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Energy price increases and mitigation policies: Redistributive effects on Italian households

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Abstract

Since the second half of 2021, there has been a sharp increase in the prices of energy goods (electricity, heating gas, fuels) as well as of food, leading to inflation rates never experienced in Italy in the last forty years. Such high inflation rates prompted the Italian government to take measures to curb the prices of energy products, to increase social bonuses on electricity and gas bills, and to provide one-off allowances to households. The crucial question is what impact the price increases have had on households and whether the measures taken have protected the household sector from these increases. Therefore, we perform a microsimulation exercise on the period July 2021-March 2023 to quantify the effects of the price increases and of the measures on household expenditure and income. Our results indicate that the regressive impact of price increases was mitigated by the price containment measures due to their progressive nature and that the contribution of one-off allowances and social bonuses was very relevant. In 2022, the year in which households benefitted from the measures for twelve months, the fiscal policy interventions also succeeded in reducing inequality, the at-risk-of-poverty rate and energy poverty.

Keywords: microsimulation; redistribution; energy prices mitigation policies; energy consumption; energy poverty.

JEL classification: D10; D30; H31; I32; Q48.

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1. Introduction and literature review

In the last two years, there has been an extraordinary and generalised increase in the consumer price index, driven mainly by energy –electricity, gas and fuels– and food prices. The euro area annual inflation rate was 6.9% in March 2023, down from 10.6% in October, while in September 2021 the rate was 3.4%. In Italy, annual inflation reached 11.8% in October 2022, while electricity prices increased by 199%, gas prices by 90.7% and fuel prices by 7.7%. Figures for March 2023 show a drop in annual inflation to 7.6%, although the value is still high compared to the past (in March 2021, the change in the index had been 0.8% over the corresponding period); also, in March this year, the energy components recorded annual changes of 28%, 3.6% and -6.3% for electricity, gas and fuels, respectively.

In mid-2021, when price rises were still considered temporary, the European Commission expressed its willingness to help and support countries addressing the negative impact on households and businesses, especially because they were facing the likelihood of higher energy bills at a time when many of them had been made economically fragile by the COVID-19 pandemic (EC, 2021). However, following the Russia-Ukraine war, price rises have become much more pronounced and long-lasting, which called for extensive countries' intervention.

Since the second quarter of 2021, Italy's government has repeatedly intervened with measures to mitigate the adverse effects of energy price increases on households and businesses, earmarking 91.2 billion euros between June 2021 and March 2023. This has put Italy among the countries with the highest level of public intervention in the euro area, with a ratio to GDP equal to 4.8%, ahead of France (3.5% and 92.1 billion), Germany (3.1% and 118.6 billion) and Spain (3.1% and 41.1 billion). The fiscal policy package consists of three sets of measures: (i) reduction/cancellation of the general system charges of electricity and gas bills and cuts in the VAT rate of gas bills, (ii) cuts of excise duties of fuels, and (iii) provision of one-off allowances to individuals and increases in the amounts of households' energy bills benefits (the so-called 'social bonuses') to compensate for economic or health deprivation.

The nature of the price increases, as well as the design of the measures to mitigate them, suggest that the impacts may be not homogeneous across households. Indeed, the different composition of expenditure and the greater propensity to consume of the less affluent segments of the population make it likely that the impact of the inflationary shock is higher for lower expenditure/income households. For instance, Claeys et al. (2022) show the existence of discrepancies in the inflation rates in most European countries along the expenditure distribution, with increasing gaps between the first and the last quintile that reached almost 5 percentage points in September 2022 in the case of Italy. At the same time, some of the measures, especially the social bonus that is attributed based on the means testing criterion ISEE (indicator of the equivalent economic situation) and the one-off allowances that are in a fixed sum and therefore progressive, are likely to reduce regressivity, favouring less well-off households and counterbalancing, at least partially, the price increases.

The aim of this paper is threefold. First, we provide a quantification of the likely effects of energy price increases and of the counterbalancing policy measures on household expenditure and an assessment of their distributive impact on Italian households, over the period July 2021-March 2023. For this purpose, we build three simulation scenarios – baseline, actual and theoretical – which we use to evaluate the changes in expenditure incurred by households following price rises and the introduction of mitigation measures and the theoretical changes that would have occurred in the absence of the fiscal package. Therefore, we look at their impact along the expenditure and income distribution to gauge their redistributive nature (i.e., whether they are progressive or regressive). Second, we look at the changes in inequality and at-risk-of-poverty incidence and, third, we explore a measure of energy poverty and its variations in our scenarios.

This paper fits in the literature on static microsimulation, which enables us to quantify the so-called 'first-round effects' (Bourguignon and Spadaro, 2006) of the joint contribution of price rises and mitigation policies on household expenditure and income. As far as Italy is concerned, some studies have recently assessed the impact of energy prices increase on households and of the introduction of measures to mitigate them. The Bank of Italy (2022) quantifies that, without the Government's measures, price increases would have absorbed more than 20% of disposable income for households in the first income quintile and about 6% for those in the last; by accounting for the Government's measures, the effect drops to about 12% for the former and almost 5% for the latter. According to Curci et al. (2022) in 2022 the measures attenuated inflation by just less than 2 percentage points on average and the strengthening of social bonuses was the most effective measure in mitigating the regressive effect of the inflationary shock. The simulation exercise of the Parliamentary Budget Office (PBO, 2022a) suggests that the mitigation measures would fully offset the expenditure increases due to the price dynamics for households in the first decile of expenditure in the twelve months from June 2021 to May 2022. However, the persistence of inflation over the months from July to September 2022 led to a deterioration of households' purchasing power (PBO, 2022b).

This paper also fits in the literature that deals with the likely redistributive effects of inflation and that dates to Bach and Ando (1957) and Ackley (1978), among others. After years of generalised low inflation levels, the last two have seen a rebirth of the topic due to recent exceptionally high price rises and the perception that inflation can have an uneven impact across households. The main result of the most recent studies is that the effects of price increases differ significantly across the population, because of their different spending patterns. At the European level, Menyhért (2022) finds that inflation has increased the European average of households in material and social deprivation by 2 percentage points since August 2021. Villani and Vidal Lorda (2022) find that in 8 out of the 17 EU countries under analysis, lower-income groups whose consumption basket is mainly composed of essential goods are most affected by the increase in prices, and that poorest households suffered a rise in prices 2 to 5 percentage points higher than the wealthiest households between March 2021 and March 2022. The results of Claeys and Guetta-Jeanrenaud (2022) show that in Belgium, France and Italy, in 2021 the actual rate of inflation faced by the lowest income categories was higher than the rate of inflation of the highest income categories. Gürer and Weichenrieder (2020) reveal the existence of a pro-rich inflation in Europe, showing that over the period 2001-2015, the consumption bundles of the poorest deciles in 25 European countries have, on average, become 11.2 percentage points more expensive than those of the richest deciles. The work of Kaplan and Schulhofer-Wohl (2017) lies on a parallel strand of research since it documents large heterogeneity in inflation rates at household level in the US, but this owes to differences across households in prices paid within the same categories of goods. Finally, acknowledging that in the euro area total private consumption was significantly affected by energy supply shocks, Bobasu and Gareis (2022) find that the inflationary shock only had a negligible negative impact on consumption of services, but a larger negative one on durable goods.

Finally, since to our knowledge there are no papers looking at the impact of increased energy prices and their mitigation policies on energy poverty in Italy, we provide a quantification of by how much energy poverty would have risen because of sky-rocketing energy prices without the containment measures and by how much it has changed in a scenario with these policies. In the literature there are three main approaches to measure energy poverty: (i) by comparing energy costs to an expenditure threshold, (ii) by using self-reported housing conditions (the so-called 'consensual' approach) and (iii) by comparing the level of energy services to a benchmark (the so-called 'direct measurement' approach) (see Faiella and Lavecchia, 2021, for more details). Across Europe, different countries adopt different measures of energy poverty but not all of them have an official indicator (such as Germany and Italy). In 2011, Hills introduced a new indicator based on the 'Low-Income High-Costs' (LIHC) principle (Hills, 2011 and 2012), which classified households as energy (or fuel) poor those with: (i) an income, after energy costs, below the official poverty threshold and (ii) fuel costs above the national median level. As far as Italy is concerned, it still lacks an official energy poverty measure, despite Faiella and Lavecchia (2015) proposed a measure that was first presented in the 2017 National Energy Strategy (SEN) and that was also included in the Integrated National Energy and Climate Plan (PNIEC) thereafter. It is based on the LIHC principle but, because of lack of income in the expenditure survey data, it is a 'low-expenditure high-costs measure'. Moreover, it innovates on Hills by including less well-off households with zero heating expenditure. In this paper we employ the indicator developed by Faiella and Lavecchia (2015 and 2021) and apply it to three scenarios (baseline, actual and theoretical) to gauge by how much the price rises and mitigation measures have, or would have, impacted on energy poverty.

To conduct our analysis, we employ various data sources. First, the Household Budget Survey (HBS), which provides a detailed expenditure breakdown by item at the household level. Second, electricity and gas prices decomposed into all their tariff components, which allow us to retrieve quantities demanded from the HBS expenditure. Third, the Italian module of European Union Statistics on Income and Living Conditions (IT-SILC), on which we perform a statistical matching to associate HBS consumption to household income and wealth.

We start by building three scenarios. The ‘actual scenario’, which represents what has occurred in terms of price increases and measures introduced: it extends from July 2021 (the first month in which the first price containment measures were introduced) to March 2023. The ‘baseline scenario’, which identifies the period before the increases and measures. The ‘theoretical scenario’, which incorporates the price increases but assumes no mitigating measures. For each scenario, we compute both energy-related expenditure and total expenditure. Then, we need to quantify bonuses and one-off allowances and to identify eligible households. To this end, we employ the matched SILC-HBS database and simulate the means testing criterion ISEE, which is one of the elements, together with income and household composition, that are necessary to assign the benefits. Then, the benefits are subtracted from baseline and actual expenditure.

By comparing the theoretical expenditure with the baseline one, we obtain the distributional effects of the price increases without the mitigation policies, while by comparing the actual expenditure with the baseline one, we obtain the joint distributional effects of price increases and mitigation policies. Finally, by comparing the theoretical scenario with the actual one, we can quantify the effects of the mitigation measures.

Our empirical results show that the measures contributed strongly to containing price increases and that they exhibit a progressive nature: higher in percentage terms for the lower end of the distribution, lower for the upper end. We observe the strong contribution of social allowances and bonuses in the first deciles. The overall increase in prices (energy and non-energy products) in combination with the support measures is estimated in an average percentage increase in total expenditure of 6.4%, which would have risen to 11.3% without the measures. We also simulate that the increase of energy prices alone, again in combination with the mitigation policies, caused an average percentage increase in energy expenditure of 4%, which would have reached 52.6% without the measures. The fiscal policy interventions succeeded in keeping the Gini index of the actual scenario stable around that of the baseline scenario. This result refers to a design that covers the years 2021-2023 in full (36 months). Instead, if we look at 2022, the only year in which households could benefit from the measures for 12 months, the measures are estimated to have reduced inequality by 0.5 percentage points. The policies also succeeded in reducing the at-risk-of-poverty rate (by 0.8pp in the three-year scenario and by 1.5pp in the 2022 scenario) and energy poverty (2pp in the 2022 scenario).

The paper proceeds as follows. Section 2 describes the data and how we construct some of the necessary variables to conduct our analysis. Section 3 illustrates the measures introduced by the government to mitigate the price rises. Section 4 discusses the methodology underlying the microsimulations. Section 5 presents and discusses the empirical results, while Section 6 concludes.

2. Data and descriptive statistics

To perform the analysis, we need various pieces of information. First, we need expenditure at the household level and by item. Second, we need price indices and energy prices. Third, we need household income and wealth indicators to assign social bonuses and allowances. Since a single database containing all the necessary information does not exist, we draw from various sources and our own data processing.

2.1 Household expenditure

Data on household expenditure are provided by the HBS, which collects detailed information on all expenditure items incurred by a representative sample of the Italian population. The survey collects data on the monthly expenditure for 303 items and a selection of households' socio-demographic characteristics, such as household composition, region of residence and month of the interview. The design of the survey is such that each month one twelfth of households is interviewed, so that by the end of the year all sampled households are interviewed. This implies that monthly household expenditure represents one twelfth of yearly expenditure and the computation of expenditure in the three scenarios will take into account this structure. Our microsimulation model runs on 2014 data, but expenditures are calibrated to 2019 (the year chosen as our baseline scenario, as detailed in Section 5.1) by applying national accounts growth rates by the twelve COICOP (Classification of Individual Consumption by Purpose) categories. The sample consists of 16,804 households.

