Nevertheless, and as mentioned above, electricity price control can also be justified in terms of the energy transition objective and the need to keep electricity cheaper than other fossil fuel energy products in order to accelerate electrification.

[59] Sgaravatti, Giovanni, Simone Tagliapietra, Cecilia Trasi, Georg Zachmann. National fiscal policy responses two the energy crisis. 24.03.2023. Brugel https://www.bruegel.org/dataset/national-policies-shield-consumers-rising-energy-prices

[60] Electricity constitutes the highest share of expenditure in 18 MSs.

Figure 10: Welfare gains (% of total expenditure) due the VAT reduction on electricity in Belgium, Portugal and the Netherlands



4.2 Policy scenario 2: Excise duties reduction on fuels

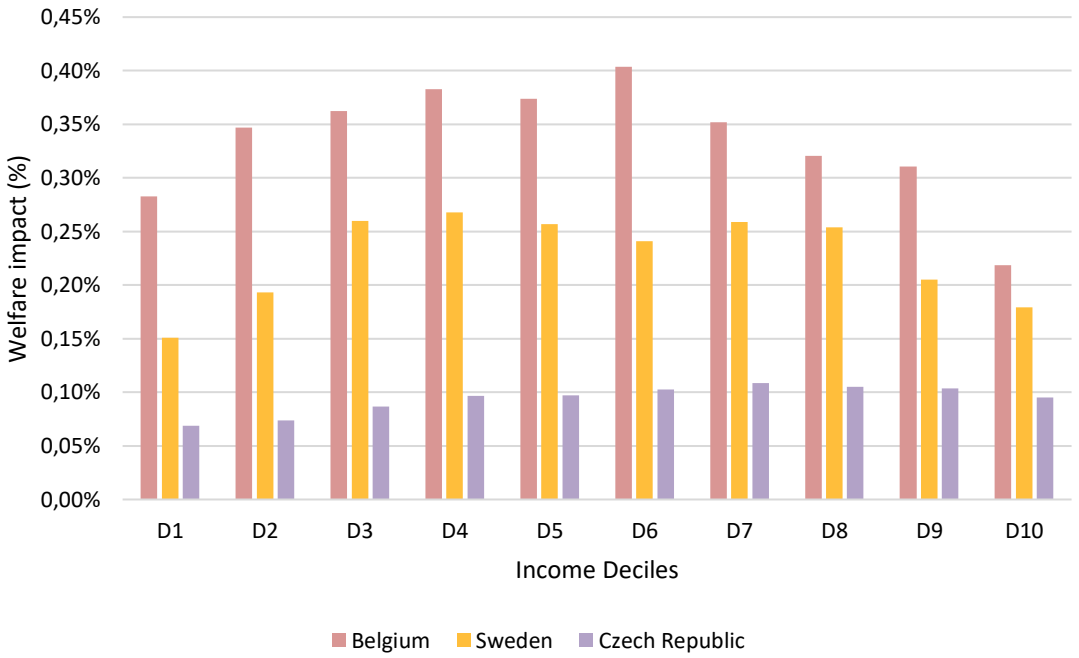
During 2022, most MS introduced reductions on excise duties on fuels. For instance, Belgium applied an excise duty reduction of 17.5 cts/liter for petrol and diesel with an estimated cost of EUR 927 million for the Belgian state[61]. Similarly, Sweden applied a reduction of 10 cts/liter for petrol and diesel with an estimated cost of EUR 336.9 million. Czech Republic also applied a reduction of 6 cts/liter for petrol and diesel with an estimated cost of EUR 561 million for the Czech Republic state.

Figure 12 shows the comparative welfare impacts between the *Reference scenario* and *Policy scenario 2* in Belgium, Sweden, and the Czech Republic, i.e., the figure shows who benefit more from the excise duties reduction in fuel. The results, shows that the middle- and high-income groups have benefit more from this tax reduction. In western MS, as mentioned in section 3, across the income distribution, transport fuels constitute the biggest share of expenditure of middle-income households (private car ownership being less common among

[61] For the Budget and the desing of the Policy scenarios we have used the information from Sgaravatti, Giovanni, Simone Tagliapietra, Cecilia Trasi, Georg Zachmann. National fiscal policy responses two the energy crisis. 24.03.2023. Brugel https://www.bruegel.org/dataset/national-policies-shield-consumers-rising-energy-prices

lower income households). Hence, the tax reduction and support on fuel in western MS have clearly benefit more those households in the middle of the income distribution. The regressive impact of the fuel tax reduction is even more pronounced in the CEE MS, as the case of Czech Republic, since are transport fuel expenditure tends to increase more in proportion with income.

