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An Investigation into the Effectiveness of Social Protection Expenditures in Combating Income Inequality

Araştırma Makalesi /Research Article

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ABSTRACT: *This study examines the effectiveness of social protection expenditures in reducing income inequality, using data from 29 European countries between 2007 and 2021. Employing a fixed-effects panel quantile regression method, it highlights the varying impacts of different expenditure components. The findings reveal that expenditures targeting families and children, such as childcare services, family allowances, and educational support, have the strongest positive effect across all quantiles. Expenditures on sickness, disability, and unemployment also significantly reduce inequality, while housing and social exclusion expenditures show limited or no impact, suggesting areas for policy enhancement. Country-level differences are evident, with Scandinavian countries achieving better outcomes due to efficient policies, while Baltic and Eastern European countries face challenges in achieving similar effectiveness. Additionally, economic growth strengthens the impact of social transfers, whereas inflation and population growth negatively influence outcomes. These findings highlight the need for well-targeted and practical policies to make social protection spending more effective in reducing income inequality. Future research should focus on longer-term studies and better understanding differences between countries to guide policymakers.*

Keywords: *social protection expenditure, income inequality, fiscal policy effectiveness*

Gelir Eşitsizliği ile Mücadelede Sosyal Koruma Harcamalarının Etkinliği Üzerine Bir Araştırma

ÖZ: *Bu çalışma, sosyal koruma harcamalarının gelir eşitsizliğini azaltmadaki etkinliğini, 2007-2021 yılları arasında 29 Avrupa ülkesine ait verileri kullanarak incelemektedir. Sabit etkili panel kantil regresyon yöntemi ile gerçekleştirilen analiz, farklı harcama bileşenlerinin etkilerindeki değişiklikleri ortaya koymaktadır. Bulgular, çocuk bakım hizmetleri, aile yardımları ve eğitim destekleri gibi aile ve çocuklara yönelik harcamaların tüm kantillerde en güçlü pozitif etkiye sahip olduğunu göstermektedir. Hastalık, engellilik ve işsizlik harcamaları da gelir eşitsizliğini önemli ölçüde azaltırken, konut ve sosyal dışlanma harcamalarının sınırlı ya da etkisiz olduğu görülmüş ve bu alanların politika geliştirme açısından iyileştirilmesi gerektiği vurgulanmıştır. Ülkeler düzeyinde farklılıklar belirgin olup, İskandinav ülkelerinin etkin politikalar sayesinde daha iyi sonuçlar elde ettiği, buna karşın Baltık ve Doğu Avrupa ülkelerinin benzer bir etkinlik sağlamakta zorluk yaşadığı gözlemlenmiştir. Ayrıca, ekonomik büyümenin sosyal transferlerin etkisini güçlendirdiği, enflasyon ve nüfus artışının ise bu etkileri olumsuz yönde etkilediği tespit edilmiştir. Bu bulgular, sosyal koruma harcamalarının gelir eşitsizliğini azaltmadaki rolünü optimize etmek için hedefe yönelik ve uygulanabilir politikaların gerekliliğini vurgulamaktadır. Gelecekteki araştırmalar, uzun dönemli analizlere ve ülkeler arasındaki farklılıkların daha iyi anlaşılmasına odaklanarak politika yapıcılara rehberlik edebilir.*

Anahtar Kelimeler: *sosyal koruma harcamaları, gelir eşitsizliği, maliye politikası etkinliği*

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1.Introduction

With the spread of neoliberal policies worldwide and the impact of globalisation, income inequality has increased rapidly in both developed and developing countries. Changes driven by technological advancements, the disadvantage faced by unskilled workers in global competition, and the growing demand for skilled labour are among the main reasons for this situation (Acemoglu et al., 2001; Atkinson, 2007; Stiglitz, 2012). As income inequality has become one of the most significant social and economic challenges of the globalised world, the demand for public social expenditures to address this issue has risen significantly. To meet this demand, governments intervene to reduce income inequalities through fiscal policy instruments. Among these interventions, social protection expenditures stand out as a key fiscal policy tool that helps the welfare state achieve its goal of ensuring minimum living standards for its citizens through concrete measures. Consequently, ensuring equality in income distribution, as one of the primary objectives of the welfare state, elevates social protection expenditures to a position of critical importance in achieving this goal.

Income distribution can generally be examined under two main categories: primary income distribution and secondary income distribution. Primary distribution (market distribution) refers to how the income generated through market mechanisms is shared among different social classes, while secondary distribution (redistribution of income) encompasses state interventions aimed at addressing the inequalities created by the market. If income inequalities are observed to decrease in secondary distribution compared to primary distribution due to implemented social transfers, it indicates that public policies are well-designed and yield effective outcomes (Afonso et al., 2010). In particular, the change in the Gini coefficient before and after transfers serves as a crucial indicator for evaluating the success of social transfers in reducing income inequality. In this context, government interventions carried out through social transfer expenditures contribute to reducing income inequalities and enhancing social welfare. Indeed, the greater the reduction in income inequality, the more successful public social policies can be considered.

This study aims to evaluate the effectiveness of social protection expenditures in reducing income inequality by identifying which components have the most significant impact. To achieve this objective, a fixed-effects panel quantile regression method is applied to data from 29 European countries covering the period from 2007 to 2021.In this context, it is essential to highlight several aspects of this study that differentiate it from the existing literature. First, unlike other studies that typically focus on the Gini coefficient as the dependent variable, this study examines the reduction rate in the Gini coefficient after social transfers compared to the pre-transfer situation to assess the effectiveness of social protection expenditures in addressing income inequality. Moreover, the use of social protection expenditures and their subcomponents as explanatory variables

allows for the disentanglement of their effects on various social and economic outcomes. Specifically, analysing both total social protection expenditures and their subcomponents individually can reveal which areas of public spending yield more effective results. Furthermore, this study employs the fixed-effects panel quantile regression method. While traditional panel data analysis methods generally focus on average effects, the quantile regression method provides a deeper understanding by focusing on different quantiles of the conditional distribution. This methodological advantage enables the measurement of the impact of social protection expenditures on income inequality at different levels of reduction in the Gini coefficient.

The subsequent sections of the study are structured as follows. First, the theoretical framework of the income distribution issue and the role of social transfers in this process are discussed. Then, the relevant literature on the impact of social transfers on income distribution is reviewed. In the empirical section of the study, the variables used are introduced, followed by a presentation of the methodological approach and findings. The study concludes with results and policy recommendations.