Figure 1a depicts the composition of household expenditure by consumption categories in our 2019 calibrated dataset. 'Food and non-alcoholic beverages' are the item weighing the most (16.7%). They are followed by 'Transport' (15.2%), which contains expenditure on fuels for private transport (4.5% of total expenditure). The item 'Housing, water, electricity, gas and other fuels', excluding imputed rents, has a relative weight of 9.4%. Within this, electricity accounts for 1.6% of total expenditure and heating fuels for 2.4%.

Households consuming more of the goods that have experienced a higher price increase will see their purchasing power decline more markedly. All the items considered have a decreasing relative weight along the expenditure distribution (Figure 1b).[1] This trend is more evident for food, which drops from 25.5% in the first decile to 10.9% in the last one, while electricity decreases from 3.8% to 0.8%, heating

[1] Deciles are calculated based on equivalised expenditure, which is household expenditure divided by an equivalence scale accounting for household composition. We use the OECD-modified scale that assigns value 1 to the first adult, 0.5 to the second adult and 0.3 to children under 14 years of age.

gas from 3.8% to 1.1% and, finally, private transport fuels from 4.7% to 3.5%. Because of these observed patterns, one can expect different impacts of the price increases per household.

FIGURE 1 ABOUT HERE

2.2 Inflation and energy prices

Although the general price index only increased by 1.4 % in the first half of 2021, the energy components showed stronger dynamics: 16.9 % gas, 11.8 % fuels and 2.5 % electricity (Figure 2). At this stage the Government intervened by implementing mitigation policies. However, prices continued to rise, reaching very high growth rates between June 2021 and November 2022: 13.4 % for the general index, 247.8 % for electricity, 121.4 % for gas and 12.4 % for fuels. It is noteworthy that these changes underestimate price growth as they already incorporate containment measures. As of December 2022, the first reduction of the energy components occurred: -19.6% for electricity and -22.4% for gas over the period November 2022-February 2023, while the price of fuels rose again over the same period (5%) due to the abolition of the excise duties cut.

FIGURE 2 ABOUT HERE

To retrieve quantities demanded from the HBS data and to subsequently build expenditure in our simulation scenarios, we need prices of the three energy expenditure components and their tariff composition. For electricity, prices and their tariff composition are provided quarterly by Acquirente Unico, while for gas, they are provided quarterly by ARERA.[2] Finally, the prices of private transport fuels (petrol and diesel) and their tariff breakdown are provided daily by the Ministry of Ecological Transition. How quantities are obtained is the object of Section 5.4.

Utilities price their electricity by applying a two-part tariff: a volumetric charge that covers the marginal cost of producing an extra kilowatt-hour (kWh), and a fixed monthly charge that covers any remaining fixed costs such as building and operating the power plant and transmission lines.[3] This scheme applies also in the case of Italy. Figure 3 shows the percentage composition of electricity prices of 2018-Q3 as an example: we observe a gradually decreasing incidence of marketing and transport costs and an increasing weight of taxes and system charges. Overall, the electricity unitary price decreases as the amount consumed increases.

[2] Acquirente Unico is the public company, wholly owned by Gestore dei Servizi Energetici S.p.A. (in turn wholly owned by the Ministry of Economy and Finance), set up by Legislative Decree No. 79 of 16 March 1999 to guarantee the supply of electricity to domestic consumers and small businesses that have not yet switched to the free market. ARERA is the Regulatory Authority for Energy, Networks and Environment.

[3] Departures from this efficient scheme and their implications are discussed by Levinson and Silva (2022) for the US.

FIGURE 3 ABOUT HERE

Figure 4 shows the percentage composition of the gas price for a typical consumer, by region, calculated by applying the tariff structure of 2018-Q3 to an annual consumption of 1400 standard cubic metres (smc).[4] Natural gas weighs on average 38%, against 20.7% for transport and meter management, while the largest share is for taxes (39.6%). Regional heterogeneity is observable, due mainly to the lower level of excise duties in the Southern regions, which determines a lower weight of the tax component, while the weight of transport costs is higher in the South.

FIGURE 4 ABOUT HERE

2.3 Income and the means-testing indicator

One-off allowances and energy bonuses are granted based on individual income and/or on the means testing criterion ISEE (Indicator of the Economic Equivalent Situation). However, the HBS does not report household income or financial and real assets to build the ISEE. Therefore, we draw on the dataset created by means of our tax-benefit microsimulation model, which is based on a statistical matching between HBS and IT-SILC (the Italian module of European Union Statistics on Income and Living Conditions) to combine consumption, income and wealth variables in a single dataset. To do so we draw on Baldini et al. (2015) and Baldini et al. (2018). The matching is performed on 2015 IT-SILC, which collects data on income, poverty, social exclusion and living conditions. Information on social exclusion and housing conditions is collected mainly at household level, while income, its components and socioeconomic characteristics (occupational status, education, etc.) are obtained at individual level. Socio-demographic characteristics refer to the year of the interview, while incomes refer to the previous year (i.e., the incomes of the 2015 survey refer to 2014). The 2015 wave covers 17,985 households and 42,987 individuals, including children.[5] As already specified in Section 2.1, for the HBS we use the 2014 survey year for coherence with the income variables of IT-SILC. Appendix A provides some details on the matching procedure.

With the statistical matching we now have, for each household, all the consumption items to which we can associate income and wealth information to simulate the ISEE, which will be employed to identify the households eligible to social bonuses and one-off allowances. The ISEE is also needed to identify

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[4] The standard cubic metre (scm) is the unit for measuring the volume of gas under 'standard' temperature and pressure conditions. Using the standard cubic metre makes it possible to calculate the volume of gas distributed and consumed in a standardised manner. In this way, citizens can pay for the actual gas consumed regardless of, for example, the geographical areas in which they reside, which could influence the volume of gas.

[5] We do not employ a more recent wave of IT-SILC, since from the 2016 release Istat stopped providing the extra set of Italy-specific variables necessary to perform the microsimulations. Income values are brought forward by using the National Accounts growth rates.

citizenship income recipients, one of the categories entitled to one-off-allowances. Appendix A provides details on how we deal with the variables of real and financial assets needed to build the means testing indicator.

3. The set of simulated measures

In this paper we focus on the increases in energy prices (electricity, gas for heating and fuel for private transport) and the effects of the measures to contain them on household budgets with the aim of quantifying their respective distributional effects. In detail, the fiscal package consists of three groups of measures: (i) measures to contain energy prices, (ii) one-off allowances to households, and (iii) social energy bonuses (Table 1).

TABLE 1 ABOUT HERE

The first group consists of an initial reduction in the general system charges of the electricity bill (third quarter of 2021), subsequently (October 2021) transformed into their cancellation. It also includes the reduction of general system charges of the gas bill, the reduction of VAT on gas bills to 5% and a 25-eurocent cut of excise duties on fuels from October 2021; these cuts also affect the VAT paid since they enter its taxable base.

The second group encompasses the €200 one-off allowance granted in July 2022 and the €150 one granted in November 2022. They both target individuals in economic difficulty (recipients of unemployment benefits and citizenship income) and employees, pensioners, freelancers, self-employed workers with annual income up to €35,000 for the 200-euro allowance and with annual income up to €20,000 for the 150-euro allowance.

Finally, the third group includes the so-called ‘social energy bonuses’ (for economic hardship and for physical hardship) targeting specific categories of households: those with ISEE below 8,265 euros, a limit raised to 12,000 euros from March 2022 and to 15,000 euros from January 2023, large households, recipients of citizenship income, households with members in precarious health conditions. These bonuses were in place even before the energy emergency (‘ordinary’ component), but the fiscal package increased the threshold of the means testing criterion and the amounts of the bonuses (‘extraordinary’ component). The principle of uniqueness applies to this type of bonus, i.e., it can only be paid for one of the bills, be it water, electricity, or gas. For electricity, the total annual amounts (ordinary bonus + extraordinary bonus) for the years 2018 to 2022 are shown in Table 2.

TABLE 2 ABOUT HERE

For heating gas, the total annual amounts for the years 2018, 2019, 2021 and 2022 are shown in Table 3, which also shows that the amount of the bonus depends on the climate zone – defined according to the average daily temperature – in which the dwelling is located.[6]

TABLE 3 ABOUT HERE

The resources allocated by the legislative measures adopted by the government for households and businesses amount to €19.4 billion in the first half of 2023 and to €66.2 billion for 2022, after the €5.5 billion allocated for 2021 (Table 4). This is an overall intervention that places Italy at the highest level among the major economies of the euro area: 4.8% in terms of GDP (€91.1 billion), followed by France (3.5%, €92.1 billion), Germany (3.1%, €118.6 billion) and Spain (3.1%, €41.1 billion). Most of the resources are directed to mitigating the increases in utility bills until the first half of 2023, with a focus on disadvantaged households, and to curbing fuel prices by a 30.5 cent reduction in excise duties from mid-April 2022 until December 2022.

TABLE 4 ABOUT HERE

4. Methodology

The objective of this paper is to quantify the changes in expenditure over the period from July 2021 to March 2023, which has seen both price increases and measures to contain them, to assess their distributional impact on households. To this end we need to look at household expenditure for each of the three energy items (electricity, gas for heating and fuel for private transport) and how it has changed because of both the price increases and the mitigation measures.

4.1 The design of the simulation scenarios

We want to build the expenditure in three scenarios, the comparisons of which will allow us to perform the impact and distributional analyses. The scenarios are the following: (i) actual, (ii) baseline and (iii) theoretical.

The 'actual scenario' represents what has occurred in terms of price increases and measures introduced: it extends from July 2021 (the first month in which the first price containment measure was introduced, i.e., the reduction of general system charges on the electricity bill) to March 2023. It extends for 21 months: 6 in 2021, 12 in 2022 and 3 in 2023. The 'baseline scenario' identifies a period before the price increases and fiscal policy measures, i.e. a period of so-called 'normality'. It must be of the same

[6] In the years 2018 to 2021, the item 'heating' was encompassed in the item 'hot water and heating'. Since the item is present separately from the aggregate only in 2022 data, we took the 2022 percentage share of the item 'heating' and applied it to the years 2018-2021 to obtain to get the item. Climate zones were defined in Presidential Decree No. 412 of 26 August 1993.

duration and cover the same months as the actual scenario to take into account different consumption patterns throughout the year (e.g., seasonality). The choice should have been the period July 2019-March 2021. However, this period includes the COVID-19 crisis, during which households, subject to lockdowns and restrictions, reduced consumption and modified their consumption patterns. Therefore, we build a fictitious period of 21 months from the 2019 data (the year before the pandemic crisis): 12 months of actual 2019, a replication of the second half of 2019 (reflecting the second 6 months of 2021) and a replication of the first quarter of 2019 (reflecting the first 3 months of 2023). This results in an 'extended' 2019 period that is taken as the baseline. Finally, the 'theoretical scenario' is the one incorporating the price increases but assuming no mitigating measures; it also runs from July 2021 to March 2023.

By comparing the expenditure of the theoretical scenario with that of the baseline scenario, we obtain the distributional effect of the price increases without the mitigation policies, while by comparing the actual scenario with the baseline one, we obtain the joint distributional effect of price increases and mitigation policies. Finally, by comparing the theoretical scenario with the actual one, we can quantify the effect of the mitigation measures on household expenditure.

4.2 Expenditure

We assume that in the three scenarios quantities remain unchanged: this means that changes in expenditure between scenarios depend only on prices.

In the 'baseline scenario', household expenditure for the aggregate of the three energy goods S^E is the following:[7]

$$S^E_{base} = 12 * \sum_{j=1}^{3} \sum_{i=1}^{21} [(q_{i,j}^{base} * p_{i,j}^{base}) \, (1 + vat_{i,j}^{base})] \tag{1}$$

where $q_{i,j}^{base}$ are the quantities, $p_{i,j}^{baseline}$ the prices (normally including the cost of the raw material, system charges and excise duties) and $vat_{i,j}^{base}$ is the value added tax for each month of the baseline period *i* = 1, …, 21 and category *j* = 1, 2, 3 (electricity, gas, fuels).

