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Economies

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*Suggested Citation:* Militaru, Eva; Cristescu, Amalia; Vasilescu, Maria Denisa; Stanila, Larisa (2024) : Microsimulation analysis of COVID-19 and inflation effects on Romanian household income dynamics, *Economies*, ISSN 2227-7099, MDPI, Basel, Vol. 12, Iss. 12, pp. 1-19, <https://doi.org/10.3390/economies12120344>

This Version is available at:

<https://hdl.handle.net/10419/329271>

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## Article

# Microsimulation Analysis of COVID-19 and Inflation Effects on Romanian Household Income Dynamics

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**Abstract:** In recent years, EU member states have faced two significant crises: the COVID-19 pandemic and high inflation, exacerbated by geopolitical instability. These events have led to a decline in household purchasing power. Our study aims to quantify the impact of these crises on household income dynamics in Romania, using data from the EU Survey on Income and Living Conditions and the EUROMOD tax-benefit microsimulation model. We analyze income changes across demographic segments from 2019 to 2021 (COVID-19 period) and 2021 to 2023 (inflation crisis), focusing on household characteristics such as the presence and number of children, the gender of the household head, and the presence of elderly members. Our findings reveal that while disposable income increased from 2019 to 2021, the poorest 10% experienced the smallest gains. In 2022–2023, inflation eroded these increases, and the lower half of the income distribution struggled with reduced earnings and pensions. Despite this, the Gini coefficient for disposable income decreased from 2019 to 2023, indicating a reduced inequality. Our study highlighted that targeted public policy interventions are essential to support vulnerable households and mitigate the effects of economic shocks.



**Citation:** Militaru, Eva, Amalia Cristescu, Maria Denisa Vasilescu, and Larisa Stanila. 2024. Microsimulation Analysis of COVID-19 and Inflation Effects on Romanian Household Income Dynamics. *Economies* 12: 344. <https://doi.org/10.3390/economies12120344>

Academic Editor: Fabio Clementi

Received: 16 October 2024

Revised: 11 December 2024

Accepted: 13 December 2024

Published: 16 December 2024



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**Keywords:** distributional impact; policy interventions; microsimulation model; COVID-19; inflation; income inequality

## 1. Introduction

Every country in the world faced challenges in 2020, with some more affected than others regarding social categories. Young, low-educated, low-income workers were more exposed to income and employment risk (Pouliakas and Branka 2020) and, therefore, were once again more vulnerable (Michálek 2023). Many individuals in these vulnerable groups found themselves at the beginning of the pandemic unable to cope with the loss of income.

At that moment, governments tried to protect the most vulnerable through discretionary measures (tax rebates, income subsidies), automatic stabilization (unemployment benefits for those who lost their jobs, for example), and government support for companies. In Romania, the government also tried to support employment, imposing tax measures and benefits for those employees with employment contracts suspended due to pandemic containment measures. Technical unemployment was also considered a protection measure. Also, individuals benefitted from postponing the payment of installments to bank loans.

After the first year of the pandemic, European Union member states were confronted with high inflation. Initially generated by the economic disruptions associated with the COVID-19 pandemic, this inflationary surge was further exacerbated by the geopolitical instability and economic consequences stemming from the war in Ukraine (which started in 2022), resulting in severe price escalation. Inflation influences household income by

reducing real purchasing power, worsening income inequality, and increasing borrowing costs. It can also erode savings, depress consumer confidence, and put pressure on government budgets. Over time, these factors can stifle economic growth and destabilize the broader economy, adversely affecting vulnerable populations.

In response to the extra pressures on household welfare, governments needed to find and implement a new range of policies to mitigate the effects of soaring energy prices and inflation. There are two main categories of measures impacting households: non-targeted price support (price measures) and means-tested measures (transfers measures) for higher price protection. In Romania, the government tried to contain energy price increases and inflation by adopting the following measures: reducing energy tax and retail price regulation and transfers to vulnerable groups, business support, taxes, and regulatory measures on profits (Bardazzi et al. 2024). Similar measures have been adopted in Bulgaria, Denmark, Germany, and Poland.

The COVID-19 pandemic crisis, the energy price crisis and high, double-digit inflation—all on the background of deficits that left the state with a narrow space for intervention—comprise the context in which the cost of living has risen rapidly in the last 3 years in Romania, changing consumer behavior and reshaping household budgets. The fluctuation of food costs has had the strongest distorting effect on Romanian budgets in the last three years, with food spending having the largest share in total consumption spending, at over 30%. Inflation in the last 3 years had a negative impact on all the households in Romania, but this impact differed significantly for low-income households compared to high-income households because of the structure of expenditures and their ability to absorb increases in the cost of living through savings or loans (Caisl et al. 2023).

Low-income households were facing dramatic increases in the prices for current consumer goods, which even led to the inability of some people to ensure normal living conditions, reaching a state of material deprivation. The structure of household expenditures and consumption baskets varies depending on income groups, with low-income households spending much more on essential products. According to the Romanian National Institute of Statistics, consumption expenditures represent 61.5% of total household expenditures. Still, for the households with the lowest incomes, it accounts for approximately 90% of total expenditures. In contrast, for the households with the highest income, consumption expenditures represent approximately 50% of the total (National Institute of Statistics 2024).

Economically disadvantaged households also have the lowest capacity to cope with sudden increases in the cost of living by using savings because they are more often faced with liquidity constraints and are not very successful in saving. According to the Romanian National Institute of Statistics, the lowest-income group households in Romania managed to save only 0.1% of their total income in 2023, while the highest-income group households saved, on average, over 18.0% of their total income (National Institute of Statistics 2020). The authorities have adopted measures to moderate the increase in inflation and to reduce the impact of inflation on the population. Still, these measures were not sufficient. Other measures are also needed, especially for low-income households, to ensure they are not further vulnerable to the risk of poverty and social exclusion caused by inflation.

Within this framework, our study aims to address the following research question: how have different types of households been impacted by the COVID-19 pandemic and the subsequent price increase crisis, and to what extent have the measures implemented to mitigate their effects alleviated economic pressures across diverse demographic and socioeconomic groups? Specifically, we seek to understand how differences in income distribution by deciles, income structure by sources, and household composition influence the challenges faced, the benefits received, and the effectiveness of these measures in addressing the needs of vulnerable households.

Our research offers valuable insights into the changes in income distribution resulting from recent years' crisis. While income inequality in Romania has been examined over time, including the effects of the coronavirus crisis, to the best of our knowledge, the

impact of rising inflation in the more recent period has yet to be thoroughly evaluated. This paper aims to fill this gap by providing a detailed quantification of how rising prices, alongside the COVID-19 pandemic, have reshaped the income dynamics across different household types in Romania. This objective is pursued by utilizing the EU Survey on Income and Living Conditions (EU-SILC) dataset, in conjunction with the EUROMOD tax-benefit microsimulation model, enabling a nuanced analysis of the socioeconomic implications across diverse demographic groups. By focusing on the interplay between inflation and pandemic-related economic shifts, this study offers a comprehensive and unique assessment of Romania's changing landscape of income inequality.

This paper is organized as follows. Section 2 reviews the relevant literature and Section 3 delineates the methodology and datasets used in the study, while Section 4 presents a detailed analysis of the results. Section 5 offers the concluding remarks, synthesizing the insights derived from the research.

## 2. Literature Review

Extensive literature explores the impact of the COVID-19 pandemic on various income, vulnerable groups, and income inequality, with many studies relying on microsimulation analyses conducted using the EUROMOD model.