2. Theoretical Framework: Income Distribution and the Role of Social Transfers

Under the conditions of perfect competition, it is argued that resource allocation in the market is efficient. However, economics rests on two fundamental pillars: efficiency and equity. The critical point to emphasize here is that achieving efficiency does not necessarily imply the achievement of equity. The most widely accepted indicator of equity is income distribution. Income distribution refers to the allocation of resources generated in an economy among the factors of production, either through the market mechanism or a centralized political decision-making process. This definition highlights the existence of two types of income distribution: primary income distribution and secondary income distribution. These correspond to the conceptualizations of “distribution of income” and “redistribution of income,” respectively. While primary distribution occurs through the market mechanism, secondary distribution involves state intervention aimed at creating a more equitable income distribution using various instruments. In short, income redistribution represents the state's effort to adjust the income distribution created by the market to a level deemed more equitable through specific policy tools (Kirmanoğlu, 2014: 201-211).

Inequality, a concept that emerges in various aspects of social activities, carries different meanings depending on the individual and the context. At this point, it is useful to distinguish between monetary and non-monetary inequality. While issues related to monetary inequality are measured in terms of financial metrics, non-monetary inequality encompasses broader dimensions, such as welfare or capabilities (Atkinson and Bourguignon, 2000). For instance, according to the Indian economist Amartya Sen (1980), the root of inequalities lies in deficiencies

in capabilities. Sen, associates the concept of "well-being" with truly living well-being able to live a long life, eat well, maintain good health, and achieve literacy, among other human capabilities. In Sen's perspective, the value of a standard of living is not in the possession of goods but in the life itself. Thus, from his point of view, what is intrinsically valued is people's capabilities, and inequality and poverty, for this reason, are fundamentally deficiencies in capabilities.

When we consider the measurement methods of inequality and the commonly used inequality indices, we see that they encompass various dimensions. However, economists are primarily concerned with the monetary aspect, focusing on household or individual income or consumption (Heshmati, 2004). Methods used to measure income inequality include the Lorenz Curve, Kernel Density Estimator, Pen's Parade, and the Kuznets Curve. These methods analyse different aspects of inequality and often serve complementary roles. The Lorenz Curve is one of the most widely used methods to visualize fairness in income distribution; it extends at a 45-degree angle under conditions of absolute equality but approaches the horizontal axis as inequality increases. Furthermore, the generalized Lorenz Curve stands out as it provides information not only about inequality but also about income levels. The Kernel Density Estimator, by adjusting the bin widths in histogram data, allows for a smoother analysis of distributions (Jenkins and Kerm, 2008). Pen's Parade, used to emphasize outliers in income distribution, dramatizes income inequality through the metaphor of a "parade of dwarfs," clearly illustrating income disparities by representing individuals' incomes with physical dimensions. Lastly, the Kuznets Curve offers a theoretical framework to explain the relationship between economic growth and income inequality, positing that inequality initially increases during the development process and subsequently decreases with the implementation of redistribution policies. The Kuznets Curve is regarded as an important model for understanding the dynamics of economic growth and inequality (Acemoglu and Robinson, 2002).

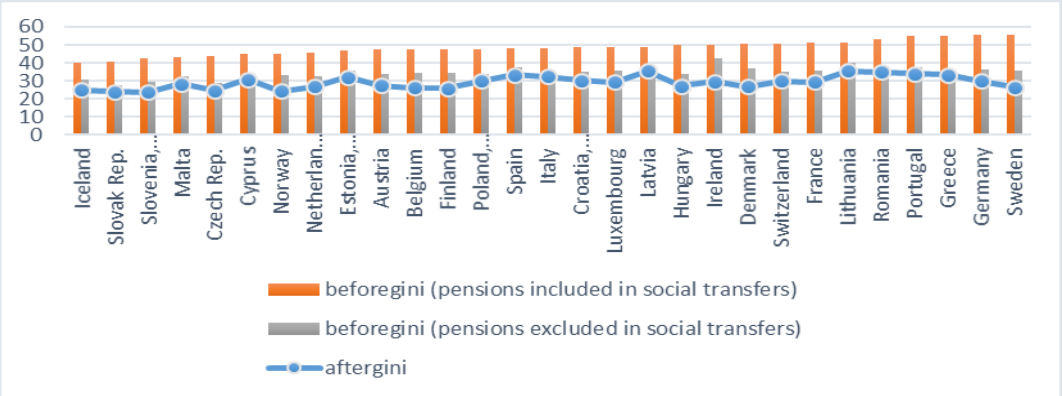
The commonly used inequality measurement methods are briefly summarised above. Commonly used inequality measurement indices are as follows: Gini Coefficient/Generalised Gini Coefficient, indices based on percentage Ratios (p980/p20, p10/p/50 etc.), Variance Coefficient - Logarithmic Variance, Robin Hood Index (Ricci-Schutz, Pietra Ratio, Hoover Index), General Entropy and Atkinson Index. Among these, Robin Hood Index, Atkinson Index and General Entropy methods provide important tools to assess the effects on social welfare and to make analyses for population subgroups. Thus, it is possible to analyse inequality in more detail at both micro and macro levels (Fellman, 2018). There are also Suits, Kakwani and Reynold-Smolensky indices that reveal the progressivity and income redistribution effect in analyses of tax policies (Arcarons and Calonge, 2015).

In conclusion, there are numerous indices available for measuring income inequality. Among these, the Gini Coefficient is the most widely used due to its simplicity and ease of calculation. The Gini Coefficient ranges between 0 and 1, representing the ratio of the area between the Lorenz curve and the line of absolute equality to the total area under the line of absolute equality. A Gini Coefficient closer to 1 indicates greater inequality. This coefficient provides significant advantages, particularly in cross-country comparisons and in assessing the impact of policies on inequality.

Social protection expenditures are among the primary tools used by states to combat income inequality. Social protection refers to a comprehensive set of programs aimed at safeguarding individuals and households against poverty, inequality, and risks through cash or in-kind support (Ait Mansour, 2016). These programs aim to enhance individuals' resilience against various social, economic, and environmental risks, such as illness, old age, unemployment, and natural disasters. Social protection measures funded by the state help individuals manage risks and actively participate in societal life. Social protection expenditures address a wide spectrum of social groups, encompassing a range of spending categories. These include expenditures on sickness and disability, old age, survivors, family and children, unemployment, housing, combating social exclusion, and other social protection measures (IMF, 2024).

