



# Income Inequality in the Over-Indebted Eurozone Countries and the Role of the Excessive Deficit Procedure

George Petrakos<sup>1</sup> · Kostas Rontos<sup>2</sup> · Luca Salvati<sup>3</sup> · Chara Vavoura<sup>4</sup> · Ioannis Vavouras<sup>5</sup>

Accepted: 22 May 2023 / Published online: 8 June 2023

© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2023

## Abstract

The present study identifies economic, political, and institutional variables that influence the distribution of personal incomes in the Eurozone countries facing severe fiscal imbalances, namely Greece, Italy, Portugal, and Spain. Crucially, this paper is the first to investigate the effect of the corrective arm of the Stability and Growth Pact, the so-called Excessive Deficit Procedure (EDP), on the income distribution of the aforementioned economies, where EDP was imposed over a long time period. The empirical results of this study show that (i) EDP impact depends on the specific mix of policy measures undertaken and that (ii) a high public debt does not reflect the existence of common factors shaping income distribution in the four Southern European economies. The share of labor income in total income, constitutes a significant determinant of income inequality. However, we find that the relationship between labor share and income inequality is also country-specific, depending on the intrinsic characteristics of each individual economic system.

**Keywords** Fiscal imbalances · Gini coefficient · Income distribution · Labor income · Southern Europe

**JEL Classification** D31 · D63 · E02

## 1 Introduction

The revision of the Stability and Growth Pact (SGP) is currently at the forefront of discussions within the European Union (EU), especially since its suspension in March 2020, as a response to the COVID-19 pandemic.<sup>1</sup> In this ongoing debate,

<sup>1</sup> The SGP is a set of fiscal rules designed to prevent European Union (EU) countries from spending beyond their means and to pursue sound public finances. Its suspension via the activation of the ‘general escape clause’ allowed national governments to mitigate the socioeconomic impact of the pandemic by exceeding the deficit and debt limits imposed by the SGP.

✉ Luca Salvati  
luca.salvati@uniroma1.it

Extended author information available on the last page of the article

emphasis has been placed on the effects of fiscal consolidation on debt sustainability (Alvarez 2021), leaving its impact on income inequality largely unexplained. The present paper aims at filling this gap investigating how the SGP, and especially the implementation of its corrective arm known as the Excessive Deficit Procedure (EDP),<sup>2</sup> has affected income inequality.

To integrate our analysis into the aforementioned debt-sustainability debate, we focus on the four European countries that, as of the end of 2020, have been associated with the highest public debt and, more specifically, with a government consolidated gross debt of at least 120% of their respective Gross Domestic Product (GDP). These countries, according to Eurostat estimates, are Portugal (135.2%), Italy (155.3%), Greece (206.3%), and Spain (120.0%),<sup>3</sup> being usually referred as PIGS countries based on their name initials. Not surprisingly, these ‘over-indebted’ countries are also the EU member states subjected to the EDP over the longest time periods (Portugal: 2005–2017; Italy: 2005–2013; Greece: 2004–2007 and 2009–2017; Spain: 2009–2019). This characteristic renders them a unique case when assessing empirically whether submission to the EDP constitutes a decisive determinant of income inequality.

When we consider the income distribution, we essentially look into personal income distribution, which refers to the way income is distributed among members of a given society, regardless of its origin, focusing on the discrepancies between higher and lower incomes. We measure income inequality via the Gini coefficient,<sup>4</sup> considered as a satisfactory statistical measure<sup>5</sup> insensitive to the extreme values of income distribution. More specifically, in order to account for the inherent differences in both size and composition of households, we used the Gini coefficient of equivalized disposable income.