Regarding the impact on income, [Gasior et al. \(2024\)](#), utilizing the EUROMOD tax-benefit microsimulation model, highlighted the heterogeneity across European countries in the effects of the coronavirus crisis on household incomes and the extent to which various tax-benefit policies mitigated income losses. In Ireland, automatic stabilizers had the strongest impact, contributing up to 6% to changes in the mean disposable income, while the COVID-19 specific tax and benefit changes increased household income by 4%. [Angelov and Waldenström \(2021\)](#) used Swedish data and showed that measures taken by the government helped keep the decline in overall earnings below 5–7%, arguing that in the absence of this support, the decrease would have been almost twice as large. For the UK, US, and Germany, [Adams-Prassl et al. \(2020\)](#) pointed out that at the bottom of the earnings distribution, the initial income loss was around 35% in the UK and US and around 20% in Germany. What helped German people to suffer less from income reduction was their short-time work (STW) schemes, which only needed to be adjusted so the eligibility criteria for STW were less stringent, a decision made at the very beginning of the pandemic.

Using microsimulation methods to analyze the UK policy response to COVID-19 in April and May 2020, [Brewer and Tasseva \(2021\)](#) showed that households lost an average of 7% of their net income. [Bronka et al. \(2020\)](#) used the UKMOD tax-benefit model to assess the distributional and budgetary effects of the pandemic crisis in the UK, comparing the impact of the initial shock with and without emergency measures, deducing that policy interventions reduced the decline in average household disposable income from 3% to 1%. The Coronavirus Job Retention Scheme and increases in benefits helped mitigate income losses. [Almeida et al. \(2020\)](#) studied the impact of the pandemic on household income and the effects of policy measures in the European Union. Without intervention, household income in the EU would have dropped by 5.9% in 2020, but with policy measures, the decline was reduced to 3.6%. These policies significantly protected households from income losses and mitigated the regressive effects of the crisis.

However, the pandemic did not have uniform effects, with some individuals being more severely affected than others. [Brewer and Gardiner \(2020\)](#) showed that in the UK, the labor market shock has disproportionately affected lower-income workers, but the strengthened social security system has helped soften the impact on incomes. They argue that lower-income households were more likely to have taken on debt, borrowed, or reduced savings, reflecting their limited ability to cut spending compared to higher-income groups. On the contrary, [Brewer and Tasseva \(2021\)](#) demonstrated that higher-income families experienced the greatest impact from earnings losses during the pandemic. [Hacıoğlu-Hoke et al. \(2021\)](#), using spending, earnings, and income data for the UK, discovered that the top income quartile accounted for nearly half of the consumption decline, with spending

dropping significantly more than income. But, the bottom quartile experienced smaller spending cuts and larger earnings drops, but overall income remained more stable due to increased government benefits. Thus, the wealthy were more affected in terms of consumption, while the poor suffered more from declines in labor income, being partially protected by government support. In France, Germany, Italy, and Spain, [Clark et al. \(2021\)](#) pointed out that income-support policies focused more on lower-income groups than on equal compensation for all. Furthermore, they concluded that the self-employed were hardest hit by the pandemic. However, in Italy, the new policies adopted to protect low-income groups during the pandemic compensated only partially for the 30% loss in market income ([Figari and Fiorio 2020](#)).

The effects of the pandemic on income inequality have also been a subject of investigation. Using the EU-SILC database for Ireland in conjunction with the EUROMOD model to perform a microsimulation of the distributional impact of the COVID-19 pandemic, [O'Donoghue et al. \(2021\)](#) deduced that despite increasing market income inequality, disposable income inequality decreased, primarily due to crisis-driven policy measures and the tax-benefit system. The largest decrease occurred during the first wave of COVID-19 but decreased as the benefits became more targeted. Also, using data from France, Germany, Italy, and Spain, [Clark et al. \(2021\)](#) showed a decrease in relative inequality between January 2020 and January 2021. Although inequality appeared to rise until May 2020, it fell below pre-pandemic levels by September, with France's decline being slower. The absolute household income inequality also decreased. On the other hand, the results from [Figari and Fiorio \(2020\)](#) indicated that the pandemic led to increased inequality and risk of poverty in Italy. For Sweden, [Angelov and Waldenström \(2021\)](#) demonstrated that government measures to mitigate the effects of the pandemic also addressed income inequality, with estimates suggesting that, in the absence of these measures, the rise in inequality could have been up to three times higher.

During the COVID-19 pandemic, household incomes were also affected as a result of rising unemployment. [Juranek et al. \(2020\)](#) demonstrated that the labor markets of all the countries were severely hit by the pandemic, although Sweden performed slightly better than its neighbors. This analysis indicates that the lockdown comes at a cost in terms of labor market performance, at least in the short run. [Masik \(2022\)](#) identified the dimensions of resilience undertaken in the literature, characteristics describing resilient systems, and spatial scales in the context of which resilience research and strategic planning are carried out. This research is relevant to our analysis because strengthening social and institutional resilience is performed by the community and agents and serves, among others, strengthening vulnerable groups and increasing institutional efficiency. These aspects are also useful in the development of economic and social policies.

The measures imposed to contain the effects of the COVID-19 pandemic affected the economic sectors and, implicitly, the categories of employees differently. As a result, the categories of households experienced varying impacts on their income. [Ebbinghaus and Lehner \(2022\)](#) examined various welfare regimes and concluded that the Continental, Mediterranean, and Liberal models prioritized maintaining employment relationships more than those in Nordic, Central, and Eastern European countries. In this context, government support for firms was beneficial ([Almeida et al. 2021](#)), in its absence, many jobs would have been lost. [Ciolek \(2021\)](#) showed that the increase in unemployment was strongly influenced by the share of employment in services, especially in less knowledge-intensive services such as trade, accommodation, and gastronomy. Moreover, it turns out that a higher share of women working in services was associated with a higher increase in unemployment than in the case of men working in services.

Regarding inflation and its distributional effects, higher inflation usually impacts the poorest, who do not rely on savings to support their consumption in time. Furthermore, individuals face different inflation rates according to their consumption patterns, and low-income households often face higher inflation rates. For example, [Charalambakis et al. \(2022\)](#) observed that the recent increase in inflation has affected low- and high-income



households in the euro area differently, with the gap between their effective inflation rates at its widest since 2006. Low-income households are disproportionately affected due to their higher spending on essentials such as food and energy, limited savings, and greater liquidity constraints. In contrast, high-income households have more flexibility to substitute expensive goods and absorb cost increases through savings. The inflation gap is mainly driven by rising food and energy prices, which have a harsher impact on poorer households.

[Claeys and Guetta-Jeanrenaud \(2022\)](#) obtained similar results. Investigating inflation's impact in Belgium, France, and Italy, they found that the lowest income categories (the lowest-earning fifth of households in France and Italy and the lowest-earning quarter in Belgium) had to deal with a higher actual rate of inflation compared to the rate of inflation experienced by the highest income categories. [Bardazzi et al. \(2024\)](#) analyzed the effects of the 2021–2023 price increases on Italian household spending using a microsimulation model to highlight the distributional changes. Their study pointed out the uneven impact of inflation across different households and showed that the targeted measures significantly reduced the regressive impact of inflation. In addition, the policies implemented helped stabilize household budgets by compensating for nearly half of the inflation-driven increase in expenses. Similar results were obtained by [Bonfatti and Giarda \(2024\)](#): the regressive impact of inflation was mitigated by fiscal measures. Although key policies were designed to protect low-income households and firms in energy-intensive industries ([Varga et al. 2022](#)), the varying design and nature of these measures have contributed to differing impacts across households and firms.

[Sologon et al. \(2023\)](#) explained that the large variations in inflation that exist across European countries are due to the specific combination of goods with price increases and their share in the household budget. In poorer countries, the budget shares of food, domestic fuels, or electricity are higher than in more prosperous countries.