Energy goods expenditure in the 'actual scenario' is:

$$S^E_{actual} = 12 * \sum_{j=1}^{3} \sum_{i=1}^{21} [(q_{i,j}^{base} * p_{i,j}^{actual})(1 + vat_{i,j}^{actual})] - (bonuses + allowances) \tag{2}$$

where *i* goes from July 2021 to March 2023 and *j* = 1, 2, 3. For bonuses and allowances, see Section 3 and Section 4.5.

[7] In equations (1) to (5) we multiply by 12 because the HBS design is such that only one twelfth of the sampled households is interviewed each month, as reported in Section 2.1.

Finally, energy goods expenditure in the 'theoretical scenario' is as follows:

$$S_{theo}^{E} = 12 * \sum_{j=1}^{3} \sum_{i=1}^{21} [(q_{i,j}^{base} * p_{i,j}^{theo})(1 + vat_{i,j}^{theo})] \quad (3)$$

where i goes from July 2021 to March 2023 and $j = 1, 2, 3$.

For the other categories of goods ($j = 4, \dots, 12$), expenditure S^A of the baseline scenario corresponds to the expenditure of the enlarged 2019 period:

$$S_{base}^{A} = 12 * \sum_{j=4}^{12} \sum_{i=1}^{21} s_{i,j}^{A\,base} \quad (4)$$

For the actual and theoretical scenarios, $S_{actual,theo}^{A}$ is obtained by inflating monthly expenditures by category of the baseline scenario, $s_{i,j}^{A\,base}$, with the consumer price indices for each month $i = 1, \dots, 21$ and category $j = 4, \dots, 12$:[8]

$$S_{actual,theo}^{A} = 12 * \sum_{j=4}^{12} \sum_{i=1}^{21} s_{i,j}^{A\,base} * [1 + \Delta(NIC_{i,j})] \quad (5)$$

where price variations, $\Delta(NIC_{i,j})$, are computed between 2021-2023 and the baseline period, both for the actual scenario and for the theoretical one. This implies that other expenditures are the same in the two scenarios).

Therefore, total expenditure in each of the three scenarios is the following:

$$S_{base,actual,theo}^{TOT} = S_{base,actual,theo}^{E} + S_{base,actual,theo}^{A}. \quad (6)$$

Impact evaluation is performed by comparing expenditure levels between scenarios. A comparison of the theoretical scenario with the baseline scenario gives the distributional effect of the price increase in the case of no policies, while a comparison of the actual scenario with the baseline scenario gives the distributional effect in the presence of mitigation policies. We will therefore look at the following differences:

$$S_{theo}^{TOT} - S_{base}^{TOT} = expenditure\ variation\ without\ policies \quad (7)$$

$$S_{actual}^{TOT} - S_{base}^{TOT} = expenditure\ variation\ with\ policies. \quad (8)$$

By comparing total expenditures, in the assessment we are also including the inflationary effects of goods other than energy. If we want to restrict the analysis to price increases of energy products only, we will have to look at the differences between energy expenditures in the three scenarios: $(S_{theo}^{E} - S_{base}^{E})$ and $(S_{actual}^{E} - S_{base}^{E})$.

To obtain the three energy expenditure aggregates in the three scenarios, it is necessary to have prices, quantities and taxes. Under the hypothesis of invariance, the quantity consumed of electricity, gas and

[8] Unlike in the case of the three energy items, it is not necessary to decompose expenditure into quantities and prices.

fuel is that of the baseline scenario ($q_{i,j}^{base}$) obtained by dividing household expenditure by the prices and taxes observed in the baseline period. Given the prices and taxes in the effective scenario, the corresponding variables in the theoretical scenario are derived using the tariff components prior to the introduction of the measures, as illustrated in the following section.

4.3 Prices

Herein, we tackle to what prices are in the three scenarios. In the baseline scenario, prices are net of increases and fiscal policy measures; in the actual scenario, prices reflect both inflationary increases and mitigation measures; in the theoretical scenario, prices are those of the actual scenario to which we add charges, excise duties, etc. (everything that has been abolished/reduced), so as to have the 'theoretical' prices, i.e. those before measures, or equivalently the 'what would have happened without measures' prices.

For fuels, we employ the monthly prices provided by the Ministry of Ecological Transition. For the theoretical scenario, the excise duty that was abolished is added back to the actual net price and the VAT is recalculated to obtain the theoretical price (Table 5). In September 2022 (actual scenario) the price paid by the consumer was 1.775 euro/litre (the net price was 0.976 euro/litre). To obtain the theoretical price, one adds the excise duties that were cut (0.250 euro/litre) to the actual net price, recalculates the VAT and thus obtains the theoretical final price that the consumer would have paid if the government had not intervened with the excise duty cut: therefore, the theoretical price stands at 2.080 euro/litre. Note that although the excise tax was cut by 25.0 cents/litre, the cost borne by the government (or equivalently the consumer's savings) increases to 30.5 cents/litre due to VAT being calculated on the sum of net price and excise duties.

TABLE 5 ABOUT HERE

For electricity, Table 6 provides an example of the prices in each of the three scenarios, using quarterly data made available by Acquirente Unico. The table refers to the electricity bill issued for the main residence with a 3-kWh meter: in the simulations we will assume that all households have these characteristics. For monthly data, quarterly values are assigned to each month of the quarter. In addition to the prices, the expenditure by levels of electricity consumed is also provided: this allows us to attribute the prices to the household expenditure on electricity in the HBS, by intervals, and thus obtain the quantities.

The general system charges of the pre-measures scenario are given in column (1) of Table 4. For the actual scenario, the system charges are zero as they were abolished (column 2) and the final price is given in column 6. In the theoretical scenario, the pre-tax price (column 7) is the sum of the pre-tax price of the actual scenario (column 3) and the pre-measures charges (column 1): after adding excise duties (column 4) to this price, 10% VAT is applied (column 8) to obtain the theoretical final price (column 9).

TABLE 6 ABOUT HERE

For gas, ARERA provides pre-tax prices by consumption classes in cubic metres. We focus on consumption classes related to domestic users, with a meter class up to G6 (the one normally used by this type of users). The price of gas consists of an energy quota, variable by consumption classes, and a fixed quota, differentiated by territorial areas. The energy quota includes the cost of natural gas, the cost of transport and meter management, and system charges. Excise duties and the regional surtax are added to the energy quota, and once the fixed quota is added, VAT is applied. Since the government's measures have affected the system charges and the VAT rate, it is necessary to reconstruct these two components in the theoretical scenario. For this purpose, it is necessary to add the system charges prior to the reduction to the price of natural gas and the transport costs in force in the period July 2021-March 2023 and to apply the VAT rates in force in the pre-measures scenario. As an example, Table 7 shows the final prices, as well as the system charges and VAT, for the various consumption classes in the three scenarios for the Emilia-Romagna region.

TABLE 7 ABOUT HERE

4.4 Quantities

As already mentioned, we assume that the quantities (kilowatt-hours for electricity, cubic metres for gas and litres for fuels) do not vary in the three scenarios. Therefore, the quantities of the actual and theoretical scenarios will be those retrieved for the baseline scenario, as shown in equations (1), (2) and (3). For fuels, quantities are obtained dividing the petrol and diesel expenditure of the baseline scenario, provided by the microeconomic data, by the monthly petrol and diesel prices from the Ministry of Ecological Transition, respectively. For electricity, we divide HBS expenditure by prices, but this is done by expenditure classes, since prices are differentiated by consumption levels. Gas prices are also differentiated by consumption bands. Therefore, to attribute a price to each household and derive the annual quantity consumed, we calculate annual expenditure classes for each consumption bracket provided by ARERA and associate them to the corresponding expenditure classes computed from the HBS.

4.5 Social bonuses and one-off allowances

To quantify bonuses and one-off allowances, we need to identify the eligible households. The dataset created within our microsimulation model provides us with all the necessary information (income, ISEE, occupational status, household composition, etc.) to assign the benefits.

As for the one-off allowances, the eligibility criterion for employees, pensioners, freelancers and self-employed workers is personal income (not above 35,000 euro for the 200-euro allowance and not above 20,000 for the 150-euro one); other eligible individuals are those in economic difficulty (see Section 4).[9] Based on these pieces of information, we identify eligible households and assign them the allowances.

As for the social bonuses, the eligibility criterion is more complicated: it depends on the household having the ISEE below a certain threshold (8,265 euro until September 2021 and 12,000 euro afterwards). The amounts paid out vary by household type and were modified by the new legislation as of October 2021, as discussed in Section 4 and shown in Table 6 and Table 7. Since social bonuses existed even before the implementation of the new fiscal package, we compute them both in the baseline scenario and in the actual one.

Amounts of both the electricity and the gas bonuses depend on household size. However, for gas, they also vary according to climate zones, which do not correspond to the Italian regions, as depicted in Figure 5. However, the HBS-SILC matched dataset provides us with the region of residence but not with the climate zone. To obtain an approximation of the percentages of climate zones by region, we first assign each province the climate zone in which most of the population resides, and then aggregate the population of the provinces by climate zone to get the percentage share attributable to each climate zone by region. These percentages constitute the weights to calculate the weighted average of the bonus per household according to the region of residence.

FIGURE 5 ABOUT HERE

For social bonuses, the principle of uniqueness applies, i.e., they can only be paid out for one of the bills among water, electricity or gas. In our simulations, we omit the simulation of the bonus on the water bill, as it is not the subject of this work. Instead, we proceed to the simulation of the economic hardship bonuses on the electricity and gas bills: once we identify the households entitled to receive them in the baseline scenario, we calculate their amounts and allocate the larger one to the households.

Once calculated, bonuses and allowances are subtracted from the actual energy expenditure in equation (2) as specified in equation (9). Bonuses are also subtracted from the baseline expenditure, since they were paid off, despite with lower amounts, also before the energy-related fiscal stimulus.

[9] One of the categories of households entitled to the allowances is that of citizenship income recipients. IT-SILC does not provide this piece of information, which is therefore simulated in our microsimulation model (see Baldini et al., 2018, for more details).

5. The empirical results

This section presents the results of the microsimulations carried out to assess the distributional impacts of the price increases experienced from July 2021 until March 2023 (actual/theoretical scenario) compared to the “enlarged” 2019 period of equal length (21 months) (baseline scenario). Moreover, recall that we are working under the assumption of invariance of the quantities consumed, that is, we assume that consumers do not change their behaviour. This seems to be an acceptable hypothesis in a short-term analysis.

5.1 Distributive analysis

In our simulations we estimate an overall cost of the measures of around 33 billion euros over the time horizon July 2021-March 2023, broken down by type of intervention as follows: 36.7% for the reduction of electricity and gas bill charges, 36.3% for one-off allowances,14.3% for the reduction of fuel excise duties and 12.7% for economic hardship bonuses (Figure 6a).

At the territorial level, the North-West and the South are the two areas receiving the largest benefits, 26.9% and 23% respectively (Figure 6b). However, they differ in the relative weight of the interventions: the effects of the reduction in charges on electricity and gas bills and the reduction in excise duties are more pronounced in the North-West (11.5% and 4.3% respectively, compared to 6.5% and 2.5% in the South), while the relative contributions of allowances and social bonuses in the South are higher (9.3% and 4.6% respectively, against 8.9% and 2.2% in the North-West). The North-East and Centre receive 18.4% and 20.3% of the resources, respectively, while the Islands 11.3%.

FIGURE 6 ABOUT HERE

In terms of changes in expenditure, Figure 7 shows the percentage change in total actual expenditure (expenditure on energy products and expenditure on other goods and services) compared with the pre-measures scenario by deciles of equivalised expenditure (orange dots).[10] The price increases together with the support measures resulted in an average percentage increase in spending of 6.4%. However, the increases show differences along the expenditure distribution, ranging from 0.8% in the first decile to 7.4% in the last. If there had been no measures, spending would have increased by 11.3% on average, with decreasing values along the income distribution: from 14.5% in the first decile to 9% in the last.

FIGURE 7 ABOUT HERE

FIGURE 8 ABOUT HERE

The contribution of energy expenditure to overall expenditure variation averaged 1.2%, which would have been 6.2% without the measures (Figure 8). Note the negative value of actual expenditure in the

[10] For the definition of equivalised expenditure, see footnote 1.

first decile: the measures more than offset the higher outlays. The measures contributed strongly to containing price increases and show a progressive nature: higher in percentage terms for the lower part of the distribution, smaller for the upper part (negative bars in Figure 7 and Figure 8).[11] In particular, the large contribution of allowances and social bonuses can be observed in the lower deciles.