Figure 1 below examines the Gini coefficients of the countries included in the study for the years 2007–2021, both before and after social transfers. The pre-transfer Gini coefficients are further divided into two categories. The first category, referred to as "beforegini-pensions included in social transfers," reflects the scenario where pensions are considered as part of social transfers, representing a situation with no additional contributions. The second category, "beforegini-pensions excluded in social transfers," excludes pensions from social transfers and incorporates their effect into the calculation of the Gini coefficient.

Graph 1: Gini Coefficient Before and After Social Transfers (2007–2021 Averages)



Source: Created by the author by utilising Eurostat 2025 data.

The countries presented in Graph 1 are ranked in ascending order based on their *beforegini* values (pensions included in social transfers). This scenario, where no additional contributions are considered, including pensions (pensions included in social transfers), essentially reflects pure primary income distribution (market distribution). Within this framework, the countries with the most unequal primary income distribution are Greece, Germany, and Sweden. After social transfers, the countries with the most unequal income distribution are Romania, Lithuania, and Latvia. In the case where pensions are not considered as social transfers (pensions excluded in social transfers), the countries with the most unequal income distribution are Latvia, Lithuania, and Ireland. The observed differences between primary and secondary income distribution, as illustrated in Graph 1, primarily stem from the diverse social policies implemented by governments.

Table 1 below presents the Gini coefficients before and after social transfers for the countries included in the analysis for the year 2021, along with the *ginidif* values, which indicate the effectiveness of social transfers in reducing income inequality. The calculation of the *ginidif* variable is based on the formulation provided in Table 2.

Table 1: GINI Coefficients and the Success of Social Transfers, 2021

Countries	**aftergini**	**beforegini**	**ginidif**
Slovenia	23.2	41.0	76.7
Sweden	23.4	44.3	89.3
Norway	23.7	43.1	81.9
Slovak Rep.	24.5	42.2	72.2
Denmark	25.2	45.2	79.4
Czechia	25.3	44.9	77.5
Hungary	25.6	48.8	90.6
Austria	26.2	46.3	76.7
Finland	26.2	46.4	77.1
Malta	26.3	40.4	53.6
Belgium	26.3	46.7	77.6
France	26.6	49.9	87.6
Luxembourg	27.4	44.0	60.6
Netherlands	27.6	45.4	64.5
Iceland	28.0	39.0	39.3
Cyprus	29.8	37.3	25.2
Switzerland	30.4	46.5	53.0
Germany	30.4	54.4	78.9
Ireland	31.3	48.2	54.0
Spain	31.9	45.4	42.3
Italy	32.0	47.7	49.1
Poland	32.2	51.4	59.6
Estonia	33.4	46.9	40.4
Lithuania	33.8	46.9	38.8
Greece	34.3	49.4	44.0
Latvia	35.4	47.2	33.3
Portugal	36.8	51.0	38.6
Romania	38.3	55.6	45.2

Note: Since Croatia has no data for 2021, it is not included in the table.

Source: Created by the author by utilising Eurostat 2024 data.

Table 1 demonstrates the effectiveness of social transfers in reducing income inequality for the year 2021. The countries listed in the table are ranked from the lowest to the highest post-transfer Gini coefficient, reflecting the scenario where no additional contributions, including pensions, are considered. The *ginidif* value, which represents the difference between the Gini coefficients before and after social transfers, measures the extent to which social transfers reduce inequality. The results indicate that Norway, France, Sweden, and Hungary are the most successful countries in reducing income inequality through social transfers. In contrast, the effectiveness of social transfers appears to be more limited in countries such as Cyprus, Latvia, and Portugal.

3. Literature Review

A review of the relevant literature reveals that numerous studies have examined the relationship between income distribution and social transfers. These studies generally suggest that public social expenditures have a reducing effect on income inequality, indicating a negative relationship between social expenditures and income inequality. In other words, social protection expenditures are generally expected to decrease income inequality. Within this framework, the following section highlights several studies focusing on the relationship between social protection expenditures and income inequality.

Afonso et al., (2010), analysed the impact of public social expenditures on income distribution and their efficiency in 26 OECD countries using data from the 1995–2000 period. The study, conducted with Data Envelopment Analysis (DEA), found that social expenditures and education levels improved income distribution. However, it was noted that the efficiency of social expenditures varied across countries, with higher efficiency observed in countries with strong educational achievements and high-quality public institutions. The results highlighted the importance of not only increasing expenditure amounts but also enhancing expenditure efficiency to achieve a more equitable income distribution. Niehues, (2010); examined the relationship between social expenditures and income inequality in selected European countries during the 1993–2004 period using the Dynamic Panel Data Analysis method and identified a negative relationship between social assistance and income inequality. Component-level analyses showed that unemployment and old-age benefits had a statistically significant and negative effect on income inequality. Foster (2012) investigated the impact of social security, health, and education expenditures on income inequality in a study covering 12 developed OECD countries and 35 developing countries using Cross-Sectional Panel Data Analysis. The study found that social expenditures significantly reduced the Gini coefficient in industrialized countries, while in developing countries, health and education expenditures decreased inequality; however, social security expenditures were found to increase inequality.

Doerrenberg and Peichl (2014) examined the impact of social expenditures on income inequality in OECD countries using the Fixed Effects Model and panel

data analysis methods. Their findings revealed that social expenditures reduce income inequality more effectively than taxation. İlgün (2015) evaluated the effects of public social expenditures on income distribution in 17 OECD countries during the 1995–2012 period using panel data analysis. The results showed that an increase in the share of social expenditures in GDP has a positive effect on reducing income inequality. Karabulut et al. (2016) examined the effects of social transfer expenditures on income distribution and found that transfer incomes reduced the Gini coefficient compared to the pre-transfer period. The results indicate that social transfer expenditures can serve as an effective social policy instrument in mitigating income inequality. Eroğlu et al. (2017) examine the impact of social assistance expenditures on income inequality in 21 OECD countries, including Türkiye, from 2004 to 2011 using panel data analysis. The findings indicate that social assistance spending reduces income inequality and is more effective than education expenditures in addressing distributional disparities. Additionally, unemployment and population growth exacerbate inequality, while trade openness, education expenditures, an aging population, and school enrolment have a mitigating effect.