Gini coefficients in the four Mediterranean countries were consistently higher than the European Union average, indicating greater income inequality (Fig. 1). The pattern that motivated our work can be envisaged since 2016, the final years of the EDP, when the Gini coefficients of PIGS countries showed a moderate convergence toward the European average, especially Greece, Portugal, and Spain.<sup>6</sup> We wonder whether, in the case of PIGS countries, fiscal austerity measures, embodied in the EDP, have increased inequality or if they have contributed to a more even distribution of income. The present study is, to our knowledge, the first to address this crucial question, thus contributing to a refined understanding of the effects of fiscal programs on income inequality. Given that the debate on the SGP revision is

<sup>2</sup> This mechanism has two ‘arms’, a ‘preventive’ and a ‘corrective’ one. It specifies that the state’s budget deficit cannot exceed 3% of the country’s Gross Domestic Product (GDP) and the national debt cannot surpass 60% of GDP, otherwise the EDP of the SGP is imposed to correct them.

<sup>3</sup> See Eurostat, online data code: GOV\_10DD\_EDPT1, update: 22/02/2022.

<sup>4</sup> This measure was developed by Gini (1912) and, when expressed as a percentage, it takes values ranging from 0 (absolute equality in income distribution) to 100 (absolute inequality).

<sup>5</sup> For the measurement of income inequality, see Schutz (1951), and McGregor, Smith and Wills (2019); for the Gini coefficient, see Kimura (1994).

<sup>6</sup> See Eurostat, Gini coefficient of equivalized disposable income, EU-SILC survey (online data code: TESS190, update 29/04/2022).

ongoing, the current study brings forward a timely aspect of such policies that the EU cannot afford to overlook.

To address our research question, besides the possible institutional source of inequality that is the EDP, we consider additional candidate determinants. Simply put, to what extent does a high public debt reflect the existence of common factors shaping income distribution? Hence, this paper contributes to the literature on income inequality disclosing its main causes in the four over-indebted economies of Southern Europe. Among other economic variables, we look into growth, unemployment, and the labor income share in total income. We also considered the possible presence of specific structural sociopolitical characteristics (e.g. Rontos et al. 2019), mainly in the form of political budget cycles (PBCs), which have been documented to severely affect the actual budget balance especially in Greece (Petraikos et al. 2021a).

We employ an individual model analysis that identifies different significant predictors for each country, thus emphasizing the existence of country-specific traits, which have the potential to either hinder or boost the efficiency of EDP-like measures. This article is organized as follows. Section 2 provides an extensive literature review. Section 3 describes data and methodologies employed in this study. Section 4 illustrates the main results of the econometric models. Empirical findings were discussed in Sect. 5 and, finally, Sect. 6 proposes a short, evidence-based conclusion.

## 2 Literature Review

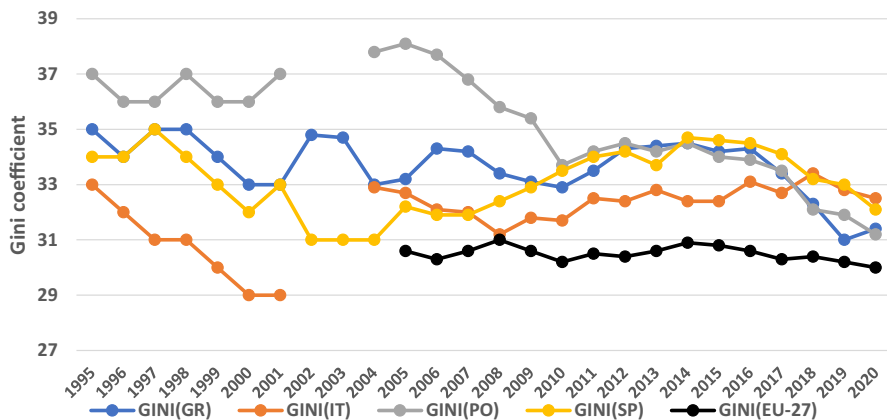
Our paper contributes to the economic literature in several ways. To begin with, this work stands in a long-established research stream on the possible trajectories for the pending reform of the SGP. Given that the basic objective of the SGP, and especially the EDP, is to ensure fiscal discipline in the EU, existing research is centered around the impact that the SGP has had on the reduction of excessive deficit and debt (e.g., Darvas et al. 2018; Blanchard 2019; Truger 2020; Blanchard et al. 2021; Alvarez 2021; Pisani-Ferry 2021). The general conclusion of these works is that the SGP has strengthened fiscal discipline (e.g., Herwartz and Theilen 2022; De Jong and Gilbert 2020).