Without the containment measures, the overall percentage variation of energy expenditure would have been 52.6%, ranging from 60.8% in the first decile to 46.6% in the last (Figure 9). The support measures succeeded in reducing the actual expenditure variation to 4% on average. However actual energy expenditure (post-measures) increased by 24.1% in the upper decile, while was more than compensated in the first decile (-54.8%).

FIGURE 9 ABOUT HERE

In absolute terms, the expenditure savings from the implementation of the measures are shown in Figure 10. Overall, the average saving was 750 euros, ranging from about 360 euros in the first expenditure decile to about 1260 euros in the last decile (Figure 10a). Savings by territory are greater for the North-West, North-East and Centre (on average about 800 euros), compared to the South and Islands with about 630 euros (Figure 10b). Employees and the self-employed achieve the largest savings (between about 810 and 830 euros) compared to the unemployed and retirees (Figure 10c), as do larger families (570 euros for single-member households and 1030 euros for households with more than 4 components) (Figure 10d).

FIGURE 10 ABOUT HERE

Let us now turn to an assessment of the overall inflationary shock (energy expenditure plus other expenditure) as a percentage of household income. The price increase that occurred in the 2021-2023 period, especially energy and food prices, would have caused, in the absence of measures, an average increase in expenditure as a share of income of 8.2% compared to the pre-measures scenario (Figure 11a). However, due to the different composition of the household basket and their different propensity to consume according to their socio-economic characteristics, this percentage incidence varies widely. In fact, for the first income decile the incidence of expenditure change on household income would have been 20.1% which gradually decreases moving along the income distribution to reach 5.5% in the last decile (blue ‘theoretical’ histogram in Figure 11a). Thanks to the measures to curb energy prices and bonuses and allowances, the actual expenditure increases relative to income were smaller than the theoretical ones: on average 5.5%, with values ranging from 6.7% in the first decile to 4.5% in the last decile (orange ‘actual’ histogram). This means that measures helped contain spending, relative to

[11] The negative bars in Figure 7 and Figure 8 are equivalent as they represent the measures for mitigating energy prices.

income, by 13.5% in the first decile to decrease to 1% in the last decile (grey 'measures' histogram), showing a strong progressive pattern.

Assessments by geographical area indicate that measures to contain spending increases were more effective, relative to income, in the South and Islands than in the rest of the country (grey histogram in Figure 11b). Looking at the occupational condition of the household head, households with an unemployed breadwinner benefited to a relatively greater extent (Figure 11c), as did single-person and larger households (Figure 11d).

FIGURE 11 ABOUT HERE

To understand by how much individual measures contributed to reducing spending increases, we refer to Figure 12. The analysis by income deciles shows that all measures have a strong progressive effect: more pronounced at the bottom of the distribution, more tenuous moving towards the top (Figure 12a). Very significant in the first decile are the contributions of allowances (5.5%) and social bonuses (4.2%). By geographical area, there is a relative stability in the contribution of reduced bill charges and reduced excise taxes on fuels, but a greater weight of allowances (1.4% and 1.5% in the South and Islands, respectively) and bonuses (0.7% and 0.8% in the South and Islands, respectively) (Figure 12b). Households headed by an unemployed breadwinner benefitted more from allowances (2%) and bonuses (1.2%) (Figure 12c). Based on family composition, we observe a greater contribution of allowances in favour of larger families (Figure 12d).

FIGURE 12 ABOUT HERE

5.2 Impact on inequality and at-risk-of-poverty

Now we look at the Gini index and the AROP rate to check whether the evidence of progressivity emerged from the previous analysis is also reflected in overall inequality and in the risk of poverty.[12] The variable of interest is household income from which we subtract expenditure and add bonuses and allowances; the resulting amount is equivalised by using the OECD-modified equivalence scale. Expenditure varies by scenario, according to price changes and fiscal policies. Expenditure in the baseline scenario is that without any price modification and any bonus or allowance, while expenditure in the theoretical scenario incorporates price changes. What discriminates between consumption in the actual scenario from the theoretical one is the implementation of excise duty cuts, general system charges cancellation and VAT reduction, as well as the provision of bonuses and allowances.

Since the Gini index and the AROP are annual concepts, we have to work on annual data. In a first exercise, we compute the Gini index and the AROP rate on 36-month time intervals, from January 2021

[12] The Gini index measures the extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution. A Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality.

to December 2023 in the actual and theoretical scenarios and on the 36 months of the 2019 enlarged baseline scenario. However, the years 2021 and 2023 are not complete, since they cover only the second half of 2021 and the first quarter of 2023, respectively. This makes it likely that the effects of the measures in these two uncomplete years, and therefore the overall effects of the entire scenario, are underestimated. For this reason, we perform a second exercise in which we look at 2022, the only year in which households benefitted from the measures for twelve months.

In the first exercise, there is evidence that the price mitigation policies succeeded in keeping the Gini index stable: it is equal to 31.4 in the baseline scenario and is estimated at 31.5 in the actual scenario; without the measures it would have risen to 32.2 (Table 8).

TABLE 8 ABOUT HERE

The Gini index is diversified by geographical area, ranging from 29.4 in the North-East to 33.2 in the Islands in the baseline scenario (Figure 13a). In all areas, the price increases without the mitigation policies would have made the index rise by 0.7 percentage points in the North and in the South, by 0.8pp in the Islands and by 0.9pp in the Centre. In the actual scenario, changes are very mild, with a 0.2pp increase in the North-West and a 0.2pp decrease in the South. As for the occupational status of the household head, gaps between statuses are very pronounced (Figure 13b). In the baseline scenario, the Gini index for households with an employed head is 30.6, while the index for those with an unemployed head is as high as 41.7. In the theoretical scenario, for all statuses, we estimate increases between 0.6pp for the employed to 1pp for the category "other inactive". In the actual scenario we simulate an increase of 1.6pp for the unemployed and of 0.8pp for households with another inactive household head. This result, especially for the unemployed, may seem surprising, but it can be explained by the fact that the economic status is a self-assessed condition and that it refers to the year of the interview contrary to income that refers to the previous year. To bypass these issues, we identify the unemployed by looking at whether they receive unemployment benefits: by applying this criterion, the Gini index of this category decreases by 0.3pp between the baseline scenario and the actual one (from 30.6 to 30.3), while it rises by 0.8pp (31.4) in the theoretical one.

FIGURE 13 ABOUT HERE

The effectiveness of the policies is also reflected in the at-risk-of-poverty (AROP) rate.[13] We estimate a reduction between the baseline scenario and the actual one of 0.8pp, from 19.5% to 18.7%, while in the theoretical scenario it is estimated to increase to 20.2% (Table 8). At the territorial level, we observe very wide differentials, ranging from 10.2% in the North-East to 37.8% in the Islands, in the baseline scenario (Figure 14a). Households of the South and Islands are those who benefitted the most, with a reduction from 31.3% to 29.6% and from 37.8% to 35.7%, respectively. In the absence of the mitigation

[13] The AROP is the percentage of persons living in households where the equivalised total disposable household income is below the 60% of median equivalised disposable income of all households.

measures the figures would have been 32.4% and 37.5%, respectively. At the occupational level, households with an employed household-head are those benefitting the most from the measures with a reduction in the AROP of 0.9pp, from 16.5% to 15.6% (Figure 14b). The unemployed do not see any improvement in the AROP between the actual and baseline scenario; however, they are those who would have suffered the most without the measures (+2.5pp increase between the theoretical and the baseline scenario). However, with the new definition of the unemployed we simulate a drop of 1pp between the baseline scenario and the actual one (from 21.2% to 20.2%) and an increase of 0.8pp between the baseline and the theoretical (from 21.2% to 22%).

FIGURE 14 ABOUT HERE

In the second exercise, when looking at 2022 only, we observe a reduction of the Gini index from 31.5 in the baseline scenario to 31 in the actual, and a reduction of the AROP rate from 19.5% in the baseline to 18% in the actual, corresponding to a reduction of 0.5pp in the Gini index and of 1.5pp in the AROP (Table 8). Our intuition of a possible underestimation of both indicators in the case of the 36-month case is confirmed. These patterns are also reflected in the values of the Gini index and the AROP rates by geographical area and self-assessed occupational status of the household head (Figure 15 and Figure 16, respectively).

FIGURE 15 ABOUT HERE

FIGURE 16 ABOUT HERE

Again, we note the anomaly in the increase in the Gini index for households with an unemployed head between the baseline and the actual scenario: if we look at those who receive unemployment benefits instead of those who declare themselves unemployed, we observe a reduction in inequality of 0.9pp (from 30.6 to 29.5). As for the AROP, the reduction is more marked than in the three-year scenario: -3.2pp, from 21.2% to 18%.

5.3 Impact on energy poverty

To evaluate changes in energy poverty in the actual and theoretical scenarios compared to the baseline one, we employ the definition of energy poverty proposed by Faiella and Lavecchia (2015 and 2021), which has been included in the SEN since 2017 and in the PNIEC thereafter. The indicator follows the approach proposed by Hills (2011 and 2012) consisting of a Low-Income High-Costs (LIHC) type of measure, but it innovates by including less affluent households with zero heating expenses. The indicator identifies households for which two conditions occur simultaneously: an incidence of energy expenditure more than twice the national mean value and a difference between total expenditure and energy expenditure below the Istat relative poverty threshold; households with zero heating expenditure and with equivalised expenditure below the national median value are also included. Formally, energy poverty η_3 is defined as (Faiella and Lavecchia, 2015 and 2021):

$$\eta_3 = \frac{1}{n}\sum_{i=1}^{n} w_i \left\{ I\left[\frac{s_{i,e}^{eq}}{S_i^{eq}} > 2 * \left(\frac{\sum_{1=1}^{n} s_{i,e}^{eq}}{\sum_{i=1}^{n} S_i^{eq}}\right)\right] * I\left[\left(s_i - s_{i,e}\right) < s_j^*\right] \cup \left[I(s_i^r = 0) * I\left(S_i^{eq} < P50\left(S_i^{eq}\right)\right)\right]\right\} \quad (9)$$

where w_i are household-level sample weights, I is the indicator function taking value 1 when the condition holds, $s_{i,e}^{eq}$ is energy equivalised expenditure of household i, S_i^{eq} is total equivalised expenditure of the i-th household, the ratio $\frac{\sum_{1=1}^{n} s_{i,e}^{eq}}{\sum_{i=1}^{n} S_i^{eq}}$ is the share of equivalised energy expenditure out of total equivalised expenditure, the difference $\left(s_i - s_{i,e}\right)$ is expenditure after energy costs for each household, s_j^* are the official relative poverty thresholds by number of household components *j* (*j* = 1, …, 7+), s_i^r is heating expenditure of the i-th household and finally $P50\left(S_i^{eq}\right)$ is the median value of total equivalised expenditure.

The trend of energy poverty in Italy is shown in Figure 17: the indicator is relatively stable over time, fluctuating around an average of 8% over the entire period 1997-2021.

FIGURE 17 ABOUT HERE

For energy poverty we look only at one-year scenarios: 2019 for our baseline scenario and 2022 for the actual and the theoretical ones. Therefore, the starting point for the analysis is the official figure for energy poverty in Italy in 2019 (8.5%). Then, we simulate energy and overall expenditure in the alternative scenarios: actual (which incorporates price increases and implemented mitigation measures) and theoretical (which excludes tariff reductions and transfers to households). This makes it possible to determine the incidence of energy expenditure on total expenditure and whether the household has an expenditure, net of the energy component, below the relative poverty threshold in the two scenarios, for each household. Given these quantities, it is possible to calculate the energy poverty index in the actual and theoretical scenarios.

Our simulations show that energy poverty in the actual scenario would be 6.5%, thus indicating that the measures to curb energy expenditure have been effective; without them, in the theoretical scenario energy poverty is simulated at 9.1%. The simulated values of energy poverty in 2022 are in line with expectations, predicting a decrease in energy poverty in the actual scenario compared to the baseline scenario (-2pp), mainly due to social bonuses and allowances, and an increase in the theoretical one (+0.6pp) reflecting high energy inflation.