In an extensive study covering several countries across different regions of the globe (namely the Czech Republic, Denmark, Germany, France, Italy, Spain, the United Kingdom, Japan, Mexico, and the United States), [Causa et al. \(2022\)](#) quantified the impact of rising prices on household welfare using national micro-based household budget surveys and CPI data for the period August 2021 to August 2022. Their results indicated a decline in household purchasing power ranging from 3% in Japan to 18% in the Czech Republic. The decline was driven by energy prices in most countries, although in the Czech Republic or the United States, inflation is more broad-based. However, the common result turned out to be the fact that inflation impacts relatively more low-income households than high-income households.

### 3. Methodology

We used the European Union Survey on Income and Living Conditions (EU-SILC) for Romania, covering the years 2020 and 2022. The EU-SILC provides a representative sample of the population at the household level, with sociodemographic information on household composition and income by main income sources. Based on this information and using the EUROMOD tax-benefit microsimulation model, we can calculate several income concepts used in the analysis, such as original income (earnings, income from property ownership, income from investments, etc.), social transfers (sum of all social benefits with means-testing or not), direct taxes (social contributions, income taxes minus tax allowances), and disposable income (as original income plus social transfers minus direct taxes).

EUROMOD is a tax-benefit microsimulation model used for comparative policy analysis across the European Union (EU), and it can assess the impact of policy changes both at country and EU level. It can give insights into the effects of social benefits and fiscal policies on income distribution, income inequality, poverty, and work incentives. The model can be used to evaluate existing policies or simulate hypothetical ones, and also to estimate the budgetary effects. In addition, the effects of policies can be tracked along different socio-

demographic groups; the winners and losers of the measures can be identified. EUROMOD incorporates the policy rules for income taxation (personal income tax, social insurance contributions), indirect taxation (VAT, excises) and social benefits (means-tested benefits, non-means-tested benefits) in each EU country, on an annual basis.

This model is based on the household representative data collected annually through the European Union Survey on Income and Living Conditions (EU-SILC). In the case of Romania, the EU-SILC survey is conducted by the National Institute of Statistics using an integrated design with a rotational sampling approach. This sample is divided into four sub-samples, each equal in size and design and representative of the entire population. Annually, three sub-samples are retained while one is replaced with a new sub-sample, ensuring that both cross-sectional and longitudinal statistics are derived from the same set of sample observations. The sample size is around 7000–7500 households, comprising around 15,000–16,000 individuals aged over 16 years.

Before being used as entry data for EUROMOD, the survey dataset underwent a process of checking and correcting the inconsistencies between variables, mostly concerning the correlation between income sources and labor market activity, family relations, non-respondent individuals, and children born after the income reference period. Several income components were imputed from aggregated amounts based on benefit rules. The income reference period was the calendar year before the year of data collection. Updating factors were applied to adjust the monetary variables for time inconsistencies between the input dataset and the policy year. However, no time reconciliation was performed for socio-demographic characteristics and labor market variables, which remained unchanged from their original values. These updating factors are typically derived from indexation rules or, when such rules are unavailable, from changes in the average value of an income component between the data year and the policy year.

We calculated the equivalent income at the household level using the modified OECD equivalence scale. We used household membership and age information to identify the households with children and the number of children. Also, to distinguish between the households led by women and the households led by men, we used, as a proxy, the household respondent, which was the person responsible for the dwelling. We created several household typologies, which we investigated to assess the effects on their incomes in two consecutive periods, 2019–2021 and 2021–2023, reflecting the impact of COVID-19 and the inflation crisis. In addition, income had been deflated by inflation, so we referred to changes in real income.

The structure of the households based on the chosen typologies is presented in Table 1. We note that two-thirds of the households did not have children, whereas, among the households with children, those with one or two children were the vast majority. Families with three or more children accounted for less than 5%, as well single-parent families. One third of the households were led by a women (she is responsible for the accommodation, according to the survey data collection rules). Almost 40% were households with elderly members (65 years and older).

Concerning the data, we should mention several limitations. The sample size was relatively small, so caution is advised when analyzing and interpreting results for smaller subgroups. Each database incorporated income for the preceding year. For subsequent years, the monetary variables were adjusted using income-specific uprating factors, while the sociodemographic and labor market characteristics were kept unchanged from their original values. Certain types of market income, such as rental or investment income, were not fully captured, whereas the employment income was slightly overestimated in the dataset. In addition, the database did not adequately capture high-income households.

Through the EUROMOD tax-benefit microsimulation model for Romania (Militaru et al. 2024), we simulated the entitlement for social benefits and the social contributions and income taxes due by individuals. For means-tested benefits, there was generally over simulation, often because the asset test could not be accurately simulated or due to the issue of benefit non-take-up. Except for the guaranteed minimum income, where some

adjustments were made, 100% benefit take-up was assumed. The childcare allowance for small children under 2 years of age (out of work) and the child incentive (in work) were under-simulated because of the poor representation of small children in the database. Also, full tax compliance was assumed, except for those who were self-employed in agriculture, living in rural areas with income below the average gross wage for whom some adjustments were made.

**Table 1.** Household typologies, % of total households.

Types of Households	2020	2022
Families with children	31.1	31.2
Families without children	68.9	68.8
Single parents	4.9	4.5
Families with 1 or 2 children	27.8	28.0
Families with three plus children	3.3	3.2
Families with young adults (<25 years)	16.2	16.5
Female head of the house	30.7	31.0
Male head of the house	69.3	69.0
Families with elderly persons in care	38.3	38.4

Source: authors' calculations using the EU-SILC database for 2020 and 2022.

Regarding income-related vulnerabilities, several key aspects deserve attention and differentiate Romania from other EU countries. Romania has the highest and most persistent at-risk-of-poverty rate among children in the European Union, with 29.6% of children living below the 60% median disposable equivalent income threshold in 2023, according to Eurostat data. This figure highlights a significant and ongoing challenge in addressing child poverty compared to other EU member states.

In addition to child poverty, Romania's overall at-risk-of-poverty rate ranks the third highest in the EU, reaching 21.1% in 2023, as reported by Eurostat. These statistics show the widespread nature of monetary vulnerability in the country. Families with three or more children face the most severe challenges, with an at-risk-of-poverty rate of 63.3% in 2023, significantly higher than the EU average of 27.8%. In-work poverty is also notably high in Romania, with 21.6% of employed individuals living in poverty in 2023, compared to the EU average of 11.6%. This highlights significant vulnerabilities within the Romanian labor market, particularly affecting the self-employed, who face important economic challenges despite being employed. These facts point to a pressing need for more targeted social policies and interventions aimed at supporting the most vulnerable.

Income inequality in Romania, measured by the Gini coefficient, has been among the highest in the EU but has seen a significant reduction in recent years, despite the challenges of the COVID-19 pandemic and the inflation crisis. Between 2019 and 2023, Romania recorded a 3.8-point drop in the Gini coefficient, the largest decrease in the EU.

Our objective was to conduct a comprehensive analysis of how various types of households have been affected by the COVID-19 pandemic and the subsequent price increase crisis in Romania, while also considering the measures implemented to mitigate their effects. This analysis sought to understand how crises and subsequent interventions have alleviated economic pressures across diverse demographic and socioeconomic groups. By examining the differences in income distribution by deciles and income structure by income sources, and household composition, we aimed to identify which segments of the population benefited the most, which faced persistent challenges, and how effectively the measures addressed the specific needs of vulnerable households. This insight will help in evaluating the overall equity and efficiency of the policies and in shaping more targeted strategies for future crises.