Altunöz and Çondur (2018) analyzed the relationship between social security expenditures and income distribution in Turkey during the period 1985–2016 using the Johansen Cointegration Test. The study found that an increase in social security expenditures had a reducing effect on income inequality and identified a bidirectional causality between the Gini coefficient and social security expenditures. Sanchez and Perez-Corral (2018) examined the impact of public social expenditures on income inequality in 28 EU member states during the period 2005–2014 using the Dynamic Panel Data Analysis method. The findings revealed a negative effect of public social expenditures on income inequality, with this effect being more pronounced in developing EU countries. Doumbia and Kinda (2019), in a study covering 83 countries, investigated the impact of social protection and infrastructure expenditures on income inequality using Panel Regression Analysis. The study concluded that increasing social protection expenditures reduces income inequality and that social expenditures financed through cuts in defense spending further enhance this effect. İnam (2019) investigated the relationship between social expenditures and income distribution in 29 EU member states, including Türkiye, for the period 2007–2015 using panel data analysis. The findings indicate that healthcare expenditures have a positive impact on income inequality, while social protection expenditures contribute to reducing inequality. Specifically, an increase in healthcare expenditures is associated with greater income disparity, whereas higher social protection spending leads to a more equitable income distribution.

D'Agostino et al. (2020) analyzed the relationship between social expenditures and income inequality in 26 OECD countries during the period 1980–2015 using panel data regression analysis and confirmed the inequality-reducing effect of social expenditures. Dayar and Akıncı (2020) examined the impact of public

social transfer expenditures on personal income distribution in Turkey for the period 1987–2016. The study employed the "Maki (2012) multiple structural break cointegration test," the "Fully Modified Ordinary Least Squares (FMOLS) test," and the "Hatemi-J (2012) asymmetric causality test." The findings revealed a long-term cointegration relationship between public social transfer expenditures and the Gini coefficient, an indicator of income inequality, showing that a 1% increase in expenditures reduces the Gini coefficient by 0.505%. Kalkavan and Ersin (2020) analysed the impact of social expenditures on income distribution in OECD countries during the period 1980–2015 using the Dumitrescu-Hurlin Causality Test and found a significant causal relationship between social expenditures and income inequality.

Osabohien et al. (2020) analysed the impact of social protection programs on income distribution in 38 African countries during the period 2000–2017 using Panel Data Analysis. The study found that a 1% increase in social protection expenditures reduced income inequality by 26%. Polat (2020) examined the impact of household transfer payments on income distribution using data from 36 OECD countries for the period 1996–2018. The findings indicated that transfer payments significantly reduced income inequality. Yardımcıoğlu and Yayla (2020) examine the impact of social protection expenditures and pension payments on income distribution in seven Central and Eastern European countries from 2005 to 2017 using panel data analysis. The empirical findings indicate that while pension payments have a statistically significant negative effect on income inequality, social protection expenditures do not exhibit a statistically significant impact.

Popova (2023) investigated the impact of social protection expenditures on income poverty and inequality using 535 observations from 101 countries between 1998 and 2017. The study assessed the effects of the focus level of social expenditures on lower-income groups and the expenditure amount through panel data regression analysis. The findings revealed that social protection expenditures effectively reduced income inequality and poverty, with this effect being more pronounced in low- and middle-income countries. Yılmaz and Rakıcı (2024) analyze the long-term impact of social protection expenditure components on income inequality in Türkiye from 1987 to 2018 using the ARDL model. The findings indicate that, except for healthcare expenditures, social protection spending reduces income inequality.

4. Data, Methodology and Findings

4.1. Data

The primary objective of this study is to assess the effectiveness of social protection expenditures in mitigating income inequality. To this end, data from 29

European countries[2] covering the period 2007–2021 were utilized, selected based on data availability. This period encompasses critical economic shocks, including the 2008 global financial crisis and the Covid-19 pandemic, both of which significantly influenced social protection policies and expenditures.

Table 2: Data

Acronyms	Variables	Measurement Units	Source
Dependant Variable			
ginidif	$\frac{beforegini - aftergini}{beforegini} \times 100$	% change	Eurostat, 2024
Explanatory Variables			
esp	Expenditure on Social Protection	Percent of GDP	IMF, 2024
esd	Expenditure on Sickness & Disability	Percent of GDP	IMF, 2024
eoa	Expenditure on Old Age	Percent of GDP	IMF, 2024
efc	Expenditure on Family & Children	Percent of GDP	IMF, 2024
es	Expenditure on Survivors (Widow and Orphan Pensions, etc.)	Percent of GDP	IMF, 2024
eu	Expenditure on Unemployment	Percent of GDP	IMF, 2024
eh	Expenditure on Housing	Percent of GDP	IMF, 2024
eosp	(Expenditure on Social Exclusion n.e.c.) + (Expenditure on Social Protection n.e.c.)	Percent of GDP	IMF, 2024
Control Variables			
gdp	GDP per capita growth	(annual %)	World Bank, 2024
inf	Inflation, consumer prices	(annual %)	World Bank, 2024
pop	Population growth	(annual %)	World Bank, 2024

Note: In Table 1, beforegini variable shows the Gini coefficient for equivalent disposable income before social transfers (pensions are also considered as social transfers and their effect is not included in the Gini calculation). aftergini variable shows the Gini coefficient for equivalent disposable income after social transfers.

The dependent variable of this study, which aims to evaluate the effectiveness/success of social transfers, is the *ginidif* variable, representing the change in income inequality after social transfers compared to the pre-transfer situation (pensions included in social transfers). A higher *ginidif* value indicates greater success in social transfers. The explanatory variables of the study are based on the COFOG (Classification of the Functions of Government)

[2] Austria, Belgium, Croatia, Rep. of, Cyprus, Czech Rep., Denmark, Estonia, Rep. of, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, The, Norway, Poland, Rep. of, Portugal, Romania, Slovak Rep., Slovenia, Rep. of, Spain, Sweden, Switzerland

classification within the Government Finance Statistics (GFS) system of the International Monetary Fund (IMF). These variables consist of social protection expenditures and their subcomponents, including expenditures on sickness and disability, old age, family and children, survivors, unemployment, and housing. Additionally, "other social exclusion" and "other social protection" expenditures are aggregated and included in the analysis as a single variable. Control variables, such as economic growth, inflation, and population growth rate, are derived from the World Bank database and incorporated into the analysis.