FIGURE 18 ABOUT HERE

Figure 18a shows that energy poverty varies by geographical area: it is higher in the South and the Islands (8.8% and 13.2%, respectively, in the actual scenario) than in the other geographical areas. It also shows that the government measures have helped to reduce it compared to the theoretical scenario (12% and 18.3%, respectively for the South and the Islands). Looking at the occupational status of the household head, Figure 18b tells us that energy poverty is particularly high in the actual scenario for households with an unemployed head (13.7%) and for households with inactive heads other than pensioners (12.5%). The reduction in energy poverty compared to the theoretical scenario is again significant (-5.8pp and -4.9pp, respectively), due to direct transfers to these more vulnerable groups. In summary, the strong inflationary shock caused by increased energy prices is estimated to have led to a significant increase in energy poverty in Italy, which was, however, more than compensated for by tax policies in favour of the most disadvantaged groups.

6. Conclusions

Since the second half of 2021, there has been a sharp increase in the prices of energy products (electricity, gas and fuel) and food, leading to inflation rates never experienced in the last forty years. Such high inflation rates prompted the government to take measures to curb the prices of energy products, to increase social bonuses on electricity and gas bills, and to provide one-off allowances to households. Specifically, the government has earmarked almost 91.2 billion of euros for the period July 2021-March 2023 to support households and businesses and protect them from energy inflation.

The crucial question is what impact the price increase had on households and whether the measures taken protected the household sector from these increases. The different composition of expenditure and the higher propensity to consume of the less well-off groups of the population make it likely that the impact of the inflation shock is higher for lower income households. At the same time, some of the measures, especially the social bonuses that are paid out based on ISEE and the one-off allowance that are in a fixed sum and therefore progressive, have probably contributed to reducing regressivity, favouring less well-off households and counterbalancing, at least in part, the increase in prices. This means that, given the characteristics of the price increases and the design of the measures to mitigate their effects, the impacts on households are differentiated.

To test these insights, we implemented a module in our microsimulation model that simulates both the price increases and the measures to contain them. First, we estimated, over the time horizon July 2021-March 2023, a total cost of the measures of 35.2 billion of euros directed to households. Of this, the largest share is attributable to the reduction of general system charges on electricity and gas bills and the reduction of the VAT rate on gas. At territorial level, the North-West and the South are the two areas receiving the greatest benefits. However, they differ in the relative weight of the interventions: the contributions of the reduction of charges on electricity and gas bills and the VAT rate on gas and the reduction of excise duties are more relevant for the North-West, while the contributions of social allowances and bonuses are more relevant for the South.

The overall increase in prices (energy and non-energy products) in combination with the support measures resulted in an average percentage increase in expenditure of 6.4%, which would have risen to

11.3% without the measures. The contribution of energy expenditure to the actual percentage change of overall expenditure was 1.2% on average, but without the measures it would have been 6.2%. The measures contributed strongly to containing price increases and show a progressive character: higher in percentage terms for the lower end of the distribution, lower for the upper end. We observe the strong contribution of social allowances and bonuses in the first deciles.

As a ratio to household income, the general price increase brought about by the measures caused an average increase in expenditure of 5.5%. Due to the different composition of the household basket and different levels in the propensity to consume, this percentage incidence varies along the income distribution, from 6.7% in the first decile to 4.5% in the last one. In the absence of the measures, the average increase in expenditure relative to income would have been 8.2%.

Finally, the evidence of progressivity is also reflected in the stability of the Gini index in the baseline and actual scenarios; without the measures the index would have risen by 0.8 percentage points. If we look at 2022 alone, the only year in which households benefitted from the measures for 12 full months, we estimate a reduction in inequality of 0.5pp. The at-risk-of-poverty rate reflects the effectiveness of the policies, with an estimated reduction of 0.8pp (1.5pp in 2022 alone). Moreover, the measures to curb energy inflation look to have been effective also in reducing energy poverty by almost 2pp in 2022.

These results indicate that the regressive impact of price increases was mitigated by the price containment measures due to their progressive nature and that, specifically, the contributions of one-off allowances and social bonuses were very relevant.

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Appendix A

A.1 The matching procedure

IT-SILC contains detailed information on income sources, but it lacks information on expenditure; HBS, instead, provides a detailed breakdown of expenditure items. Ideally, we would like to match the two datasets to have a complete sample with income and categories of expenditure. However, the HBS does not report any information on income. Therefore, we employ a third data source, the Bank of Italy Survey on Household Income and Wealth (SHIW), as a bridge between IT-SILC and HBS, since it provides both income and consumption (although with a low disaggregation level) for each household (EC, 2013). The matching procedure consists of two steps. In the first step, we estimate an income-consumption equation in SHIW and we use the estimated coefficients to impute total consumption to IT-SILC households. In the second step, households are classified by decile of total consumption in both samples, 'observed consumption' in HBS and 'imputed consumption' in IT-SILC, so that households of each decile in IT-SILC can be matched with the households that belong to the corresponding decile in HBS. For each decile, data fusion is performed via propensity-score matching, producing a dataset in which the HBS expenditure items are attributed to each IT-SILC household.

A.2 Wealth and ISEE

The means testing criterion ISEE takes account of both household income and financial and real wealth. Since IT-SILC is not very informative on the amounts of assets, especially real ones, we perform some data manipulation. IT-SILC reports the value of imputed rents and rental income, from which we can obtain the value of the property owned by the household, both the main residence and second homes. The value of the main residence is calculated by multiplying imputed rents by the ratio between the average value of first homes and the average value of imputed rents obtained from SHIW. The value of second homes is given by the sum of all rental incomes multiplied by the same ratio. The next step consists of retrieving cadastral values. To this end, property values (first and second homes) are divided by the ratio between the average value of the main residence (from SHIW, as above) and the average cadastral value. The latter is obtained as the ratio between the aggregate cadastral value and the overall number of dwellings provided by the Italian Revenue Agency. Concerning financial wealth, IT-SILC provides the stock of savings owned by each household member. We therefore collapse the individual amounts at household level and then multiply these values by the 10-year Treasury bonds yield.

TABLES

Table 1 - Support measures for households

Type of energy	Type of measure	From	To
Electricity	Reduction of general system charges	Jul-21	Sep-21
	Deletion of general system charges	Oct-21	Mar-23
Gas	Reduction of general system charges	Oct-21	Mar-23
	Reduction of VAT rate to 5%	Oct-21	Mar-23
Fuels	Reduction of excise duties	Mar-22	Dec-22
Bonuses and allowances			
Social bonuses	Increase in amounts	Oct-21	Mar-23
	Increase of ISEE threshold	Apr-22	Mar-23
One-off allowances		Jul-22 (200€)	-
		Nov-22 (150€)	-

Table 2 - Electricity: social bonus amounts for households in economic hardship *(euro/year)*

	2018	2019	2020	2021	2022	2023 *
1-2 components	132	132	125	174	713	183
3-4 components	161	161	148	206	864	237
more than 4 components	194	194	173	241	1015	266

** First quarter*
Source: ARERA

Table 3 - Heating gas: social bonus amounts for households in economic hardship *(euro/year)*

	2018					2019					2020				
	climate zone					climate zone					climate zone				
	A/B	C	D	E	F	A/B	C	D	E	F	A/B	C	D	E	F
Up to 4 components	45	67	98	130	169	51	78	113	150	194	43	65	95	127	164
More than 4 components	54	90	134	177	237	62	103	154	204	273	52	87	129	171	229

	2021					2022					2023 (first quarter)				
	climate zone					climate zone					climate zone				
	A/B	C	D	E	F	A/B	C	D	E	F	A/B	C	D	E	F
Up to 4 components	57	94	141	198	251	312	573	940	1430	1923	171	180	234	279	337
More than 4 components	68	124	183	266	340	421	790	1317	1994	2676	148	166	218	276	335

Source: Authors' elaborations on ARERA data

Table 4 - Measures against high energy costs for households and businesses
(billions of euro)

	2021	2022	2023
Reduction of energy bills - electricity and gas system charges and gas VAT	5.0	14.7	5.6
Reduction of energy bills - social bonuses for electricity and gas	0.5	3.2	2.5
Tax credits for businesses		21.3	10
Reduction of excise duties on fuels		9.1	
One-off allowances - workers, pensioners and recipients of other benefits		10	
Other measures (transport bonus, exemption from contributions, pension indexation down payment)		7.9	1.3
Total	**5.5**	**66.2**	**19.4**

Source: Parliamentary documents.

Table 5 - An example of fuel prices
(euro/litre)

	net price	excise duties	VAT	final price
Pre-measure		0.728		
Actual price (September 2022)	0.976	0.478	0.320	1.775
Theoretical price (*)	0.976	0.728	0.375	2.080

Source: Ministry of the Ecological Transition and own elaborations
(*) Own elaboration

Table 6 - An example of electricity prices
(euro cents/kWh)

quantity consumed (kWh/year)	Pre-measure system charges (1)	Actual scenario (September 2022) system charges (2)	pre-tax price (3)	excise duties (4)	VAT (5)	final price (6)	Theoretical scenario pre-tax price (7) = (1) + (3)	VAT (8) = 0.10*[(4)+(7)]	final price (9) = (4) + (7) + (8)
300	4.18	0.0	74.87	0	7.49	82.36	79.05	7.91	86.96
…									
1200	4.18	0.0	41.92	0	4.19	46.11	46.10	4.61	50.71
…									
2700	4.18	0.0	35.82	0.81	3.66	40.29	40.00	4.08	44.89
…									
5400	4.18	0.0	33.37	2.27	3.56	39.21	37.55	3.98	43.80
…									
7500	4.18	0.0	32.69	2.27	3.50	38.46	36.87	3.91	43.05

Source: Authors'elaborations on Acquirente Unico data
Note: main residence with 3kW metre

Table 7 - An example of gas prices (case of the Emilia-Romagna region)
(*euro/scm and euro/year*)

	Pre-measures			Actual scenario (September 2022)			Theoretical scenario		
	System charges	VAT	Final price	System charges	VAT	Total	System charges	VAT	Final price
Energy quota (euro/smc)									
Consumption (smc/year): from 0 to 120	0.03	0.04	0.50	-0.34	0.04	0.96	0.03	0.12	1.42
from 121 to 480	0.07	0.05	0.76	-0.30	0.05	1.23	0.07	0.14	1.69
from 481 to 1560	0.06	0.11	0.78	-0.32	0.05	1.20	0.06	0.29	1.82
from 1561 to 5000	0.05	0.10	0.79	-0.32	0.05	1.21	0.05	0.29	1.83
from 5001 to 80000	0.04	0.10	0.77	0.02	0.06	1.55	0.04	0.29	1.80
from 80001 to 200000	0.04	0.09	0.73	0.01	0.06	1.51	0.04	0.28	1.76
Fixed part (euro/year)	-26.13	20.92	116.00	-26.13	5.38	112.94	-26.13	23.66	131.22

Source: Authors' elaborations on ARERA data
Note: main residence with metre up to class G6.