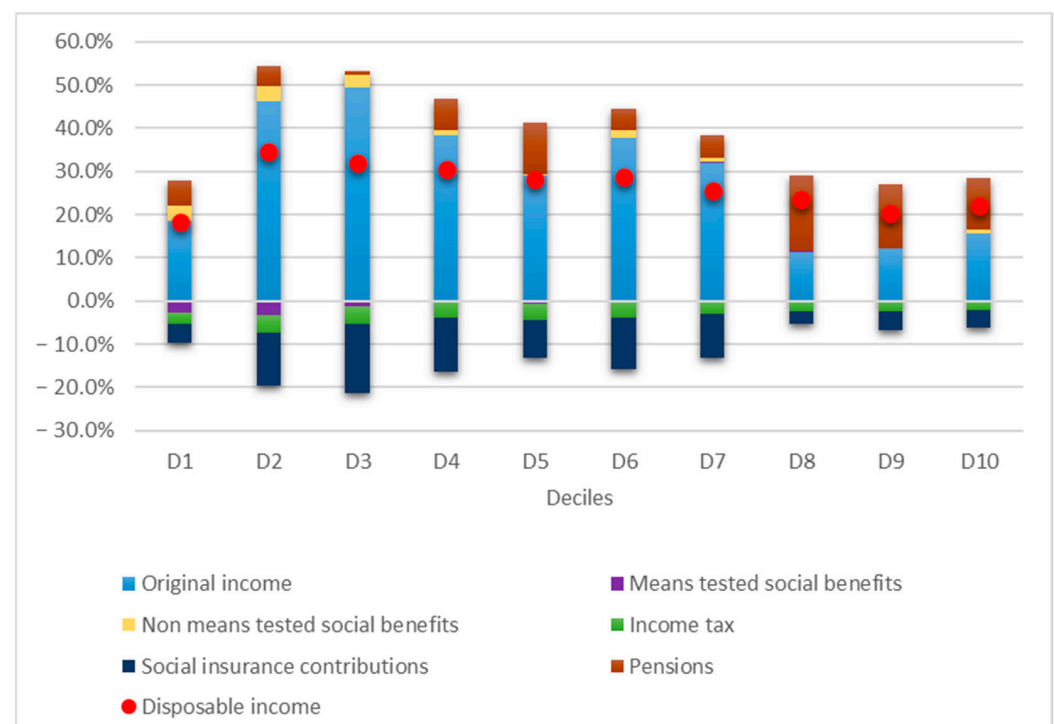


## 4. Results

### 4.1. How Was the Overall Population Affected?

The first notable trend during the COVID-19 pandemic was a significant increase in wages, particularly in the sectors that saw growth due to a combination of increased demand, cost-cutting measures, and government support. We mention information and communication, wholesale and trade, energy and water production, and agriculture and fishing. Between 2019 and 2021, real wages increased by an average of 6%. Furthermore, the self-employment income rose by more than 13%, reflecting a recovery from the initial decline in 2020 when the pandemic began. With higher earnings, there was an increase in tax revenues and social contributions.

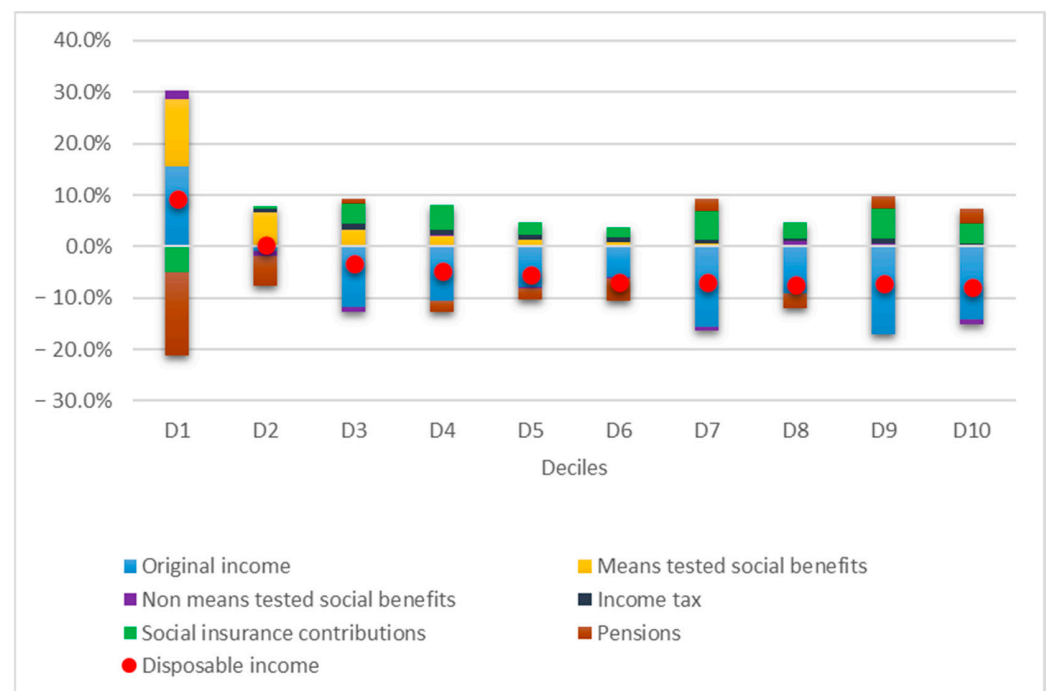
On average, household disposable income increased by 25%, further supported by more generous social benefits. The distributional impact was not homogeneous, showing significant increases for all the households, beginning with the second decile (Figure 1). The least increases were noted for the poorest 10% of the population, and the most significant for households from the second to the sixth decile. In the case of the poorest households, they lacked resources as earnings; thus, even with the support of more generous social benefits (universal child allowance, in-work incentive for parents, means-tested educational allowance, etc.), they cannot experience disposable income increases to the same extent as better-off households. It should be noted that due to the flat rate of income taxes and social contributions, higher original income increases are accompanied by higher taxes. Original income includes mainly earnings (more than 95%) and other income sources, such as income from property and other investments.



**Figure 1.** Change in real household disposable income 2019–2021, by income components, %. Note: Percentage change in mean equivalized household disposable income by income source and income decile group. Income decile groups are calculated based on household disposable income, equivalized using the modified OECD equivalence scale. Source: authors' calculations using the EU-SILC database and the EUROMOD model.

The second remark concerns the years following the pandemic, 2022 and 2023, confronted with high inflation, affecting households' income. Now, the situation looks completely different (Figure 2), and it is clear that the government, through social assistance

measures, targeted the most vulnerable population (poor households with children, older people) to preserve their standard of living. Within these two years, the government has introduced compensation measures for the increase in energy and food prices, as well as offered in-kind benefits for those in need. Clearly, these measures helped the poorest 10% of the population and made a slight difference for the next 10% (second decile). The lower half of the income distribution has benefited from a surplus of means-tested benefits, but they were not enough to compensate for the loss in earnings and pensions. For the rest of the households, losses in real earnings through inflation were not compensated for by tax-benefit measures. We should keep in mind that the results were influenced by the household composition by age and economic status, which will be further discussed when interpreting the results by various vulnerable groups, including families with children, women, young people, and older people.