In Table 3, descriptive statistics of the variable used in the study are given. Correlation matrix is given in Table 4.

Table 3: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ginidif	402	67.9	18.27	25.867	124.231
gdp	406	1.195	4.184	-14.642	23.444
inf	406	1.805	2.019	-4.448	15.402
pop	406	0.342	0.875	-2.451	3.931
esp	406	16.7	4.06	8.573	27.078
esd	406	2.729	1.292	0.413	7.551
eoa	406	8.724	2.83	1.937	16.01
efc	406	1.954	0.947	0.437	5.476
es	406	0.964	0.77	0.002	2.763
eu	406	1.089	0.803	0.05	3.783
eh	406	0.226	0.258	0	1.31
eosp	406	1.008	0.587	0.115	3.212

Source: Prepared by the author.

Table 4. Matrix of correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) ginidif	1.000											
(2) gdp	0.003	1.000										
(3) inf	-0.153	0.033	1.000									
(4) pop	0.180	-0.128	-0.126	1.000								
(5) esp	0.499	-0.289	-0.234	-0.013	1.000							
(6) esd	0.508	-0.135	0.024	0.058	0.379	1.000						
(7) esa	0.187	-0.185	-0.242	-0.208	0.752	-0.167	1.000					
(8) efc	-0.108	-0.091	-0.190	-0.121	0.365	-0.387	0.543	1.000				
(9) es	0.439	-0.121	0.038	0.266	0.433	0.501	-0.047	-0.356	1.000			
(10) eu	0.262	-0.251	-0.183	0.146	0.603	0.288	0.188	0.191	0.319	1.000		
(11) eh	0.369	-0.046	0.013	0.125	0.304	0.295	-0.065	-0.137	0.358	0.492	1.000	
(12) eosp	0.344	-0.126	-0.072	0.260	0.314	0.397	-0.119	-0.176	0.375	0.278	0.260	1.000

Source: Prepared by the author.

4.2. Methodology

This paper analyses the effectiveness of social protection expenditures in reducing income inequality using eight models, each incorporating a set of control variables. The primary distinction among these models lies in the inclusion of additional social protection expenditure components, allowing for the disaggregation of the effects of different types of expenditures and enabling a more detailed analysis of their impact on income inequality. Model 1 includes total social protection expenditures, while Model 2 incorporates sickness and disability expenditures, and Model 3 includes old-age expenditures. Model 4 examines expenditures on families and children, whereas Model 5 focuses on expenditures related to survivors and orphans. Model 6 accounts for unemployment-related expenditures, while Model 7 considers housing expenditures. Finally, Model 8 encompasses the sum of expenditures on social exclusion and other social protection measures. The models developed in this study align with previous research examining the relationship between social protection expenditures and income inequality, such as those by Niehues (2010), Foster (2012), Doerrenberg and Peichl (2014), Eroğlu et al. (2017), and D'Agostino et al. (2020), and Popova (2023). However, this study distinguishes itself from the existing literature through its methodological approach and the selection of the dependent variable, which measures changes in the Gini coefficient before and after social transfers.

The basic panel data representation of the models in this study is expressed as follows:

$$ginidif_{it} = \beta_0 + \beta_1 gdp_{it} + \beta_2 inf_{it} + \beta_3 pop_{it} + \beta_4 esp_{it} + u_{it} \quad (1)$$

$$ginidif_{it} = \beta_0 + \beta_1 gdp_{it} + \beta_2 inf_{it} + \beta_3 pop_{it} + \beta_4 esd_{it} + u_{it} \quad (2)$$

$$ginidif_{it} = \beta_0 + \beta_1 gdp_{it} + \beta_2 inf_{it} + \beta_3 pop_{it} + \beta_4 eoa_{it} + u_{it} \quad (3)$$

$$ginidif_{it} = \beta_0 + \beta_1 gdp_{it} + \beta_2 inf_{it} + \beta_3 pop_{it} + \beta_4 efc_{it} + u_{it} \quad (4)$$

$$ginidif_{it} = \beta_0 + \beta_1 gdp_{it} + \beta_2 inf_{it} + \beta_3 pop_{it} + \beta_4 es_{it} + u_{it} \quad (5)$$

$$ginidif_{it} = \beta_0 + \beta_1 gdp_{it} + \beta_2 inf_{it} + \beta_3 pop_{it} + \beta_4 eu_{it} + u_{it} \quad (6)$$

$$ginidif_{it} = \beta_0 + \beta_1 gdp_{it} + \beta_2 inf_{it} + \beta_3 pop_{it} + \beta_4 eh_{it} + u_{it} \quad (7)$$

$$ginidif_{it} = \beta_0 + \beta_1 gdp_{it} + \beta_2 inf_{it} + \beta_3 pop_{it} + \beta_4 eosp_{it} + u_{it} \quad (8)$$

In the models presented above, i and t represent the panel data dimensions, while *ginidif* denotes the dependent variable, measuring the effectiveness of social transfers in reducing income inequality. The coefficient β_0 represents the intercept term, while u_{it} denotes the error term. The coefficients β_1, β_2 and β_3 correspond to the parameters that indicate the magnitude and direction of the impact of the control variables (*gdp, inf,* and *pop*) on the dependent variable. Finally, the β_4 coefficients capture the effect of the explanatory variables,

representing different components of social protection expenditures, on the dependent variable.

This study employs the Fixed Effects Panel Quantile Regression method to model and analyze different aspects of the individual effects of the models, which are presented in their simplified form in Equations 1, 2, 3, 4, 5, 6, 7, and 8, on the conditional distribution. Quantile regression, proposed by Koenker and Bassett (1978), is an extension of classical linear regression that estimates the conditional median and other quantiles of the dependent variable. Unlike classical linear regression, which focuses on conditional mean estimation, this approach allows for the examination of the effects of covariates across the entire distribution (Buhai, 2005).