Table 8 – At-risk-of-poverty rate and Gini index
(*percentage values)*

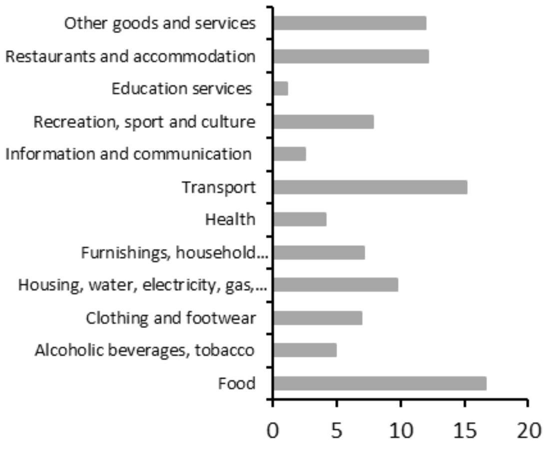
	Baseline	Actual	Theoretical
Three-year scenario			
AROP rate	19.5	18.7	20.2
Gini index	31.4	31.5	32.2
One-year scenario			
AROP rate	19.5	17.4	21.3
Gini index	31.4	31.0	33.0

Source: Authors' calculations

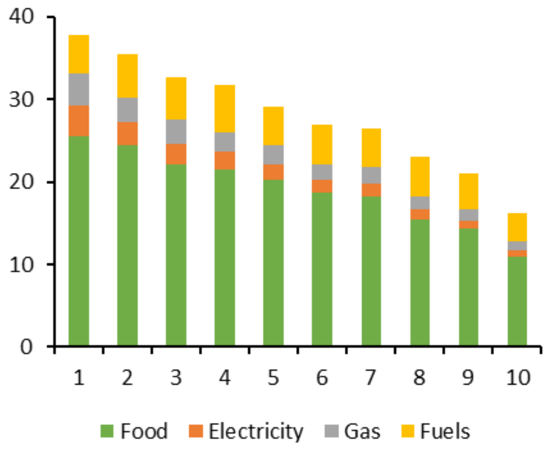
FIGURES

Figure 1 - Household expenditure composition
(percentage values)

(a) By item



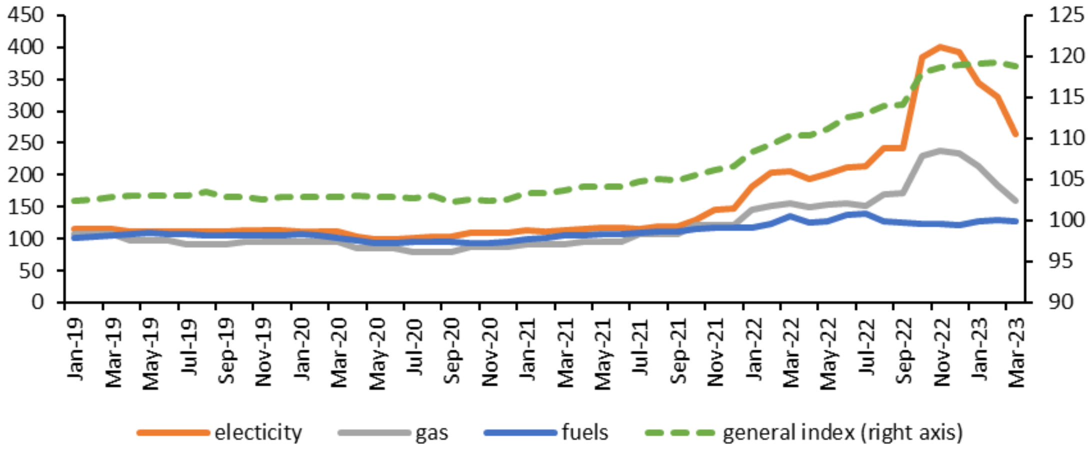
(b) By decile of equivalised expenditure



Source: Authors' elaborations on Istat data

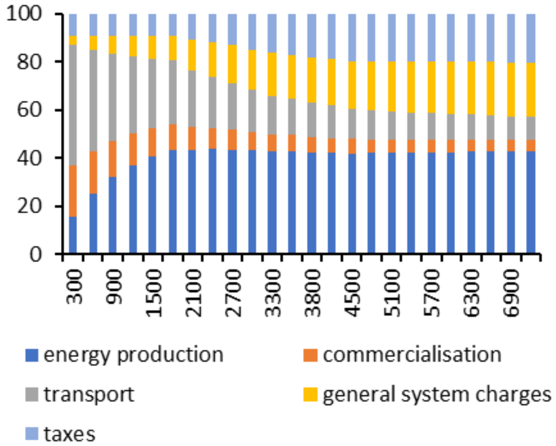
Source: Authors' elaborations on Istat data

Figure 2 - Monthly consumer price indices
(base 2015 = 100)



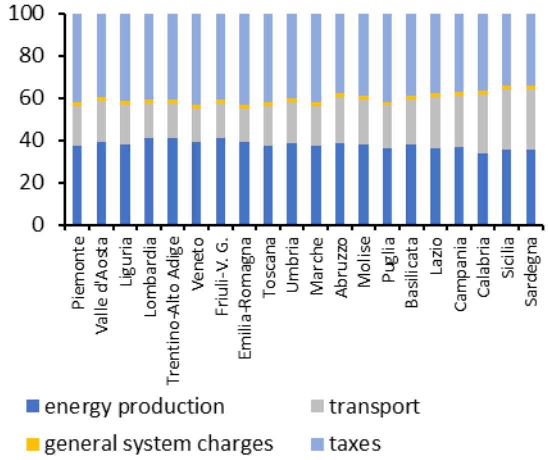
Source: Istat

Figure 3 - Composition of final electricity price
(percentage values)



Source: Authors' elaborations on Acquirente Unico data

Figure 4 - Composition of final gas price
(percentage values)



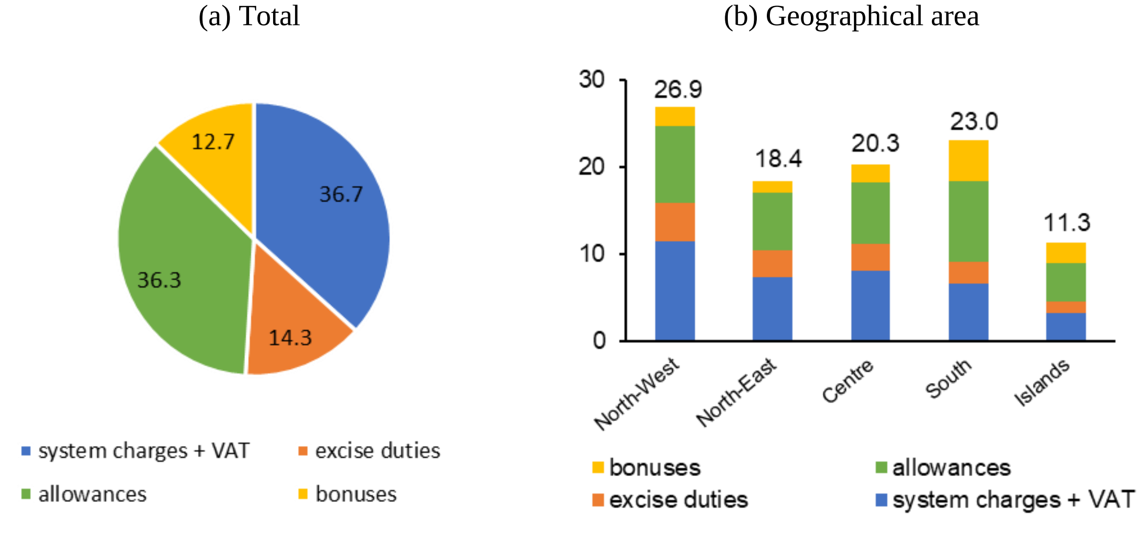
Source: Authors' elaborations on ARERA data

Figure 5 - Italy's climate zones

KEY *HDD = heating degree days*

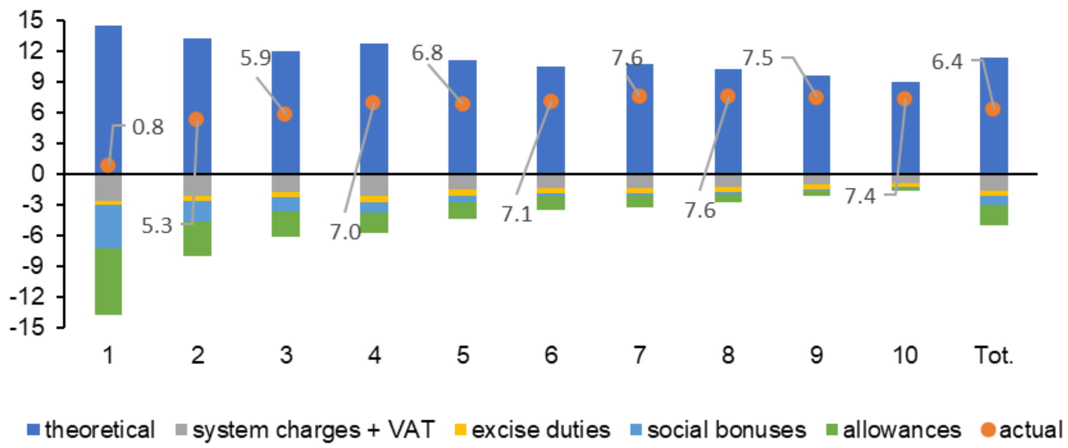
Zone A HDD <600
Zone B *601*< HDD <900
Zone C *901*< HDD <1400
Zone D *1401*< HDD <2100
Zone E *2101*< HDD <3000
Zone F HDD >3001

Figure 6 - Composition of the fiscal package by type of intervention
(percentage values)



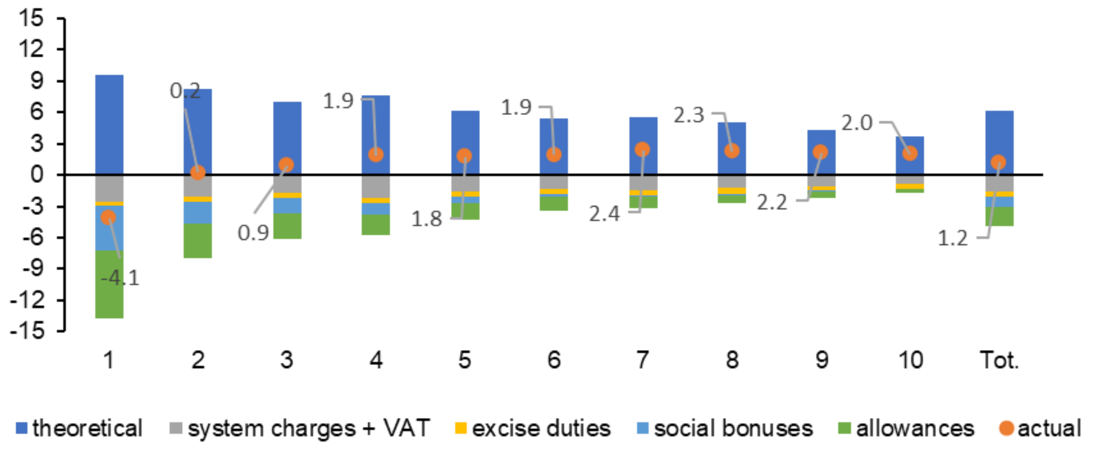
Source: Authors' elaborations

Figure 7 - Total expenditure variations by decile of equivalised expenditure
(percentage values)



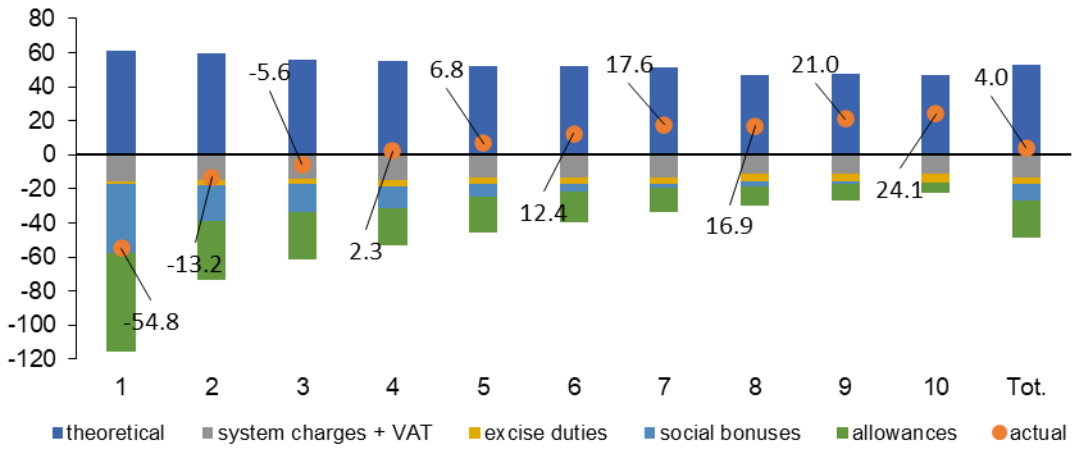
Source: Authors' elaborations
Note: percentage expenditure variations are computed between the periods 2021-2023 and the baseline period. Blue bars (labelled "theoretical") represent by how much total expenditure would have changed without government intervention; orange dots (labelled "actual") represent by how much total actual expenditure has changed.

Figure 8 - Contribution of energy expenditure variations to total expenditure
(percentage values)



Source: Authors' elaborations
Note: percentage expenditure variations are computed between the periods 2021-2023 and the baseline period. Blue bars (labelled "theoretical") represent by how much total expenditure would have changed without government intervention; orange dots (labelled "actual") represent by how much total actual expenditure has changed.