However, this research does not extend to the investigation of the effects of EDP on income distribution. Our paper adds to the literature by considering explicitly this effect and is, to our knowledge, the first to do so for the four over-indebted EU countries, where the EDP of the SGP was imposed over the longest time period in Europe. Since intuition dictates that the duration of a regime, such as the EDP, could affect its impact, these countries constitute an excellent sample for the study of the effects of fiscal programs.

A small number of studies has attempted to examine the social consequences of fiscal rules but have produced some mixed results and interpretations.<sup>7</sup> Hartwig

---

<sup>7</sup> See Penner (2001), Nerlich and Reuter (2013), Dahan and Strawczynski (2013) and Brändle et al. (2018).



**Fig. 1** The evolution of the Gini coefficient of equivalized disposal income for Greece, Italy, Portugal, Spain, and the European Union (27 member states), 1995–2020. Source: Eurostat, EU-SILC survey (online data code: TESSI190, update: 29/04/2022)

and Sturm (2019) found that ‘hard’ fiscal rules in the EU, such as expenditure or balanced budget rules that are reinforced using sanctions or automatic correction mechanisms, tend to raise income inequality. Our study digs deeper into this idea by focusing on the effect of the EDP of the SGP and assuming an impact on income inequalities mediated by country-specific forces. This is important in light of previous works highlighting the existence of divergences across the PIGS countries (e.g. Halvorsen 2016).

Moreover, in contrast to other works, our analysis of income inequality is unique also in that it is not limited to the impact of fiscal rules, but also investigates the importance of additional economic and socio-political variables that could enhance inequality levels. To this purpose, our work assumes income inequality as a multidimensional phenomenon with significant socioeconomic and political implications<sup>8</sup> (Chancel and Piketty 2021). We add to the literature investigating the possible determinants of income inequality for the four over-indebted EU countries and, to our knowledge, this study is the first to examine Southern European dynamics in a unified setup that allows for cross-country comparisons.

First, we investigated the linkage between income distribution and economic growth. This relationship is, in principle, ambiguous<sup>9</sup> and depends on the level of economic development (Bubbico and Freytag 2018). In the case of EU member states, in particular, empirical research concludes that income inequality is positively

<sup>8</sup> For income inequality see, among others, Aaberge and Brandolini (2015). For the countries under consideration, see, for instance, Agiropoulos et al. (2021) for Greece, Cueto et al. (2015) for Spain, Brandolini et al. (2018) for Italy, Arnold and Rodrigues (2015) for Portugal.

<sup>9</sup> See, among others, Juuti (2022), Jianu et al. (2021), Mdingi and Ho (2021), Aiyar and Ebeke (2020a, b), Ghosh (2020), Petersen and Schoof (2015), Szeles (2013), Shin (2012), Voitchovsky, (2005), Rey and Montouri (1999), Ram (1988) and Kuznets (1963, 1955).

related to economic growth (Doorley et al. 2021). Second, we considered the effect of unemployment, which tends to be positively correlated with income inequality (e.g., Petrakos et al. 2022b). Third, we examined the share of labor income (in the form of wages and salaries), in total income. A declining labor income share has been associated with increasing levels of income inequality. However, this relationship depends not only on the specific distribution of labor and capital incomes, but also on a number of other factors, such as the national system of social transfers and taxes. As a result, the relationship between labor share and income inequality is not as straightforward as it seems (Erauskin 2020).