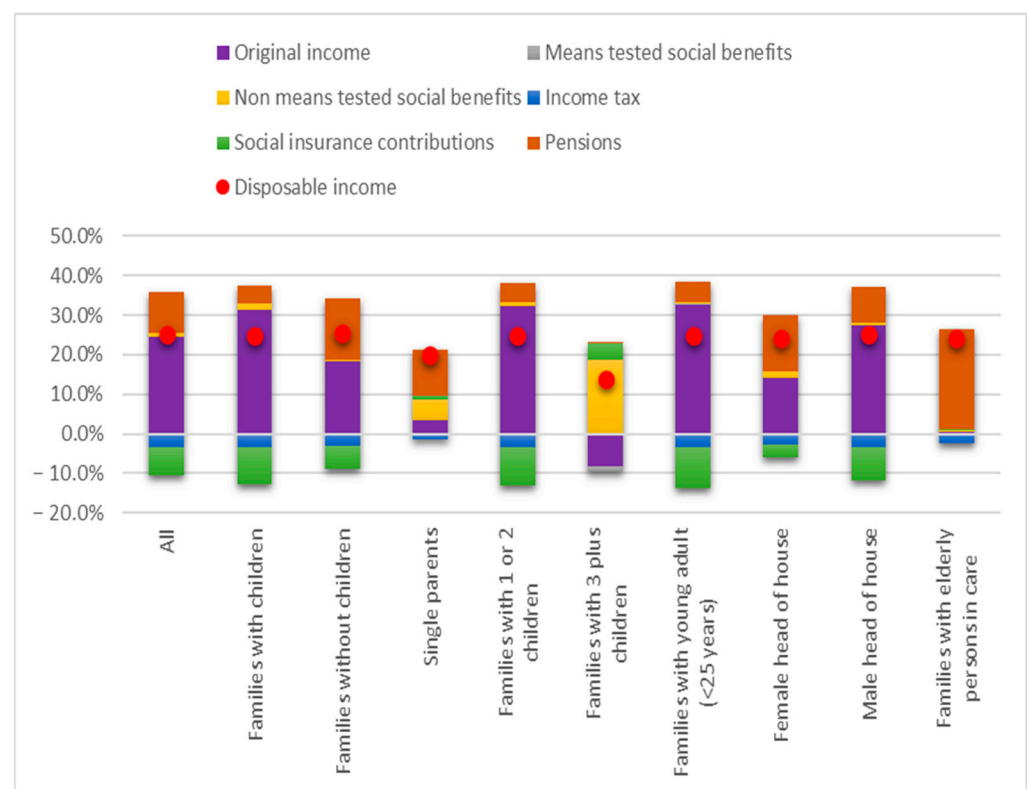


**Figure 2.** Change in real household disposable income 2021–2023, by income components, %. Note: Percentage change in mean equivalized household disposable income by income source and income decile group. Income decile groups are calculated based on household disposable income, equivalized using the modified OECD equivalence scale. Source: authors' calculations using the EU-SILC database and the EUROMOD model.

From 2019 to 2023, there has been a significant reduction in income inequality, as reflected by the decline in the Gini coefficient (0 to 1). The Gini coefficient dropped by 0.016 points up to 2021 and saw an additional decrease of 0.013 points thereafter, signaling an ongoing trend towards a more equitable distribution of disposable income.

#### 4.2. How Were Various Family Types Affected?

If we examine the variations in disposable income across different family types, we observe that, generally, the rate of change in disposable income was quite similar for all in both periods. However, the composition of disposable income was affected differently. In particular, the families without children and male-headed households saw slightly higher gains in their disposable income during 2019–2021 (Figure 3).



**Figure 3.** Change in the structure of real household disposable income during 2019–2021, by income components and various family typologies, %. Note: Percentage change in mean equivalized household disposable income by income source and income decile group. Income decile groups are calculated based on household disposable income, equivalized using the modified OECD equivalence scale. Source: authors' calculations using the EU-SILC database and the EUROMOD model.

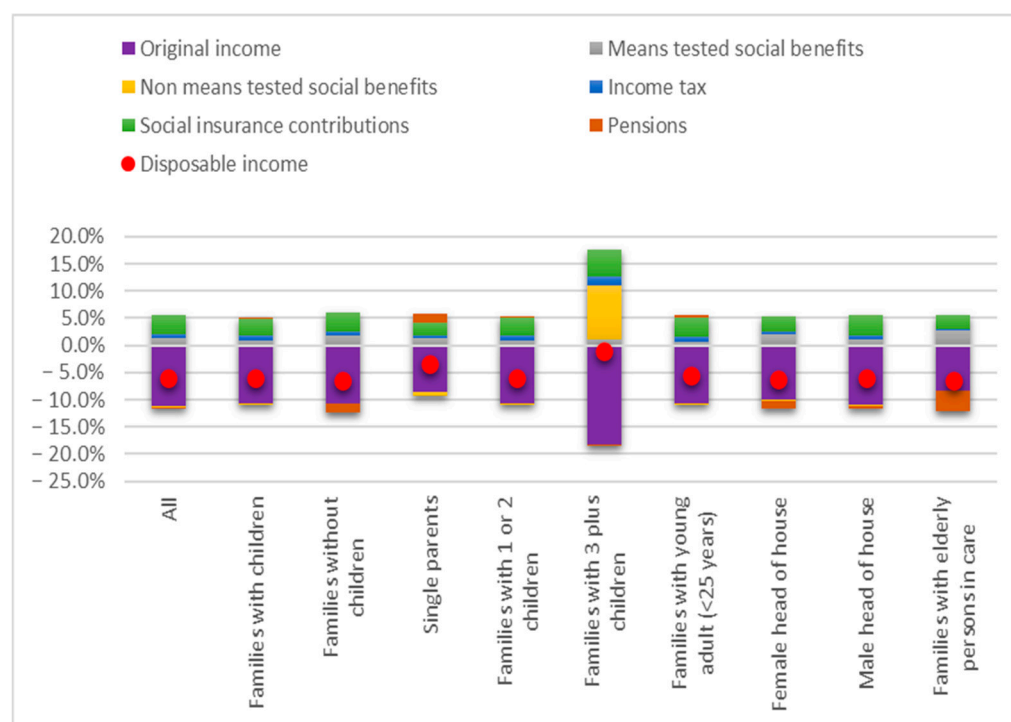
On the contrary, the most vulnerable groups, such as single-parent families and those with three or more children, experienced the smallest increase in disposable income during the COVID-19 pandemic, primarily due to a reduction in their original income (earnings). The measures to contain the effects of the pandemic and the restrictions imposed on schools forced parents, in many cases, to stay at home with their children, which reduced their income. The surplus of social benefits they receive partially compensates for the smaller increase in other income.

For families caring for elderly members, the increase in disposable income is primarily driven by increased pension benefits. Interestingly, a similar trend of increased pension income is evident among single-parent families and households headed by women, indicating a higher prevalence of elderly members in these households compared to others. This indicates that many of these households might be multigenerational, where elderly family members, most likely grandparents, live with the younger family and provide some financial support through their pensions.

The above findings could also imply that the elderly in these households play a dual role, offering both financial assistance and possibly caregiving support, such as helping with childcare, thus enabling the primary adult in the household, often a single parent or female head, to participate in work or other activities. The presence of pensioners could be a crucial factor in buffering against economic shocks, but it also means that these households are more sensitive to any changes in pension policy. Furthermore, the higher prevalence of elderly members in these households could reflect a broader societal trend in which women, especially those who are single parents, assume the responsibility of caring for older relatives, thus reinforcing traditional caregiving roles.

A notable difference in income evolution is also evident between households headed by men and those headed by women. Male-headed households experienced greater increases in original income, which subsequently led to higher payments in social contributions and income taxes. On the contrary, female-headed households benefited more from pensions and social transfers. This disparity highlights the different income dynamics, where male-headed households saw gains driven primarily by employment or business earnings, while female-headed households relied more heavily on social support mechanisms and retirement benefits, reflecting the varying economic roles and vulnerabilities within these types of households.

The 2021–2023 period stands out as different, with all the families experiencing a decrease in disposable income in real terms due to rising prices (see Figure 4). However, unlike in the previous period, families with three or more children were the least affected this time, as the significant losses in original income were mitigated by more generous social benefits and additional income tax deductions for the families with children. The supplementary tax allowances for families with children and young adults (under 25 years old) had a positive impact on these groups.