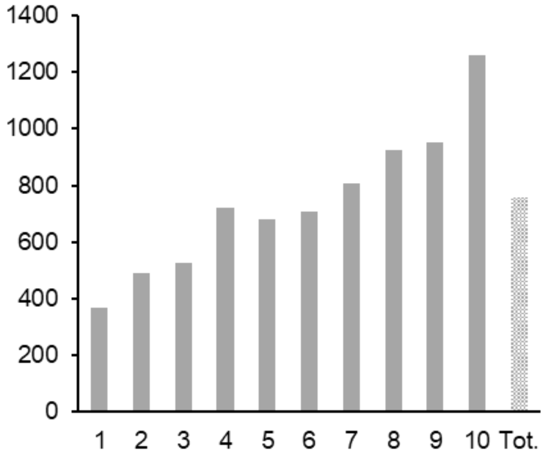
Figure 9 - Energy expenditure variations by decile of equivalised expenditure
(percentage values)



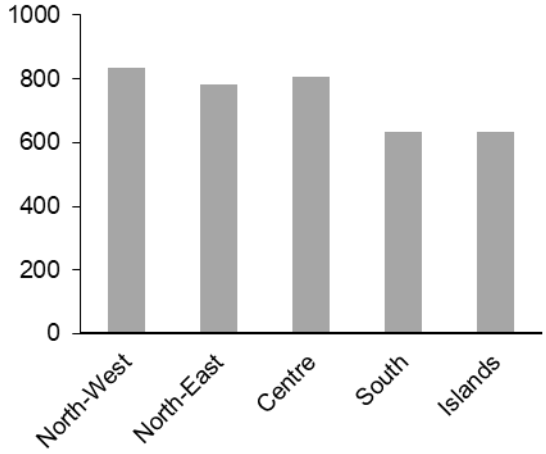
Source: Authors' elaborations
Note: percentage expenditure variations are computed between the periods 2021-2023 and the baseline period. Blue bars (labelled "theoretical") represent by how much energy expenditure would have changed without government intervention; orange dots (labelled "actual") represent by how much actual energy expenditure has changed.

Figure 10 - Expenditure savings from the implementation of the measures
(euro)

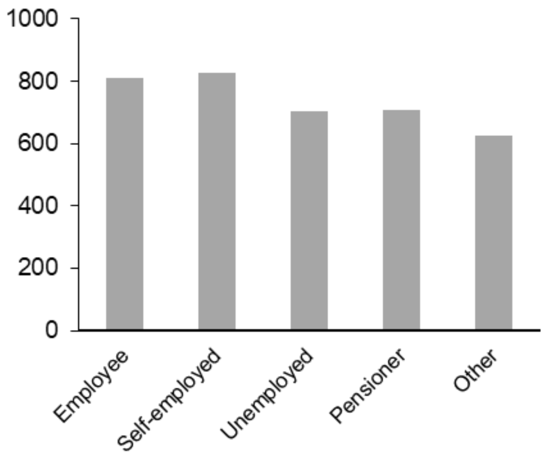
(a) Deciles of equivalised income



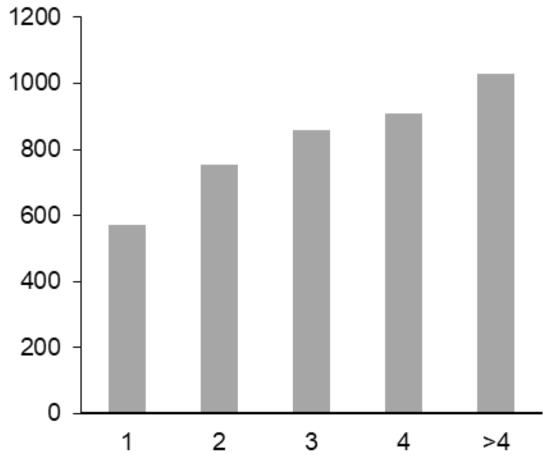
(b) Geographical area



(c) Self-assessed household-head occupational status

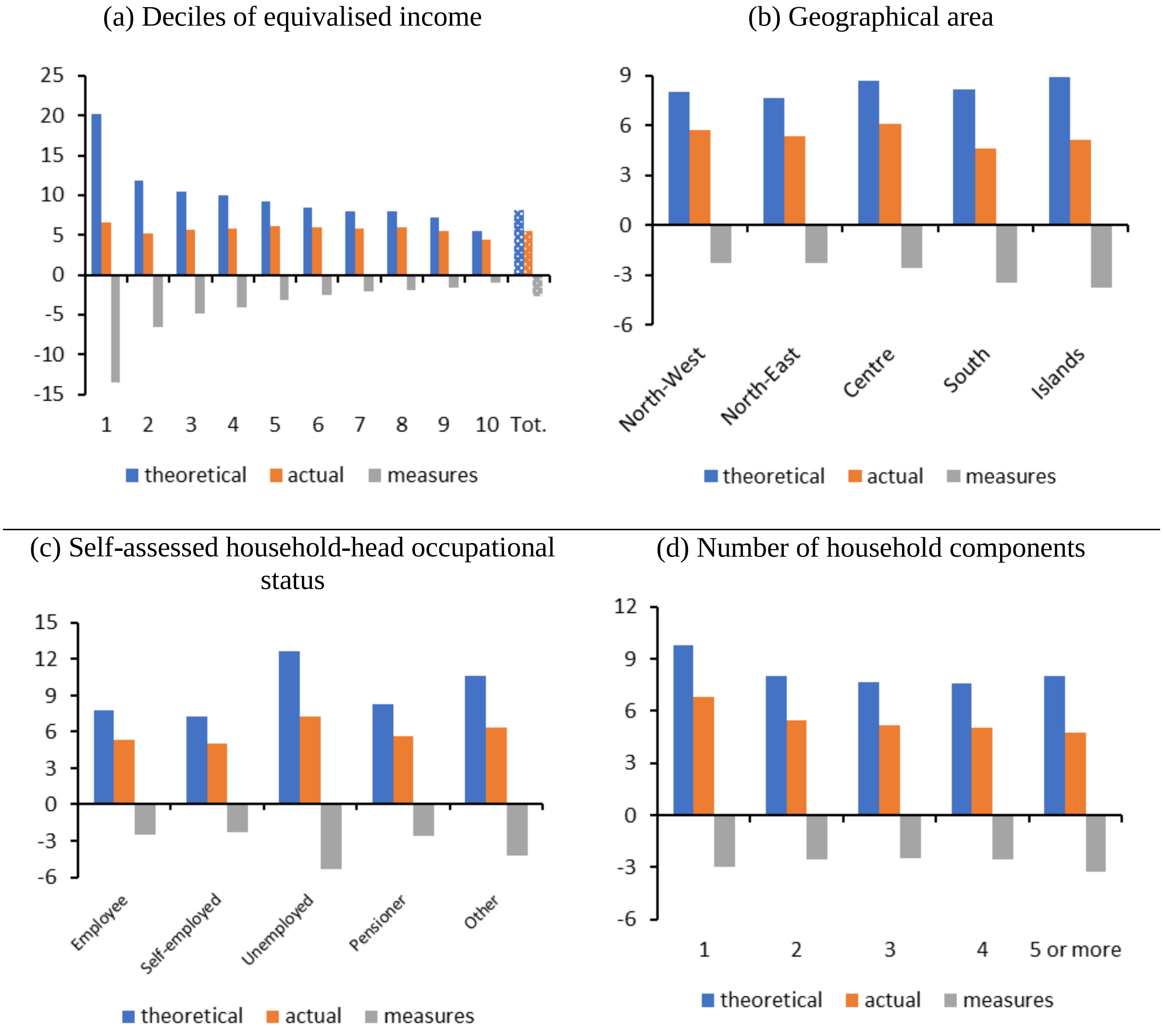


(d) Number of household components



Source: Authors' elaborations

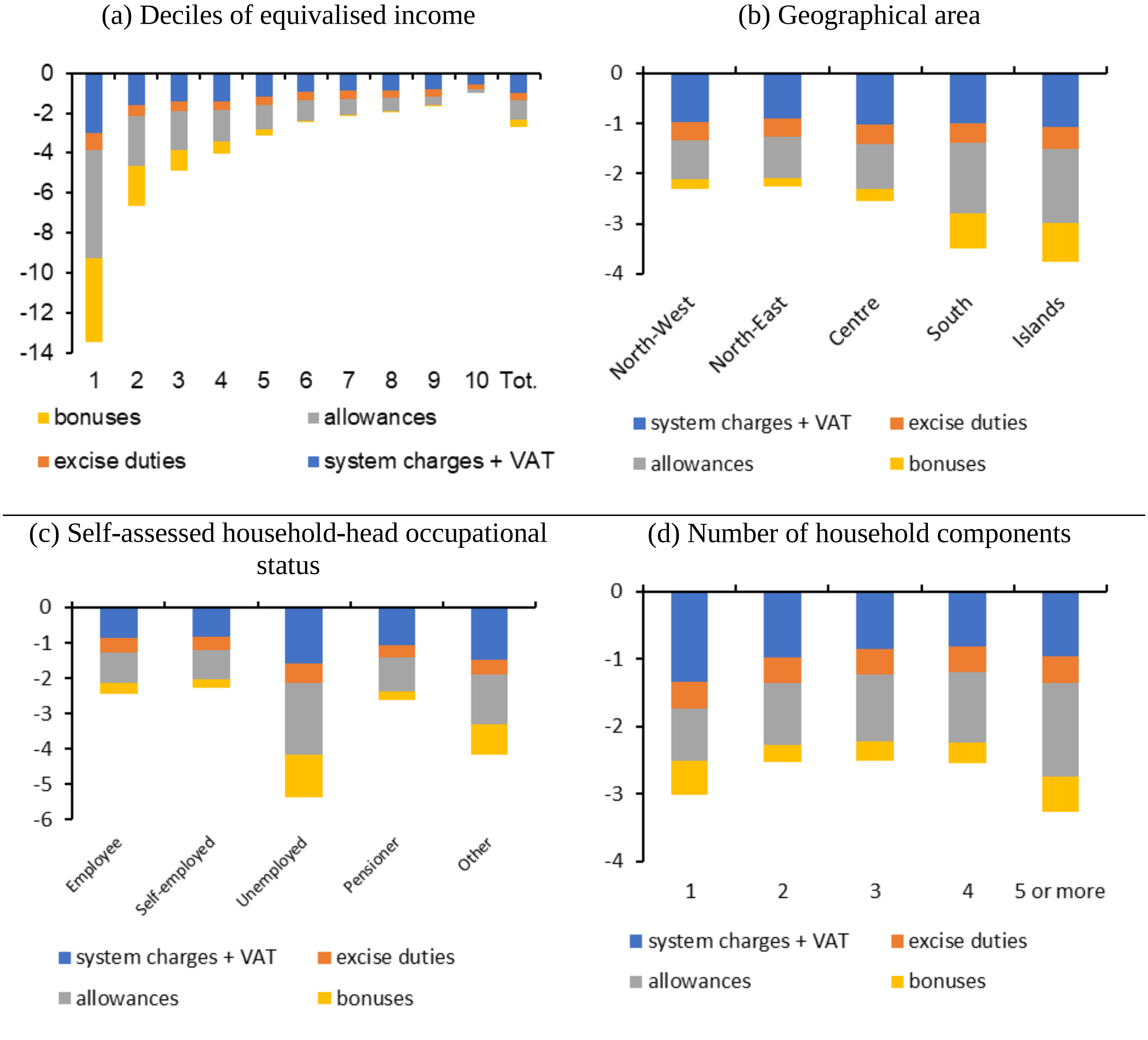
Figure 11 - Incidence on income of the inflationary shock and of the measures
(percentage values)



Source: Authors' elaborations

Note: expenditure variations are computed between the periods 2021-2023 and the baseline period. Blue bars (labelled "theoretical") represent by how much total expenditure as a ratio to household income would have changed without government intervention; orange bars (labelled "actual") represent by how much total actual expenditure as a ratio to household income has changed; grey bars (labelled "measures") quantify the effect of the measure as a ratio to household income in reducing expenditure.