Figure 11: Welfare gains (% of total expenditure) due the tax reduction on fuel in Belgium, Sweden and Czech Republic



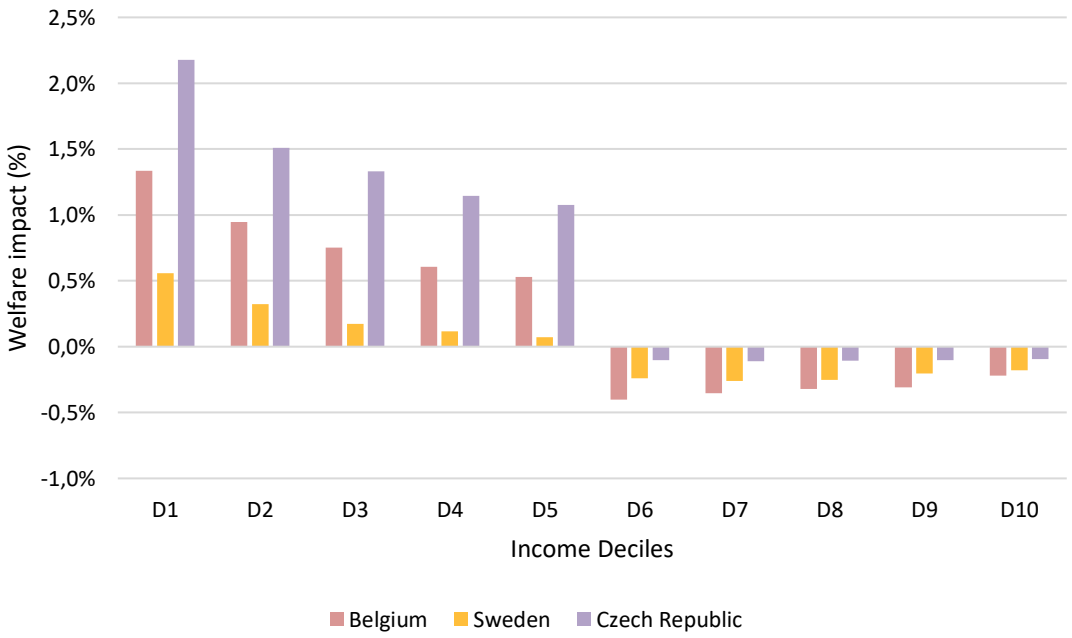
Our results underpin the argument that broad support measures provided through reductions in fuel excise taxes might be a worse policy tool than inaction, since this kind of public expenditure does not reach its target, i.e., the most vulnerable groups, diverts public resources from other public needs, and tends to aggravate social inequalities between lower income groups and middle- and high-income groups, or in eastern European countries between high-income deciles and all the others.

4.3 Direct aid to low-income groups instead of excise duties reductions on fuel

Based on the previous results and the recommendations of different organizations (ref), we have modelled the case as well where, instead of applying generalised excise duties reductions as seen in Policy scenario 2, MS would employ that budget to make lump sum transfers to direct support the 50% poorest households.

Figure 13 illustrates the comparative welfare impacts between the *Reference scenario* and *Policy scenario 3* in in Belgium, Sweden and Czech Republic, i.e., the figure shows who would benefit more from the direct support. On excise duties, Belgium spent EUR 927 million, Sweden EUR 336.9 million and Czech Republic EUR 561 million. We furthermore see that direct support benefit more the low-income groups (D1 and D2). Note that while the rebate is identical per household, its welfare impact across household types is quite different. For the poorest households (1st decile), a paycheck constitutes a marked increase in disposable income, given that in the 1st decile average annual income is lower. For the wealthiest households that receive the support (5th decile) the transfer is rather negligible. Moreover, the richest income bracket would have a negative welfare impact, as now they would have to pay more for the fuel than in the reference scenario which includes the excise duty reduction.