**Figure 4.** Change in the structure of real household disposable income during 2021–2023, by income components and various family typologies, %. Note: Percentage change in mean equivalized household disposable income by income source and income decile group. Income decile groups are calculated based on household disposable income, equivalized using the modified OECD equivalence scale. Source: authors' calculations using the EU-SILC database and the EUROMOD model.

Overall, due to reduced earnings, all the groups pay less income taxes and social contributions. Families caring for elderly members are negatively impacted by the real decline in pension income but receive more temporary means-tested benefits aimed at supporting the most vulnerable pensioners.

#### 4.3. What Are the Distributional Changes for Family Typology Related to Children?

If we examine the distributional changes in disposable income based on family typology with respect to the presence and number of children, we observe that, during 2019–2021, it generally aligned with the overall pattern highlighted earlier, although some

distinct differences are notable (Table 2). To recap, the general trend indicated substantial variation across different income deciles, with the most significant increases in disposable income occurring in the second through sixth deciles, while the poorest decile experiencing the worst outcomes. The families with three or more children showed the highest variability and the most pronounced increases in disposable income, especially within the lower income deciles (such as deciles 2, 3, and 4). However, the change in income was notably lower for the poorest decile, suggesting increased vulnerability among these lower income households with more children.

**Table 2.** The 2019–2021 change in real household disposable income, by income deciles, family typology related to children, %.

Decile	Families with Children	Families Without Children	Single Parent Families	Families with 1 or 2 Children	Families with 3 or More Children
D1	17.5%	19.1%	17.8%	25.9%	2.2%
D2	34.0%	35.6%	33.7%	31.9%	39.8%
D3	32.7%	30.9%	37.1%	32.9%	32.4%
D4	30.9%	30.2%	26.2%	28.8%	39.5%
D5	28.2%	28.0%	28.5%	28.2%	29.0%
D6	28.1%	29.3%	26.6%	27.8%	29.4%
D7	25.3%	25.5%	22.7%	25.2%	27.0%
D8	23.3%	23.8%	23.9%	23.9%	16.1%
D9	19.3%	21.2%	24.2%	19.2%	0.0%
D10	21.6%	22.6%	1.6%	22.3%	3.3%

Note: Percentage change in mean equivalized household disposable income by income source and income decile group. Income decile groups are calculated based on household disposable income, equivalized using the modified OECD equivalence scale. Source: authors' calculations using the EU-SILC database and the EUROMOD model.

Furthermore, the wealthiest deciles within this group also saw reduced increases, indicating that the income growth was uneven across the spectrum for larger families. On the contrary, the families with one or two children showed less variation in disposable income, with moderate increases typically ranging between 20% and 30%. Similarly to larger families, the richest deciles among this group exhibited the lowest income growth. Single-parent families generally showed the smallest increases across the deciles, although they saw a noticeable rise in the second and third deciles. The families without children showed moderate changes in their disposable income in most deciles without dramatic fluctuations.

In conclusion, lower-income households, particularly those with three or more children and single-parent families, experienced minimal improvements or even stagnation in disposable income. This indicates that these groups have probably faced limited access to increased income, mainly due to their original income losses not sufficiently offset by social transfers. This underscores the need for targeted policy interventions to support the most vulnerable populations. However, since the lower half of the income distribution showed a relatively higher increase in disposable income, this trend could contribute to a reduction in income inequality.

After 2021, as illustrated in Table 3, there was a noticeable decline in disposable income across most family types, particularly in the lower income deciles, with several of these deciles showing negative changes in real disposable income.

Still, the poorest households experienced some improvement, as evidenced by the predominance of positive changes in their case. Among these, single-parent families and large families with three or more children had the highest income gains in the lowest two deciles. This suggests that the measures designed to mitigate the negative impact of rising prices were more effectively targeted towards the most vulnerable families with children.



**Table 3.** The 2021–2023 change in real household disposable income, by income deciles, family typology related to children, %.

Deciles	Families with Children	Families Without Children	Single Parent Families	Families with 1 or 2 Children	Families with 3 or More Children
D1	13.3%	−1.6%	26.3%	11.7%	19.1%
D2	0.5%	−0.1%	5.8%	0.6%	0.1%
D3	−3.9%	−2.4%	−5.2%	−3.8%	−4.0%
D4	−5.7%	−4.0%	−4.9%	−5.3%	−6.8%
D5	−6.0%	−5.2%	−5.7%	−5.8%	−9.2%
D6	−6.6%	−7.2%	−7.0%	−6.4%	−7.5%
D7	−7.2%	−6.9%	−6.4%	−7.3%	0.0%
D8	−6.9%	−7.6%	−6.6%	−6.5%	−9.9%
D9	−6.6%	−7.6%	−5.5%	−6.7%	0.0%
D10	−7.9%	−8.0%	−0.5%	−8.1%	−9.2%

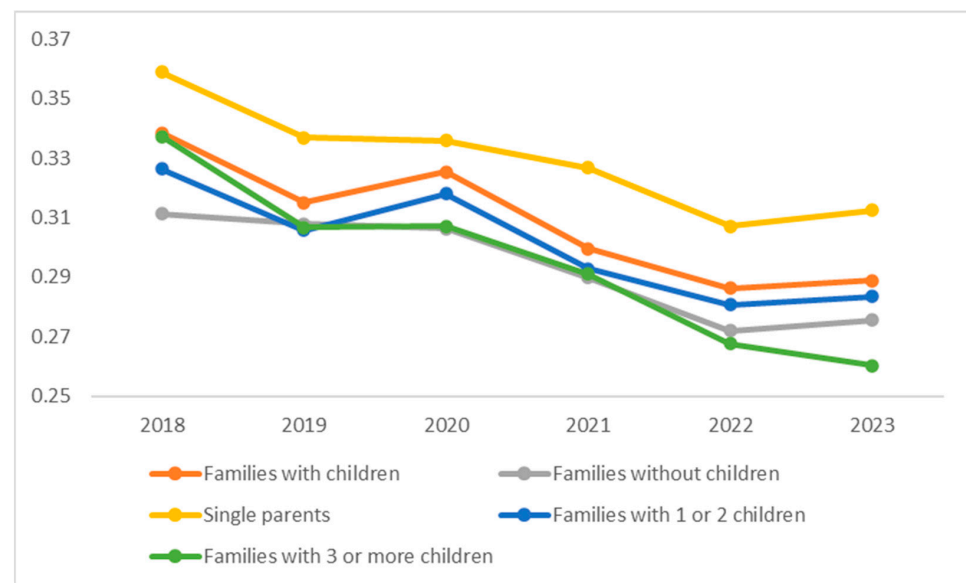
Note: Percentage change in mean equivalized household disposable income by income source and income decile group. Income decile groups are calculated based on household disposable income, equivalized using the modified OECD equivalence scale. Source: authors' calculations using the EU-SILC database and the EUROMOD model.

In the middle-income deciles, the families with three or more children generally experienced negative changes in their disposable income, indicating that they were more severely affected by economic challenges compared to other families and may not have received adequate income support. The families without children showed a pattern close to the 0% change line, suggesting relatively stable or slightly declining disposable incomes across most deciles.

Overall, Table 3 indicates that the period from 2021 to 2023 was particularly challenging for most family types, with middle-income households bearing most of the declines in real disposable income due to increased living costs. This highlights a gap in support measures for middle-income families, which appear to have been more adversely impacted than lower-income groups during this time.

When analyzing the levels and trends of income inequality across different types of households, it becomes evident that the greatest disparity exists among single-parent families, while the lowest levels of inequality are found among larger families with three or more children (see Figure 5). For these larger families, income inequality has decreased since 2021, coinciding with the introduction of targeted measures aimed at supporting families with very low incomes. These initiatives appear to have effectively reduced economic disparities within this group.