Finally, we investigated the importance of political factors. We focused on PBCs, a phenomenon defined as the fiscal manipulation triggered by the incumbent politician's pursuit of maximizing their re-election prospects (Rogoff 1990; Rogoff and Sibert 1988). The inclusion of PBCs also serves comparison purposes, since past research has found that political development in the form of political trust (Halvorsen 2016) and, especially, PBCs (Petrakos et al. 2021a) severely affect PIGS economies, most notably in the case of Greece. The limited research in the field concludes that income inequality tends to improve during pre-election periods (Sever and Emekcan 2021).

### 3 Methodology

Our study specifies the main determinants of income distribution in the four Eurozone countries facing fiscal imbalances, the so-called PIGS countries. While focusing on the effect of the EDP, we considered a number of additional economic and political factors between 1995 and 2020. We limit our analysis to the period when reliable data regarding the distribution of income in the EU were made available from the EU Statistics on Income and Living Conditions (EU-SILC) surveys. These provided timely and comparable cross-sectional and longitudinal data on income, poverty, social exclusion, and living conditions.<sup>10</sup>

#### 3.1 Variables

To achieve our objective, we specified four regression models using the Gini coefficient of equivalized disposable income (GINI), as it is defined and measured by Eurostat (EU-SILC surveys), as the dependent variable. The values of Gini coefficient range from 0 (absolute equality) to 100 (absolute inequality). A higher Gini coefficient indicates greater income inequality. Imputation via random forest algorithm has been implemented for the missing values of Italian ( $n=2$ ) and Portuguese ( $n=2$ ) data. Predictors of income inequalities include cardinal variables and dummies as follows:

---

<sup>10</sup> For methodological guidelines and description of EU-SILC target variables, see European Commission (2019).

- i) the total annual unemployment rate (UNR), which is the unemployed persons as a percentage of the labor force, as it is estimated by Eurostat.
- ii) the actual budget balance (ABB) as percentage of GDP in the respective country, as defined and measured by Eurostat. That is net lending (+)/net borrowing (-), according to the Excessive Deficit Procedure definition. The ABB (government balance) is used as a comprehensive measure of government intervention in the economy.
- iii) the growth rate of total real GDP (TYGR) as it is estimated by Eurostat, namely real GDP growth rate, chain linked volumes, percentage change on previous period GDP at market prices.
- iv) The wages and salaries as percentage of GDP (WSPY), namely the share of wages and salaries in total GDP, i.e. measuring labor income share, as it is estimated by Eurostat.
- v) the current account balance as percentage of GDP (CAB), as it is estimated by the World Bank. The CAB (external balance) serves as a comprehensive measure of the external sector of the economy.
- vi) *Elections (ELE)*, a dichotomous measure assuming the value of 1 in the years in which parliamentary (general) elections were held in each country during the period 1995–2020 and 0 otherwise. This binary variable investigates whether general elections affect income distribution.<sup>11</sup>
- vii) Excessive Deficit Procedure (EDP), another dichotomous measure taking the value of 1 in the years during which each country was subjected to the EDP of the SGP, and 0 otherwise. This binary variable explicitly investigates the possible effect of EDP on income distribution.

Model's variable selection was implemented using backward stepwise elimination (BSE) as in Eq. (1). Next, some more variables were tested and introduced to the model whenever they were found to be statistically significant using forward stepwise selection (FSS) as in Eq. (2). More specifically, (a) the Gini coefficient of equalized disposable income of the previous year (GINI-1) was introduced to the respective regression model whenever first order autocorrelation of the Gini coefficient time series was detected in the preliminary analysis (e.g. Salvati 2022); (b) the interaction term between the two dummies was tested for significance and then considered in the regression model; (c) The lagged (-1) explanatory variables, both numerical and dummy, were tested for significance and then considered in the regression model.