Figure 12: Welfare gains (% of total expenditure) of direct support on 50% poorest households instead of excise duties reductions on fuel in Belgium, Sweden and Czech Republic



These results serve to illustrate that in a crisis context direct transfers are a better policy tool to alleviate energy poverty than generalised measures, such as the reduction of excise duties that have been proven to benefit mostly the middle- and high-income deciles. This is in line with the recommendations of the International Monetary Fund (IMF), suggesting targeted and temporary cash transfers to vulnerable households as one of the best tools to mitigate the energy crisis in countries with strong social and safety nets.[62]

These results are also in agreement with the position voiced by the European Central Bank (ECB), who argued that Eurozone governments must promptly start rolling back measures aimed at cushioning the impact of energy prices in line with the fall in energy prices and in a concerted manner to avoid feeding inflation, since measures that are not temporary, targeted and tailored to preserving incentives to consume less energy "are likely to drive up medium-term inflationary pressures, which would call for a stronger monetary policy response".[63]

[62] Amaglobeli, David; Emine Hanedar; Gee Hee Hong; Celine Thevenot (2022). Fiscal Policy for Mitigating the Social Impact of High Energy and Food Prices. June 7, 2022. IMF Notes No 2022/001 https://www.imf.org/en/Publications/IMF-Notes/Issues/2022/06/07/Fiscal-Policy-for-Mitigating-the-Social-Impact-of-High-Energy-and-Food-Prices-519013

[63] Treeck, Johanna. ECB's Lagarde calls on governments to start dialling back energy-price support. 02.02.2023 https://www.politico.eu/article/european-central-bank-christine-lagarde-energy-price-support-eurozone-inflation/

5. CONCLUSIONS AND RECOMMENDATIONS

Assessing the distributional impacts of the 2022 energy crisis is a complex exercise given the heterogeneity among households in the EU, as well as between MS (policy divergences, different energy mixes, electricity needs, dependence from Russia, seasonal needs, etc.). Despite this and some methodological limitations, our model provides a general picture of the impacts on the welfare of households across the EU derived from the energy crisis.

Our results mostly confirm the literature regarding, on the one hand, energy consumption being income-, gender-, age-, and location-dependant, and, on the other hand, the effectiveness of energy poverty reduction policies being highly toolbox-dependant. Altogether our results underpin a broad call for an improvement of the policy toolbox against energy poverty at MS level, not only by strengthening with empirical evidence arguments already voiced in the literature, but also by emphasising the importance and urgency of policy improvements in this field given the current energy crisis context.

among the main conclusions we draw from our analysis is the confirmation of the regressive distributional impact of the energy crisis. The significant impact of the rise of electricity prices was not compensated by the progressive impact following from the rise in fuel prices. Another insight we get from our analysis is that the impact on welfare varies across MS. There are two reasons for these differences. Firstly, results vary according to the extent of the impact of the energy price crisis for households, which largely depends on how each MS managed to contain the rise of energy prices and its own energy mix. MS that have managed to control electricity prices show a smaller impact on the overall welfare, and in those cases the middle-income deciles have been more affected due to the rise in fuel prices. In countries where electricity prices have significantly increased, the welfare loss is higher in the poorest households, which are those more exposed to such price variations. Secondly, results are also affected by the consumption structure of each MS.

Regarding the effectiveness of the main types of measures MS used to stave off energy poverty during the energy crisis, our results denote that reducing taxes on electricity had clear progressive effects across the income distribution, especially on the lower income deciles. Regarding excise duties reductions on fuels, the results are mixed but one observed a tendency for them to be regressive, helping mostly the middle-income deciles, and the high-income deciles in eastern European countries. Finally, we observed that in all cases, direct transfers to poorest segments of the population have a clear progressive impact with respect to the reference scenario.

Hence, our results support the argument, voiced both by the International Monetary Fund and the European Central Bank, that, in an energy crisis and inflationary context as the current one, direct transfers (especially in the form of targeted and temporary cash transfers to vulnerable households) are a better policy tool to alleviate energy poverty than generalised measures, such as the reduction of excise duties on fuels that have been proven to be regressive, or even measures with a progressive impact such as electricity tax reductions.

Additionally, while the reduction of electricity taxes can be supported on the grounds that electrification is key to the decarbonisation of energy consumption and therefore it is particularly important from an environmental perspective to control electricity prices, the reduction of fuel taxes goes in the opposite direction to the objectives of the energy transition. The reduction of excise duties on fuels goes against the just and sustainable transition rationale and is hence hardly justifiable from a public interest perspective.

Following the results obtained, these are our recommendations to alleviate energy poverty:

- Policy measures should account for national particularities, and consider income, gender, age, and location of the targeted groups.
- Governments should prioritise interventions to control rises in electricity prices vis-à-vis measures to address rises in fuel prices.
- Governments should adopt support measures in the form of direct transfers targeted at the most vulnerable groups rather than broad support measures operated through a reduction on taxes on energy commodities.
- Governments should give preference to electricity tax reductions or measures to control electricity prices over inaction but prefer the latter to reductions in fuel excise taxes. Thus, from an inequality point of view, it is more advisable to introduce price control measures for electricity than for fuels.

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