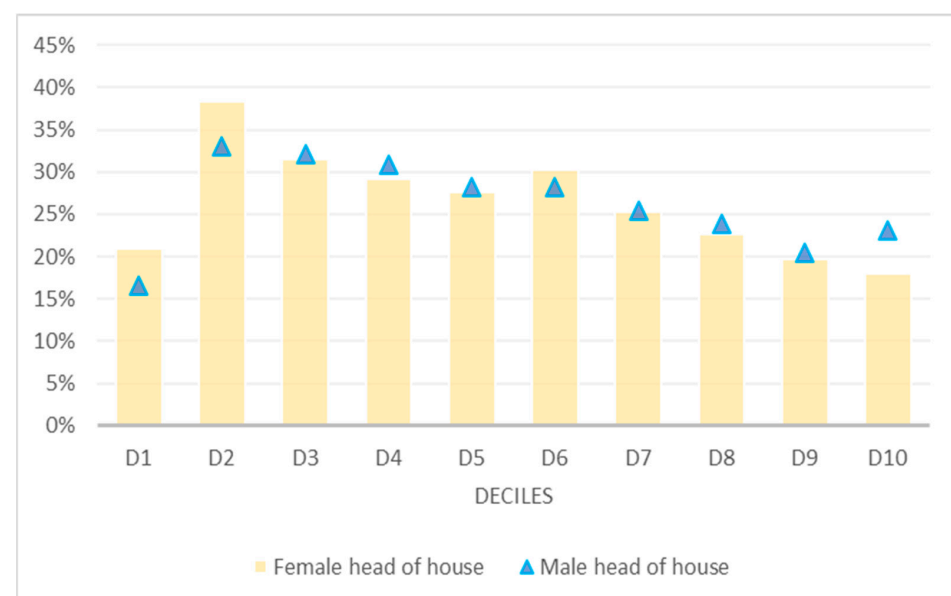
The Gini coefficient of disposable income decreased for all types between 2019 and 2023, suggesting that the two economic crises during this period had a greater impact on wealthier families, leading to a reduction in overall inequality. However, the decrease in inequality has not been uniform across different types of households. The smallest decline in inequality can be observed among families with one or two children, likely because these families are more commonly situated within the middle portion of income distribution. As a result, they have experienced less significant shifts in either direction, in contrast to both the highest-income families who saw reductions and the lowest-income families who benefited from targeted support.



**Figure 5.** Gini coefficient of disposable income, family typology related to children, %. Source: authors' calculations using the EU-SILC database and the EUROMOD model.

#### 4.4. What Are the Distributional Changes in Families Headed by Men vs. Women?

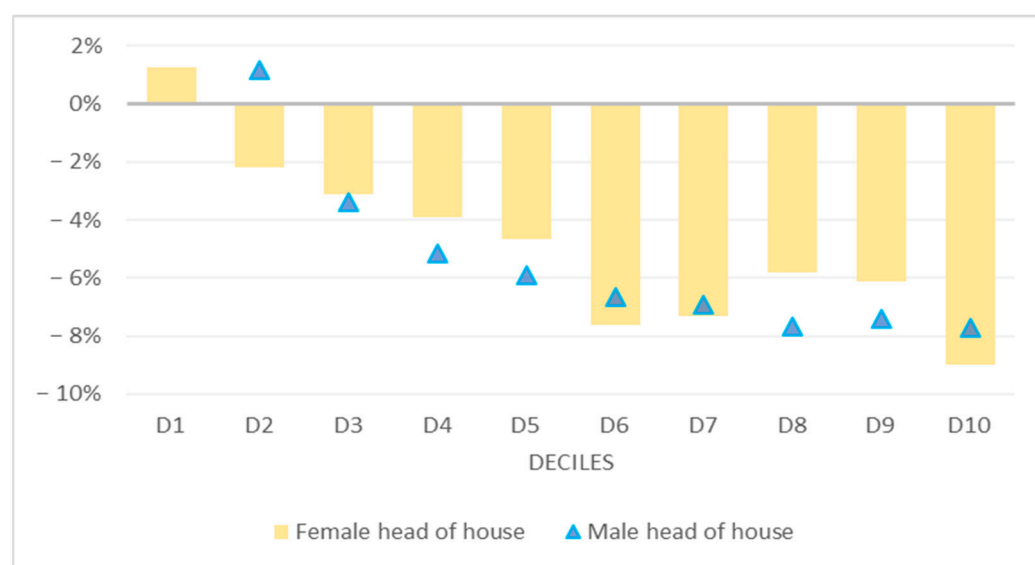
Between 2019 and 2021, the households led by women experienced slightly better or at least comparable income growth than their male counterparts within the three poorest deciles of the income distribution (Figure 6). This suggests some progress for the women-led households in the lowest income brackets. However, in all other deciles, except for the sixth, the male-headed households demonstrated a higher income growth rate. The difference became particularly pronounced in the wealthiest decile, where the male-headed households significantly outpaced the women-led households, with an income growth rate of 23% compared to 18%.



**Figure 6.** The 2019–2021 change in real household disposable income, by income deciles and gender of household head, %. Note: percentage change in mean equivalized household disposable income by income source and income decile group. Income decile groups are calculated based on household disposable income, equivalized using the modified OECD equivalence scale. Source: authors' calculations using the EU-SILC database and the EUROMOD model.

The overall trend in income growth revealed a decline as one moved from lower to higher income deciles for both male- and female-headed households, except for some variations in the first and last deciles. Specifically, in the lower income brackets, women-led households tend to experience more favorable income growth, indicating some progress in narrowing gender disparities at the bottom of the economic spectrum. Yet, this trend changes as income levels rise and male-headed households begin to show greater growth, particularly in higher deciles. This disparity becomes evident at the top end of the income distribution, highlighting that gender-based income inequality persists, especially among the wealthiest households.

Following 2021, the disposable income was declining across all the income deciles for both the female-headed and the male-headed households (Figure 7). The pattern revealed some variation: while income growth was still observed in the first decile for both genders, the income began to decline from the second decile onward.



**Figure 7.** The 2021–2023 change in real household disposable income, by income deciles and gender of household head, %. Note: percentage change in mean equivalized household disposable income by income source and income decile group. Income decile groups are calculated based on household disposable income, equivalized using the modified OECD equivalence scale. Source: authors' calculations using the EU-SILC database and the EUROMOD model.

In particular, only male-headed households in the poorest two deciles experienced significant income growth compared to their female-headed counterparts, indicating a disparity at the lowest income levels. Also, as before 2021, the female-headed households appeared to be facing significant vulnerability at the top ends of the income spectrum. These results suggest that women-led households in the extreme income groups—both the poorest and the wealthiest—are more exposed to economic risks or have fewer resources available to mitigate the impact of income loss. This disparity points to the broader challenges faced by women-led households in navigating economic instability, especially compared to male-headed households that seem better positioned to sustain growth or buffer against declines in disposable income.

The assessment of the levels and trends in income inequality between the two groups can be conducted by decomposing the Gini coefficient using Pyatt's (1976) method. In 2019, income inequality was notably higher among female-headed households compared to male-headed households. Between 2019 and 2023, the overall inequality among female-headed households decreased significantly (by 0.057 points), indicating an improvement in income distribution for these households (see Table 4). In contrast, male-headed households experienced only modest improvements.

**Table 4.** Decomposition of the Gini coefficient, by gender of household head, %.

Inequality (Gini Coefficient)	Overall Inequality		Within-Group		Between-Group		Overlap	
	2019	Change to 2023	2019	Change to 2023	2019	Change to 2023	2019	Change to 2023
Female-headed households	0.347	−0.057	0.211	−0.017	0.019	−0.006	0.094	−0.003
Male-headed households	0.316	−0.017						

Source: authors' own simulations using EUROMOD tax-benefit simulation model and the EU-SILC database.