The Ordinary Least Squares (OLS) method relies on assumptions such as the error terms having a mean of zero, constant variance, and no autocorrelation. In contrast, quantile regression does not require such assumptions and provides more reliable estimates in the presence of outliers (Davino et al., 2014). Fixed Effects Panel Quantile Regression offers robust results in panel data analysis by examining how variables behave across different quantiles. This method delivers more reliable outcomes compared to classical regression models, as it estimates the behaviour of each point in the conditional distribution rather than focusing solely on mean effects (Koenker, 2004; Machado and Santos Silva, 2019). Koenker and Bassett (1978) emphasized that quantile regression does not depend on strong assumptions regarding error terms, making it more robust compared to the OLS method. Moreover, quantile regression coefficients often vary across quantiles, enabling the assessment of explanatory variables' effects not only on the mean but also across different quantiles. Finally, quantile regression is an analytical method that does not rely on any specific distributional assumptions, allowing for greater flexibility in analyzing data (Koenker, 2004; Sherwood and Wang, 2016).

The fixed effect panel quantile regression model is expressed as follows:

$$Y_{it} = a_i + X'_{it}\,\beta + (\delta_i + Z'_{it}\,\gamma)\,U_{it} \qquad i = 1, \dots, N \qquad t = 1, \dots, T \qquad (9)$$

In equation (9) above, Y_{it} represents the dependent variable indicating the success of social transfers in reducing income inequality, while X_{it} denotes the vector of explanatory and control variables used in the study. β is the vector of coefficients estimating the effects of social protection expenditures on the dependent variable, and a_i; represents individual fixed effects, capturing individual differences and elements that remain constant over time. $(\delta_i + Z'_{it}\,\gamma)$ refers to parameters describing the effects of fixed effects on the scale and shape of the conditional distribution. The estimation process involves several steps: first, the β parameter is estimated using the averages of the data; second, the individual fixed effects a_i are estimated to control for individual differences in the model. Subsequently, the

scale parameters (δ) and (γ) of the error terms derived from the residuals are estimated. Finally, estimates are obtained at the selected quantile, and the effects on the quantile and individual effects are analyzed.

4.3. Empirical Results

This section of the study presents the empirical findings obtained within the framework of the introduced dataset and methodological approach. First, the normality of the data distribution is assessed using the Shapiro-Wilk test.

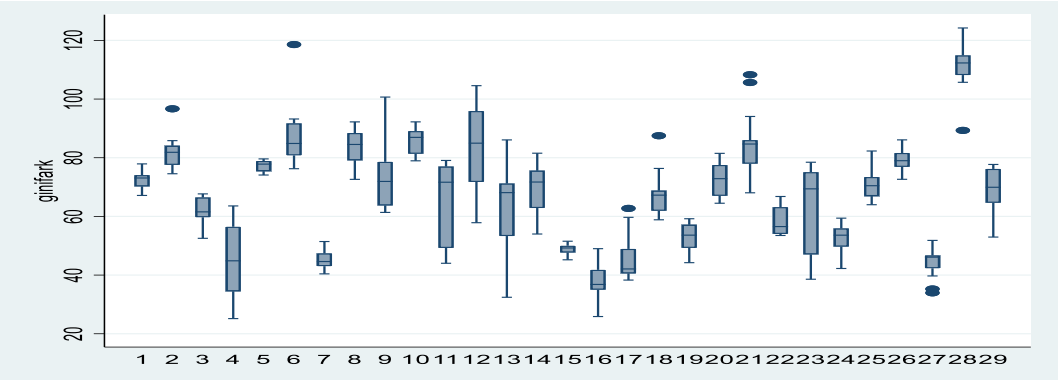
Table 5: Testing the Compliance of Variables with Normal Distribution (Shapiro-Wilk W Test Results)

Variable	W	V	Z	Prob>z
ginidif	0.953	13.114	6.128*	0.0005
gdp	0.875	34.968	8.463*	0.0000
inf	0.979	5.932	4.239*	0.0000
pop	0.981	5.182	3.915*	0.0001
esp	0.978	6.263	4.368*	0.0001
esd	0.945	15.413	6.513*	0.0000
eoa	0.977	6.502	4.458*	0.0000
efc	0.92	22.342	7.397*	0.0000
es	0.945	15.444	6.518*	0.0000
eu	0.901	27.568	7.897*	0.0000
eh	0.796	57.022	9.628*	0.0000
eosp	0.923	21.410	7.295*	0.0000

Note: * indicates statistical significance at 1% level of significance.

Table 5 presents the results of the Shapiro–Wilk W test conducted to evaluate the normality of the variables used in the study. According to the test results, the p-value (Prob> z) for all variables is found to be less than 0.05. This indicates that the assumption of normality is rejected, and the variables do not conform to a normal distribution. These findings support the preference for the Fixed Effects Panel Quantile Analysis, as this method does not require the assumption of normality (Koenker, 2004; Sherwood and Wang, 2016).

Graph 2: Boxplot of the Dependent Variable (*ginidif*)



Source: Prepared by the author.

This boxplot visualizes the distribution of the dependent variable (ginidif), highlighting its deviation from normality across different observation points. The graph emphasizes distribution characteristics such as the median, interquartile range, and outliers, underscoring the necessity for detailed analyses at the quantile level and supporting the suitability of the quantile analysis method.

Since the time dimension of the data set used in the study is smaller than the horizontal cross-sectional dimension, Pesaran (2004) CD test was used to detect cross-sectional dependence (CSD).to the results in Table 6, the null hypothesis 'there is no horizontal cross-section dependence' is rejected at 1% significance level for all series and all models and it is confirmed that there is horizontal cross-section dependence among the variables.

Table 6. Pesaran Cross-Sectional Dependence Test

Test of Cross-Sectional Dependence for the Series		
Variable	CD-test	p-value
ginidif	12.576*	0.000
gdp	55.142*	0.000
inf	51.526*	0.000
pop	2.785*	0.005
esp	33.864*	0.000
esd	9.295*	0.000
eoa	34.488*	0.000
efc	14.316*	0.000
es	15.634*	0.000
eu	24.791*	0.000
eh	3.407*	0.001
eosp	10.776*	0.000
Test of Cross-Sectional Dependence for the Panel Models		
Model 1	2.541*	0.011
Model 2	7.164*	0.000
Model 3	0.788*	0.007
Model 4	8.852*	0.000
Model 5	7.439*	0.000
Model 6	7.320*	0.000
Model 7	8.644*	0.000
Model 8	7.563*	0.000

Note: * indicates statistical significance at 1% level of significance.