### 3.2 Statistical analysis

Let  $y_i^c$  denote the observed annual value of the Gini coefficient of equalized disposable income (GINI) of the  $c$  country ( $c = 1$  for Portugal, 2 for Italy, 3 for Greece and 4 for Spain), considered as the response variable on the  $i^{\text{th}}$  time segment ( $i = 1:26$ ) Furthermore, let  $x_{jt}^c$  denote the observed value of the numerical variable  $j$ ,  $j = 1:5$  and  $z_{ki}^c$ ,

<sup>11</sup> There is vast empirical evidence that income inequality is reduced in election years (Sever and Emekcan 2021).

the observed value of the dummy variable  $k$ ,  $k=1,2$ , both on the  $i^{\text{th}}$  time segment. We estimated the average response variable as a linear combination of both numerical and dichotomous predictors (e.g. Rontos et al. 2016) in the following way:

$$E(y_i^c) = \beta_0 + \sum_{j=1}^5 \beta_j^c x_{ji}^c + \sum_{k=1}^2 \gamma_k^c z_{ki}^c \quad (1)$$

The variable selection of Eq. (1) was implemented for each country ( $c=1:4$ ) using BSE on the seven primary exploratory variables. Next, we define  $L^1 y_i^c = y_{i-1}^c$ ,  $L^1 x_{ji}^c = x_{ji-1}^c$ ,  $L^1 z_{ki}^c = z_{ki-1}^c$  and  $int z_i^c$  as the interaction term of the two dummies and we introduce them in the model when appropriate, using FSS as in (2).

$$E(y_i^c) = \beta_0 + L^1 y_i^c + \sum_{j=1}^5 \beta_j^c x_{ji}^c + \sum_{j=1}^5 \lambda_j^c L^1 x_{ji}^c + \sum_{k=1}^2 \gamma_k^c z_{ki}^c + \sum_{k=1}^2 \delta_k^c L^1 z_{ki}^c + \zeta^c int z_i^c \quad (2)$$

Ordinary Least Square (OLS) estimation has been employed in all regression models.<sup>12</sup> The results of the above model fitting were summarized for each of the four PIGS countries.<sup>13</sup>

## 4 Results

### 4.1 Greece

Model 1 had a good fit ( $R^2_{\text{adj}}=0.601$ ) and statistical significance ( $F=10.41$   $df=4, 21$ ,  $p<0.001$ ). Regression coefficients reported in Table 1 were statistically significant and economically meaningful: WSPY(GR) represents the wages and salaries as percentage of GDP in Greece, EDP(GR) is the EDP dichotomous measure taking the value of 1 in the years during which Greece was subjected to the EDP, ELE(GR) is the election dichotomous measure taking the value of 1 in the years of parliamentary elections in Greece and EDP(GR) x ELE(GR) is the interaction term of EDP(GR) and ELE(GR). We note that, in the case of Greece, EDP has a positive sign (0.701) implying that the submission of Greece to EDP exerted a negative

<sup>12</sup> We have tried other methods like Cobb–Douglas and Hierarchical Regression. Considering Cobb–Douglas production function and using MAPE (Mean Absolute Percentage Error) as operational criterion, we concluded that linear models with the lag variables where needed, have a better predictive accuracy than the multiplicative one (e.g. Salvati et al. 2019). Regarding the standard option for panel data analysis, which is the hierarchical regression or ANCOVA model with the country as variable with 4 levels (factor), it turns out that, as in our individual model analysis, we ended up with a different set of significant predictors for each country. Hierarchical regression models resulted to be multicollinear, at least for some variables ( $VIF>5$ ), and the model selection process failed to reveal the most relevant individual predictors for each country.

<sup>13</sup> Both Eqs. (1) and (2) were applied for each country and the one performing better was selected. The final selection becomes apparent from the inclusion of lagged variables (Eq. (2)), or the exclusion of lagged variables (Eq. (1)).