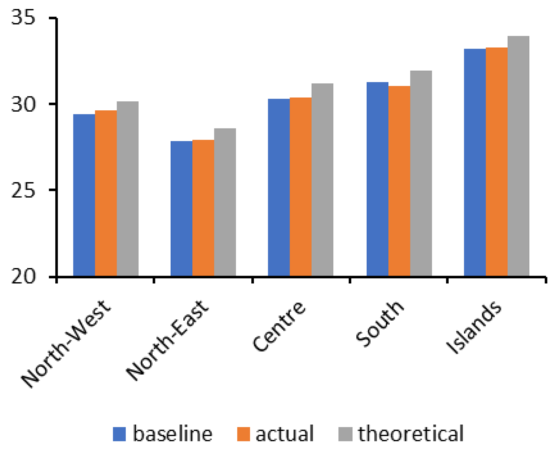
Figure 12 - Contribution of the measures to expenditure variations
(percentage values)



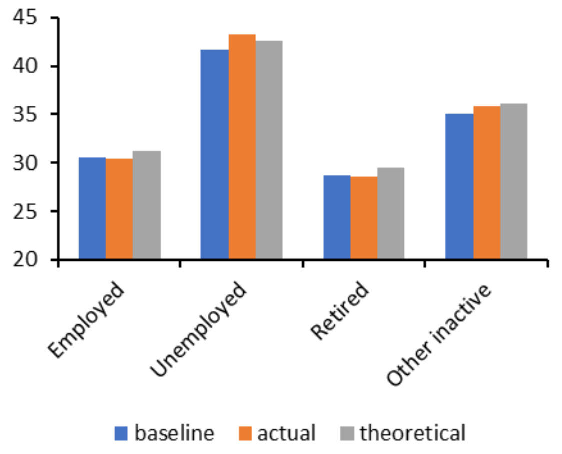
Source: Authors' elaborations

Figure 13 - Gini index: three-year scenario
(percentage values)

(a) Geographical area



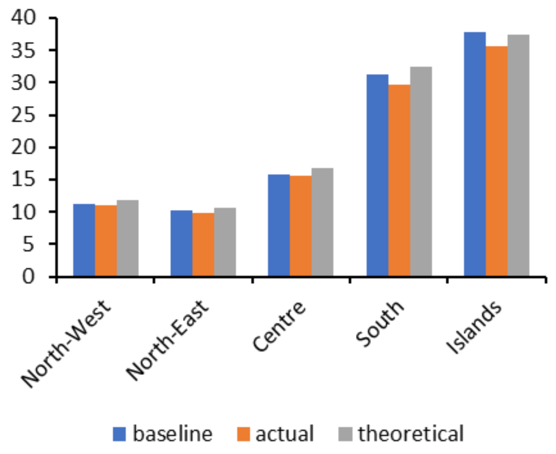
(b) Self-assessed household-head occupational status



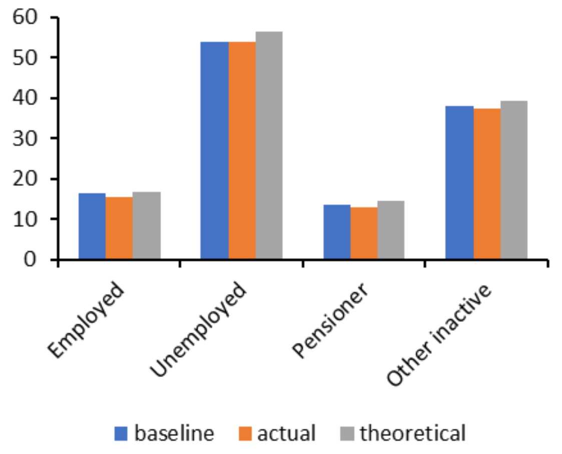
Source: Authors' calculations

Figure 14 - At-risk-of-poverty rate: three-year scenario
(percentage values)

(a) Geographical area



(b) Self-assessed household-head occupational status

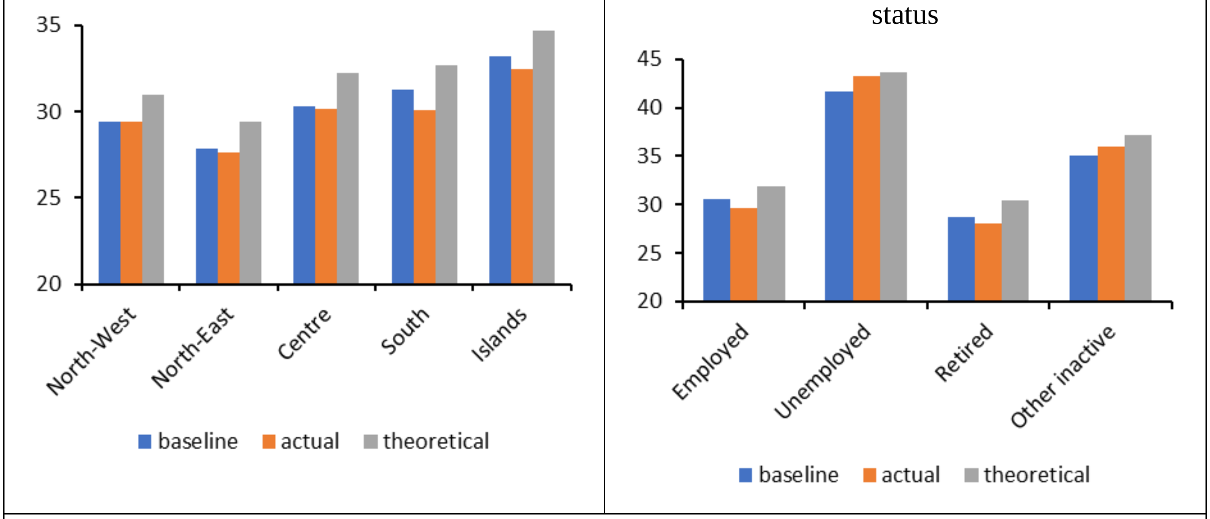


Source: Authors' calculations

Figure 15 - Gini index: one-year scenario
(percentage values)

(a) Geographical area

(b) Self-assessed household-head occupational status

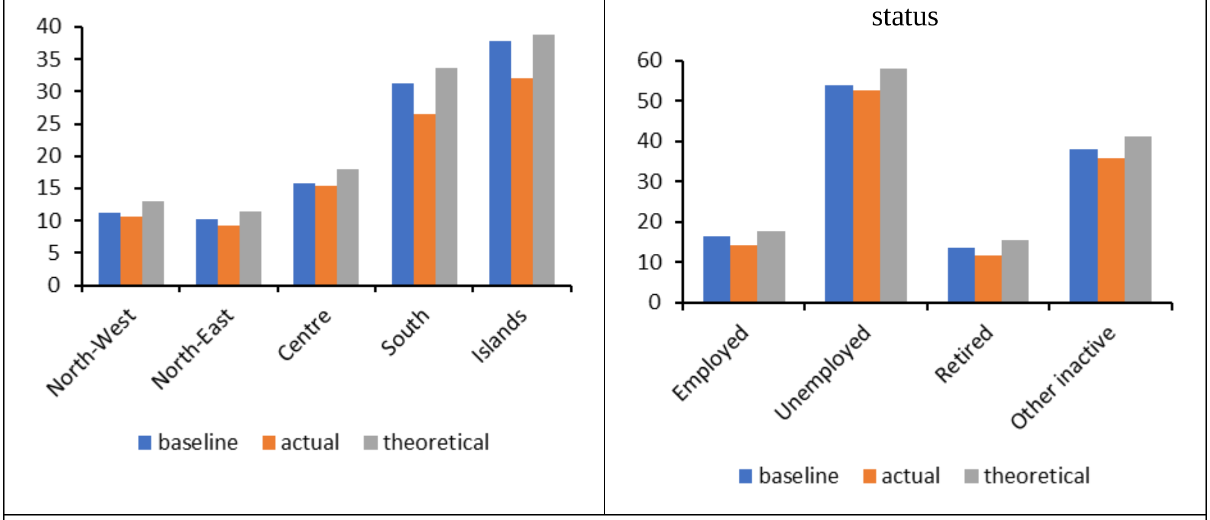


Source: Authors' calculations

Figure 16 - At-risk-of-poverty rate: one-year scenario
(percentage values)

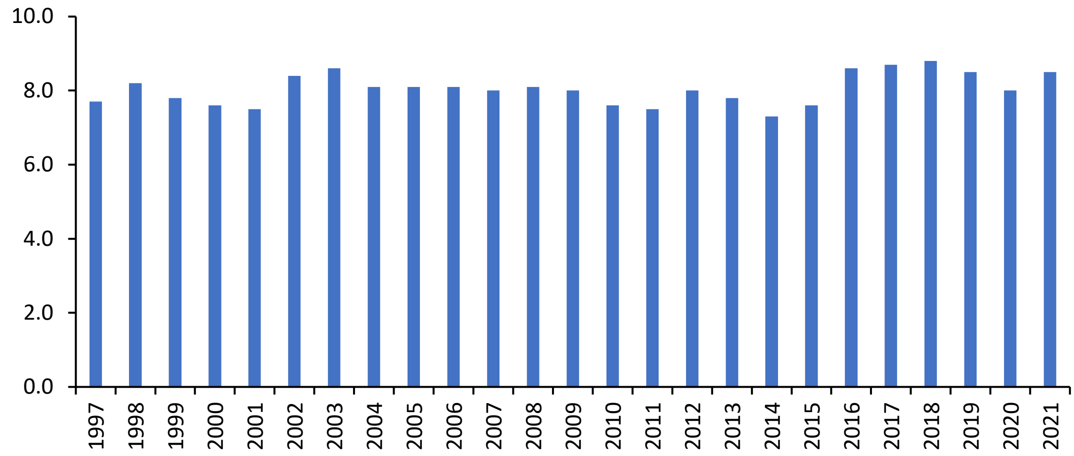
(a) Geographical area

(b) Self-assessed household-head occupational status



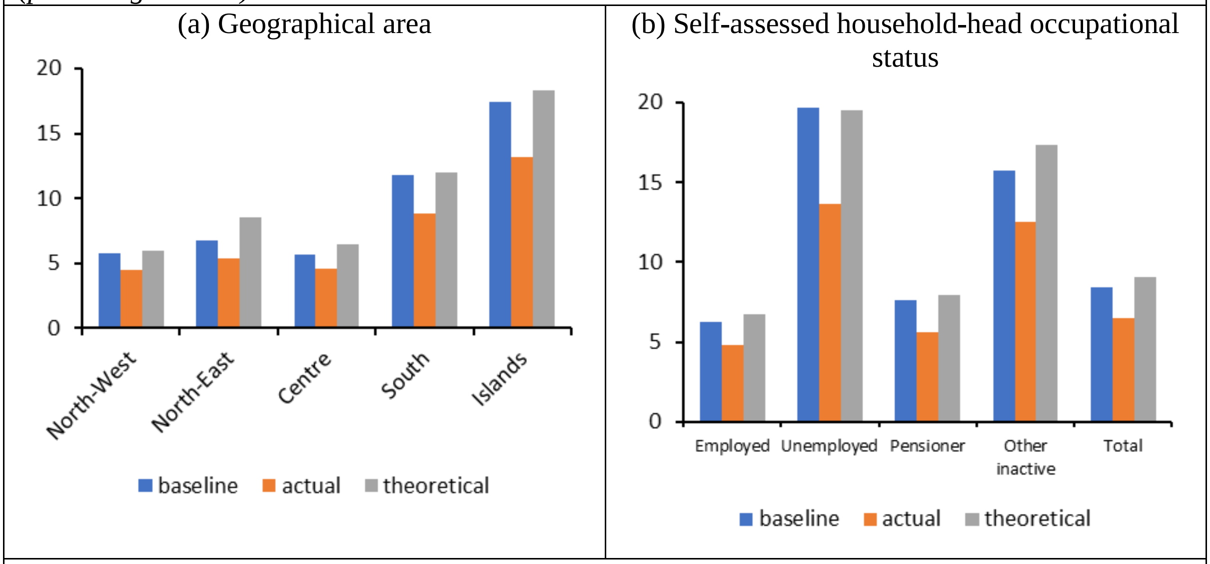
Source: Authors' calculations

Figure 17 - Energy poverty in Italy
(percentage values)



Source: Italian Observatory of Energy Poverty (OIPE)

Figure 18 - Energy poverty
(percentage values)



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