The stationarity properties of the data were examined using Pesaran's CADF test, considering cross-sectional dependence. As shown in Table 7, some variables are

stationary at level, while others become stationary only after taking the first differences.

Table 7. Cross-sectionally Dependent Panel Unit Root Test

Variable	Level		First difference	
	t-bar	p-value	t-bar	p-value
ginidif	1.175	0.880	-2.109*	0.017
gdp	-3.486*	0.000	-	-
inf	-2.725*	0.003	-	-
pop	0.889	0.813	-2.489*	0.006
esp	2.419	0.992	-4.218*	0.000
esd	1.772	0.962	-2.825*	0.002
eoa	-3.869*	0.000	-	-
efc	2.790	0.997	-4.500*	0.000
es	3.135	0.999	-2.408*	0.008
eu	1.980	0.976	-3.773*	0.000
eh	-2.572*	0.005	-	-
eosp	1.077	0.859	-6.118*	0.000

Note: *; indicates statistical significance at 1% level of significance.

In the study, some series were found to be stationary at level, while others became stationary in their first differences. In panel data analysis, it is not necessary for all series to be stationary at the same level; however, the stationarity properties of the series require the selection of appropriate econometric methods. Accordingly, a cointegration analysis was conducted to examine the long-run relationship between the dependent variable and the regressors. Given the evidence supporting horizontal cross-sectional dependence in the panel, second generation panel cointegration tests are preferred instead of first-generation tests. In this framework, the existence of cointegration is tested with the Westerlund (2008) Durbin-H method. Under the assumption that the dependent variable is I(1), this method allows panel cointegration analysis to be applied whether the independent variables are I(1) or I(0) and takes into account common factor effects (Westerlund, 2008).In the Durbin-H method, the existence of a cointegration relationship is examined separately at the group (DH-g) and panel (DH-p) levels. In the Durbin-H panel cointegration test, the autoregressive parameter is assumed to be homogeneous across all cross-sectional units. Under this assumption, the rejection of the null hypothesis implies that a cointegration relationship exists for all cross-sections. Conversely, the Durbin-H group test allows for heterogeneity in the autoregressive parameter across cross-sections; hence, rejecting the null.

Table 8. Durbin-Hausman Panel Cointegration Test Results

	DH-g	DH-p	Comment
Model 1	29.525*	2.9872***	Cointegration is observed at both the group and panel levels.
Model 2	24.595*	4.168**	Cointegration is observed at both the group and panel levels.
Model 3	108.927*	0.177	Cointegration exists for some cross-sections; however, it is absent at the panel level.
Model 4	13.558*	1.496***	Cointegration is observed at both the group and panel levels.
Model 5	19.714*	1.961**	Cointegration is observed at both the group and panel levels.
Model 6	77.846*	2.449*	Cointegration is observed at both the group and panel levels.
Model 7	8.420*	0.885	Cointegration exists for some cross-sections; however, it is absent at the panel level.
Model 8	6.137*	0.229	Cointegration exists for some cross-sections; however, it is absent at the panel level.

Notes: *, ** and *** indicate statistical significance at 1%, 5% and 10% significance level, respectively.

The results of the Westerlund (2008) Durbin-Hausman panel cointegration test presented in Table 8 assess the existence of a long-run relationship between social protection expenditures and income inequality. These findings support the long-run effect of social protection expenditures on income inequality. The fact that cointegration is generally detected indicates that the variables move together in the long run and the effectiveness of social transfers in reducing income inequality is sustainable over time. In this context, to further analyse the extent to which social protection expenditures contribute to reducing income inequality, panel quantile regression analysis will be applied in the next step. This method will provide more targeted insights to policy makers by allowing the assessment of how the effectiveness of social protection expenditures changes at different distribution points.

Table 9 below presents the results of the panel quantile analysis, which independently evaluates the impact of each expenditure category and provides a more comprehensive assessment of the role of social protection expenditures in reducing income inequality.

Tablo 9: Panel Quantile Analysis Results

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Dependent variable : *ginidif*								
0.25 quantile								
gdp	0.746* (6.02)	0.617* (4.68)	0.555* (4.23)	0.519* (4.17)	0.456* (2.63)	0.539* (3.90)	0.471* (3.60)	0.433* (3.32)
inf	-0.699** (-2.26)	-1.032* (-3.29)	-0.576 (-1.53)	-0.979* (-3.13)	-1.167* (-2.57)	-1.128* (-3.22)	-1.219* (-3.60)	-1.169* (-3.41)
pop	-0.078 (-0.07)	-1.997** (-1.84)	-0.464 (-0.35)	-0.900 (-0.76)	-2.327 (-1.55)	-1.835 (-1.59)	-2.152** (-1.90)	-2.455** (-2.15)
esp	(2.566)* (6.55)	-	-	-	-	-	-	-
esd	-	5.842* (4.23)	-	-	-	-	-	-
eoa	-	-	4.223 (5.18)	-	-	-	-	-
efc	-	-	-	17.100* (3.73)	-	-	-	-
es	-	-	-	-	3.383 (1.62)	-	-	-
eu	-	-	-	-	-	3.371** (2.23)	-	-
eh	-	-	-	-	-	-	9.059 (1.17)	-
eosp	-	-	-	-	-	-	-	0.683 (0.27)
0.50 quantile								
Gdp	0.713* (7.28)	0.540* (5.38)	0.482* (4.93)	0.446* (4.64)	0.404* (3.48)	0.466* (4.45)	0.375* (3.78)	0.346* (3.48)
Inf	-0.434** (-1.76)	-0.763* (-3.18)	-0.316 (-1.12)	-0.755* (-3.12)	-0.846* (-2.77)	-0.837* (-3.14)	-0.907* (-3.52)	-0.860* (-3.28)
pop	-0.064 (-0.07)	-2.157* (-2.63)	-0.803 (-0.80)	-1.415 (-1.55)	-2.476* (-2.47)	-2.042* (-2.34)	-2.341* (-2.73)	-2.706* (-3.13)
esp	2.680* (8.64)	-	-	-	-	-	-	-
esd	-	6.336* (6.06)	-	-	-	-	-	-
eoa	-	-	3.949* (6.51)	-	-	-	-	-
efc	-	-	-	14.549* (4.12)	-	-	-	-
es	-	-	-	-	4.232 (3.03)	-	-	-
eu	-	-	-	-	-	3.550* (3.11)	-	-
eh	-	-	-	-	-	-	9.398 (1.60)	-
eosp	-	-	-		-	-	-	0.639 (0.33)

Notes: * and ** indicate statistical significance at the 1% and 5% level, respectively. Z statistics are given in parentheses.