**Table 1** Regression coefficients of independent variables entered the econometric model predicting income inequality for Greece ( $R^2_{\text{adj}}=0.601$ ; significance at \*  $p<0.1$ ;  $p<0.001$ )

Predictor	Coefficient	Std. Error
Intercept	44.801**	1.901
WSPY(GR)	-0.427**	0.074
EDP(GR)	0.701*	0.341
ELE(GR)	-1.397*	0.439
EDP(GR) x ELE(GR)	1.207*	0.579

impact on income equality, while the interaction of EDP and ELE has also a positive sign (1.207). However, ELE has a negative sign (-1.3970) implying that during the years of general elections, income inequality was temporarily reduced.

The standardized residuals of Model 1 are symmetrically distributed around their zero mean with  $s=0.664$ , with minor outliers estimated at 1.921 (Studentized residual = -2.46 with Bonferroni  $p$ -value  $<0.05$ ) and corresponding with the 7<sup>th</sup> observation. There is an influential observation with Cook's distance close to 0.2 and high self-sensitivity (leverage score), corresponding to the 10<sup>th</sup> observation. Furthermore, Shapiro-Wilks statistic for normality ( $W=0.977$ ,  $p=0.798$ ) documented a negligible departure from the normality assumption of model's residuals. The other assumptions regarding the model residuals examined both graphically and numerically, revealed no serious regression biases. Specifically, the Durbin-Watson test for autocorrelation indicated independence ( $p=0.774$ ) and the White test failed to reject homoskedasticity ( $p=0.657$ ). Finally, a VIF below 5 for all predictors confirmed the absence of multicollinearity.

## 4.2 Portugal

Model 2 displays a remarkable goodness of fit ( $R^2_{\text{adj}}=0.830$ ) and statistical significance ( $F=30.18$ ,  $df=4,20$ ,  $p<0.001$ ). Statistically significant and economically meaningful regression coefficients were reported in Table 2. GINI-1(PO) is the one-year lagged value of the Gini coefficient of equalized disposable income in Portugal, CAB-1(PO) is the one-year lagged value of the current account balance calculated as percent share in Portuguese GDP, UNR-1(PO) is the one-year lagged total annual unemployment rate, and EDP-1(PO) is the lagged EDP dichotomous measure assuming the value of 1 if, in the previous year, Portugal was subjected to the EDP.

The standardized residuals of Model 2 were found symmetrically distributed around their zero mean with  $s=0.762$ , with the presence of one outlier at 1.879 (Studentized residual = 3.1, Bonferroni  $p<0.05$ ) corresponding with the 10<sup>th</sup> observation. The two most influential observations with Cook's distance between 0.10 and 0.15 and high self-sensitivity (leverage score), corresponded with the 9<sup>th</sup> and 15<sup>th</sup> observation. Shapiro-Wilks test of normality ( $W$  statistic = 0.962,  $p=0.452$ ) indicated no serious departure from the normality assumption for model's residuals. Additional assumptions regarding model's residuals have been examined with both graphical and numerical methods, and revealed no serious regression biases. Specifically,



**Table 2** Regression coefficients of independent variables entered the econometric model predicting income inequality for Portugal ( $R^2_{\text{adj}}=0.830$ ; significance at \*  $p<0.1$ ;  $p<0.001$ )

Predictor	Coefficient	Std. Error
Intercept	1.964	4.276
GINI-1(PO)	0.890**	0.121
CAB-1(PO)	-0.110*	0.051
UNR-1(PO)	0.227*	0.091
EDP-1(PO)	-1.621*	0.538

the Durbin-Watson test for autocorrelation indicated independence ( $p=0.99$ ) and the White test failed to reject homoskedasticity ( $p=0.864$ ). Finally, a VIF below 5 recorded for all regression predictors gave no evidence of multicollinearity.

### 4.3 Spain

Model 3 displayed a remarkable goodness of fit ( $R^2_{\text{adj}}=0.731$ ) and statistical significance ( $F=22.72$ ,  $df=3,21$ ,  $p<0.001$ ). Statistically significant and economically meaningful regression coefficients were reported in Table 3 and include GINI-1(SP), the one-year lagged value of the Gini coefficient of equalized disposable income in Spain, ABB(SP), the actual budget balance (ABB) as the percent share in Spanish GDP and TYGR(SP), the rate of growth in total real GDP.