The decline in inequality for both groups indicates that the changes in income distribution favored the poorer population, suggesting that income support programs have been effective for those at the lower end of the income distribution.

The Gini coefficient of income inequality within each group also declined, by 0.017 points, but still accounts for approximately 65% of the total inequality. The inequality between the two groups, initially around 5% of the total, declined to 4% (a nominal decrease of 0.006 points), indicating a reduction in the disparity between female-headed and male-headed households. The overlap component, which reflected the degree to which the income distributions of the two groups intersect, accounted for 29–30% of the total inequality. The slight reduction (0.003 points) in this component suggests that the overlap between the female-headed and male-headed households changed only marginally, implying minimal changes in the intersection of their income distributions.

## 5. Conclusions

Our paper analyzes the household income dynamics in Romania using data from the European Union Survey on Income and Living Conditions (EU-SILC) for 2020 and 2022 and using, for the simulation of social transfers and taxes, the EUROMOD tax-benefit microsimulation model. We evaluated household income changes across 2019–2021 (during COVID-19) and 2021–2023 (amidst the inflation crisis). We categorized the households by several typologies, such as the presence and number of children, the gender of the household head, and whether elderly members were present. The structure of the households indicates that two-thirds of the households analyzed did not have children, and most families had one or two children. Female-headed households make up roughly one-third of the households, and nearly 40% of the households included elderly members. The analysis highlights variations in the income changes in Romania across household types and deciles, the importance of social benefits in mitigating income inequality, and gender-specific vulnerabilities.

The evolution of the general context in Romania indicates, between 2019 and 2021, a higher disposable income for the population, mainly because real wages grew by 6% and self-employment income increased by more than 13%. However, the gains were unevenly distributed, with the poorest 10% of households seeing the least increase. Unlike in other countries (Clark et al. 2021) where pandemic policies were tailored to support lower-income groups, Romania adopted a uniform policy approach for the whole population. As a result, the poorer households were disproportionately affected, facing more significant changes in their labor market status. Also, contrary to the trends observed in countries such as the UK, Germany, and Sweden (Bronka et al. 2020; Adams-Prassl et al. 2020; Angelov and Waldenström 2021), disposable income increased in Romania during the pandemic.

In 2022–2023, inflation eroded previous income gains, although targeted government measures helped the most vulnerable groups, particularly low-income households with children and elderly members. Despite these interventions, the lower half of the income distribution struggled to fully offset the losses from reduced earnings and pensions. These results of our analysis align with similar research (Charalambakis et al. 2022; Claeys and Guetta-Jeanrenaud 2022), which found that inflation affects households differently, with

low-income households being the most impacted due to higher shares of essential goods and less flexibility in consumption.

In general, the Gini coefficient for disposable income decreased from 2019 to 2023, with a peak in 2020, suggesting reduced inequality overall. The rise in income inequalities during the first wave of the pandemic was observed in other countries as well, including France, Germany, Italy, and Spain (Clark et al. 2021; Figari and Fiorio 2020).

The main contribution of this paper lies in the detailed examination of how various household categories were impacted by the pandemic and the subsequent inflationary period, addressing a significant gap in the literature on Romania. Additionally, such in-depth analysis is rare, even in studies focused on other countries. Our results show that during the COVID-19 period, the families without children and the male-headed households in Romania experienced higher gains compared to single-parent families and those with three or more children, who faced reduced earnings due to caregiving responsibilities during the pandemic. Increased pension benefits provided crucial support to elderly households. During 2021–2023, all the families experienced a decline in real disposable income due to inflation. However, larger families (three or more children) were less affected, thanks to generous social benefits and tax deductions.

The distributional effects measured as the average real income growth by deciles constructed based on household equivalized disposable income indicate that the families with three or more children showed high variability in their disposable income growth during the COVID-19 pandemic in Romania, especially in lower income deciles, while single-parent families experienced minimal increases, thus indicating that more targeted support would probably have been more effective.

During 2021–2023, inflation had a widespread negative effect in Romania, particularly on middle-income families. Targeted support measures for vulnerable families provided some relief to lower income groups, but were insufficient for others. Inequalities declined for all the household groups, especially for the families with three or more children and single-parent families, showing that targeted support, especially during the inflationary period, was crucial for them. As highlighted in similar studies for other countries (Bardazzi et al. 2024; Bonfatti and Giarda 2024), public measures aimed at cushioning the effects of inflation were highly effective in Romania as well, particularly for low-income households and the most vulnerable groups.

Concerning the typology based on the gender of the household head, the results show that in the COVID-19 period, female-headed households experienced better income growth in the lower deciles compared to male-headed households, but males saw a higher growth at the higher income levels. Subsequently, between 2021 and 2023, both the male- and female-headed households faced declines in their real disposable income. The female-headed households, particularly in the extreme income groups, were more vulnerable to income losses, highlighting gender disparities. We observed a narrowing of the disparities between the two groups of households, as shown by the evolution of the components of the Gini coefficient. In this context, it would have been valuable to further explore the composition of male- versus female-headed households to gain a deeper understanding of the findings. However, due to data limitations, particularly the small sample size for certain groups, a more detailed analysis was not feasible.

Our results show that in the Romanian social and economic context, targeted public policy interventions were crucial to effectively support vulnerable households, particularly those with children, single parents, and female-headed families, to mitigate income inequality and cushion the impact of economic shocks like inflation and pandemics. Findings also highlight the critical role of social benefits and tax deductions in stabilizing incomes for larger families and low-income households and policies should focus on optimizing the design and delivery of such measures to ensure equitable support. Considering that the female-headed households, particularly in the extreme income groups, faced increased vulnerability during crises, it is essential to adopt gender-sensitive policies to address income disparities and promote resilience among female-led families.



Limitations of the research primarily concern the data used, which include a relatively small sample size and challenges in accurately capturing certain types of income (property, investment), an over-estimation of employment income, and the underrepresentation of households with the highest income.

Future work should address these limitations by conducting the same analysis on larger datasets that provide a better representation of various household categories. These simulations assume full tax compliance and complete uptake of all the eligible benefits that could influence the results to some extent. However, due to the lack of reliable external data, these assumptions cannot be adjusted.

Further research should focus on a detailed analysis of social benefits and tax policies to assess the relevance and effectiveness of each on the well-being of households and the reduction in income inequalities. Extending the analysis over a longer period could capture the long-term impacts of economic shocks and policy measures, providing a deeper understanding of income dynamics and resilience. In addition, exploring the intersectionality of household characteristics (e.g., gender, income, presence of children) would provide a nuanced understanding of vulnerability and inform more inclusive and targeted policy design.

**Author Contributions:** Conceptualization, E.M., M.D.V., A.C. and L.S.; methodology, E.M.; validation, E.M., M.D.V. and A.C.; formal analysis, E.M., M.D.V., A.C. and L.S.; resources, E.M. and L.S.; writing—original draft preparation, E.M., M.D.V., A.C. and L.S.; writing—review and editing, M.D.V., A.C. and L.S.; supervision, E.M.; project administration, A.C.; funding acquisition, A.C. All authors have read and agreed to the published version of the manuscript.

**Funding:** Part of this work was supported by the NUCLEU Program funded by the Romanian Ministry of Research, Innovation, and Digitalization, Project PN 22100104 and Project PN 22100201.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** The microdata used was provided by Eurostat only based on a research proposal and can be shared only with the researchers nominated in the research proposal. The data cannot be made available for open access.

**Conflicts of Interest:** The authors declare no conflicts of interest.

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