Table 10. Panel Quantile Analysis Results (Continued)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Dependent variable : *ginidif*								
0.75 quantile								
gdp	0.671* (4.95)	0.454* (3.39)	0.398* (3.20)	0.357* (2.85)	0.354* (2.82)	0.375* (2.75)	0.266** (1.97)	0.248** (1.86)
inf	-0.083 (-0.25)	-0.465 (-1.46)	-0.019 (-0.05)	-0.481 (-1.53)	-0.534 (-1.62)	-0.473 (-1.37)	-0.553 (-1.58)	0-.515 (-1.47)
pop	-0.047 (-0.04)	-2.334** (-2.12)	-1.190 (-0.94)	-2.044** (-1.71)	-2.621* (-2.42)	-2.300** (-2.03)	-2.556** (-2.19)	-2.987** (-2.56)
esp	2.831* (6.60)	-	-	-	-	-	-	-
esd	-	6.884* (4.92)	-	-	-	-	-	-
eoa	-	-	3.635* (4.71)	-	-	-	-	-
efc	-	-	-	11.438* (2.48)	-	-	-	-
es	-		-	-	5.056* (3.35)	-	-	-
eu	-	-	-	-	-	3.774* (2.54)	-	-
eh	-	-	-	-	-	-	9.784 (1.22)	-
eosp	-	-	-	-	-	-	-	0.590 (0.23)

Notes: * and ** indicate statistical significance at the 1% and 5% level, respectively. Z statistics are given in parentheses.

Table 9 and 10, which present the results of the panel quantile analysis, indicates that the sample is divided into three quantiles. The 0.25 quantile reflects situations where the effectiveness of social transfers in reducing income inequality is the lowest, while the 0.50 quantile represents cases where the success of social transfers is moderate. The 0.75 quantile, on the other hand, corresponds to situations where social transfers are most effective in mitigating income inequality. Upon examining Model 1, it is observed that social protection expenditures demonstrate a significant and positive impact on reducing income inequality across all quantiles.

An analysis of the models related to the subcomponents of total social protection expenditures reveals that expenditures on sickness and disability, family and children, and unemployment exhibit a significant positive effect across all quantiles. Old-age expenditures show a significant and positive impact in the second and third quantiles, while survivors' pensions demonstrate a significant positive effect only in the third quantile. Conversely, housing expenditures in Model 7, as well as expenditures related to social exclusion and other social protection expenditures reflected in Model 8, do not exhibit statistically significant effects in any of the quantiles.

In conclusion, expenditures on sickness and disability, family and children, and unemployment are significant factors in reducing income inequality across all levels. Notably, expenditures on family and children emerge as the most impactful type of social protection expenditure in mitigating income inequality. This category demonstrates a pronounced effect across all quantile levels (0.25, 0.50, and 0.75) and stands out as one of the most effective factors indicating the success of social transfers. An examination of the control variables reveals that economic growth has a strong positive impact on the success of social transfers in reducing income inequality across all models and quantiles. In contrast, inflation and population growth rate exhibit a negative effect in all instances where their impact is statistically significant.

This study's findings align with previous research, such as Niehues (2010), Foster (2012), Eroğlu et al. (2017), Sanchez and Perez-Corral (2018), Popova (2023), and Yılmaz and Rakıcı (2024), which highlight the effectiveness of social protection expenditures—particularly family and child benefits—in reducing income inequality. However, unlike some prior studies, this research employs the quantile regression method to examine the impact of social expenditures across different income levels. By doing so, it demonstrates that family and child benefits have a significant effect not only on low-income groups but across all quantiles, offering a more comprehensive perspective on the broader impact of social transfers.

5. Conclusions and Recommendations

This study examines the impact of social protection expenditures on income inequality, utilizing data from 29 European countries for the period 2007–2021. The fixed-effects panel quantile regression method employed in the analysis allows for an assessment of the varying effects of social expenditures on income inequality across different quantiles. The findings reveal that social protection expenditures are generally effective in reducing income inequality. However, significant variations are observed in the components of these expenditures and the socioeconomic structures of the countries analysed.

Social protection expenditures directed towards families and children have been found to have the strongest impact on reducing income inequality, with significant and positive effects across all quantiles. Policies such as childcare services, family allowances, and educational support stand out as key elements enhancing the effectiveness of social protection expenditures. This finding indicates that social expenditures not only address existing inequalities but also serve as a crucial investment for the future. Expenditures on sickness and disability, as well as unemployment benefits, are also observed to play a significant role in reducing income inequality, being critical in supporting the most vulnerable groups in society. Furthermore, the positive effects of old-age expenditures in the middle and upper quantiles suggest that policies targeting the elderly population may have broader implications. In contrast, the insignificant impact of housing

expenditures and spending on social exclusion highlights the need for policymakers to develop new strategies to enhance the effectiveness of interventions in these areas.

Differences between countries are among the key factors determining the effectiveness of social transfers. For instance, Scandinavian countries have achieved successful outcomes in reducing income inequality through the efficient use of social expenditures. In contrast, the impact of social transfers on inequality reduction appears to be limited in the Baltic states and some Eastern European countries. This highlights the need for countries to adopt diverse approaches in the design and implementation of social expenditure policies. Moreover, the control variables used in the study were found to have a significant influence on the success of social transfers in reducing income inequality. For example, economic growth emerges as an important factor enhancing the effectiveness of social protection expenditures in addressing income inequality. This finding underscores the supportive role of inclusive growth policies in the success of social transfers. On the other hand, inflation and population growth were found to negatively affect the impact of social transfers. Therefore, it is essential to design social policies that account for economic stability and demographic changes.

In conclusion, the success of social protection expenditures in reducing income inequality is closely related not only to the total expenditure level but also to the effectiveness of its components. Expenditures directed towards families and children have the strongest impact on reducing income inequality, while the effects of other expenditure components vary. Future research should focus on examining the reasons behind the differences among countries in greater detail and conducting longer-term analyses, which could provide valuable insights for policymakers.

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