The standardized residuals of Model 3 were symmetrically distributed around their zero mean with  $s=0.629$ . Outliers were valued at 1.121 (Studentized residual = -2.76, Bonferroni  $p<0.05$ ) corresponding with the 8<sup>th</sup> observation. Three influential observations with Cook's distance between 0.15 and 0.20 and high self-sensitivity (leverage score) were recorded, corresponding to the 7<sup>th</sup>, 10<sup>th</sup>, and 25<sup>th</sup> observation respectively. Shapiro-Wilks test of normality (W statistic = 0.945,  $p=0.197$ ) indicated no serious departure from the normality assumption. Additional assumptions regarding the model residuals have been examined graphically and numerically and revealed no serious regression biases. Specifically, the Durbin-Watson test for autocorrelation indicated independence ( $p=0.824$ ) and the White test failed to reject homoskedasticity ( $p=0.391$ ). Finally, a VIF below 5 for all predictors provided no evidence of multicollinearity.

### 4.4 Italy

Model 4 provided a good fit to real data ( $R^2_{\text{adj}}=0.616$ ) with statistical significance ( $F=10.64$ ,  $df=4,20$ ,  $p<0.0001$ ). Statistically significant and economically

**Table 3** Regression coefficients of independent variables entered the econometric model predicting income inequality for Spain ( $R^2_{\text{adj}}=0.731$ ; significance at \*  $p<0.1$ ;  $p<0.001$ )

Predictor	Coefficient	Std. Error
Intercept	14.407*	4.150
GINI-1(SP)	0.528**	0.131
ABB(SP)	-0.212*	0.061
TYGR(SP)	0.188*	0.066

**Table 4** Regression coefficients of independent variables entered the econometric model predicting income inequality for Italy ( $R^2_{\text{adj}}=0.616$ ; significance at \*  $p < 0.1$ ;  $p < 0.001$ )

Predictor	Coefficient	Std. Error
Intercept	-1.559	5.371
GINI-1(IT)	0.626**	0.163
CAB-1(IT)	-0.226*	0.122
WSPY-1(IT)	0.497*	0.201
EDP-1(IT)	-0.965*	0.518

meaningful regression coefficients (Table 4) included GINI-1(IT), the one-year lagged value of the Gini coefficient of equivalized disposable income in Italy, CAB-1(IT), the one-year lagged value of the current account balance calculated as the percent share in Italian GDP, WSPY-1(IT), the one-year lagged value of the wages and salaries calculated as the percent share in GDP, and EDP-1(IT), the lagged EDP dichotomous measure taking the value of 1 if, in the previous year, Italy was subjected to the EDP.

The standardized residuals of Model 4 were symmetrically distributed around their zero mean with  $s=0.712$ . The presence of one outlier was valued at 1.932 (Studentized residual=4.71, Bonferroni  $p < 0.05$ ) and corresponded with the 8<sup>th</sup> observation. One influential observation with Cook's distance of 1 and two other influential observations with Cook's distance between 0.15 and 0.25, corresponding with the 7<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> observation respectively, were recorded. Shapiro-Wilks test of normality (W statistic=0.954,  $p=0.304$ ) indicated no serious departure from a normality assumption of model's residuals. The Durbin-Watson test for autocorrelation indicated independence ( $p=0.524$ ) and the White test found a weak heteroskedasticity ( $p=0.036$ ). Additionally, the residual vs fitted plot showed a wavy concentration of residuals, suggesting the appropriateness of a form of  $y$ -transformation of the input variables (Table 5).

In order to cope with this evidence, we implemented a sin-transformation of the dependent variable in the above-mentioned model. This model displayed a high goodness-of-fit ( $R^2_{\text{adj}}=0.623$ ), statistical significance ( $F=10.92$ ,  $df=4,20$ ,  $p < 0.001$ ) and no deviation from the homoskedasticity assumption (White test,  $p=0.281$ ). Shapiro-Wilks test (W statistic=0.972,  $p=0.702$ ) and Durbin-Watson test for serial autocorrelation indicated normality and independence ( $p$ -value=0.13). The 7<sup>th</sup> observation remained highly influential, having a Cook's distance of 0.8. Finally, a VIF below 5 for all predictors indicated a negligible multicollinearity.

**Table 5** Regression coefficients of independent variables entered the econometric model predicting income inequality (sin-transformed) for Italy ( $R^2_{\text{adj}}=0.623$ ; significance at \*  $p < 0.1$ ;  $p < 0.001$ )

Predictor	Coefficient	Std. Error
Intercept	-18.136***	2.876
GINI-1(IT)	0.302*	0.087
CAB-1(IT)	-0.173*	0.065
WSPY-1(IT)	0.330*	0.108
EDP-1(IT)	-0.681*	0.277

## 4.5 Summary Results

Table 6 summarizes the empirical results of regression models for the four PIGS economies, presenting significant (institutional, economic and political) determinants of income inequality according to Models 1, 2, 3 and the sin-transformed version of Model 4, as presented above in this chapter. Among institutional determinants, we found evidence on the significance of the imposition of the EDP, current or lagged. Among economic determinants, we found that the lagged income inequality, as measured by the Gini coefficient of equalized disposable income of the previous year, was a significant predictor of income inequality, together with the lagged external balance (namely,  $\text{lag}(-1)\text{CAB}$ ), the current government balance (ABB) and economic growth rate in the same year. The labor market conditions, as estimated with the labor income share (current or lagged) and the lagged unemployment rate, resulted to be significant predictors of income inequalities. Finally, among political factors, general elections and the statistical interaction of elections with the EDP were found significant predictors of income inequalities, respectively assuming a positive and a negative regression coefficient.

## 5 Discussion

Empirical results of the econometric models were discussed separately for each country and commented together, in order to better define the importance of EDP and labor market efficiency, within Southern European economies. In the case of Greece,<sup>14</sup> income inequality showed no signs of temporal autocorrelation, being the only Mediterranean country where the Gini coefficient did not depend on past values. Model 1 indicated the most significant economic determinant of income inequality,<sup>15</sup> namely the share of wages and salaries into GDP, WSPY(GR), serving as a measure of the labor income share. Increases in WSPY(GR) were associated with lower income inequality. EDP positively affected income inequalities via two channels: EDP(GR) had a direct (negative) impact on income distribution; the interaction between EDP and general elections,  $\text{EDP(GR)*ELE(GR)}$ , was an additional, significant predictor of inequalities.

To better understand this interaction, it should be noticed that, in the years of general elections,  $\text{ELE(GR)} = 1$ , income equality improved in the short run. This result

<sup>14</sup> Referring to Greece, the issue of income distribution has been the subject of numerous empirical studies, such as Melidis and Tzagkarakis (2021); Andriopoulou et al. (2017); Kaplanoglou and Rapanos (2016); Matsaganis and Leventi (2014); Mitrakos (2014); Koutsampelas and Tsakoglou (2013); Mitrakos and Tsakoglou (2012); Tsakoglou and Mitrakos (2006); Tsakoglou and Panopoulou (1998); Tsakoglou (1993), and Tsakoglou (1990). A large number of studies have been carried out for the other three over-indebted countries as well, such as Iacono and Ranaldi (2021), Garofalo et al. (2018), Bonhomme and Hospido (2013), Pijoan-Mas and Sánchez-Marcos (2010), Budria (2010), and Goerlich and Mas (2002).

<sup>15</sup> Greece has the lowest wages and salaries share in GDP within the EU countries. Only for short time periods, some other countries had lower labor income shares in GDP, namely Bulgaria between 1995 and 1997, and Romania between 2009 and 2012 (see Eurostat, GDP and main components (nama\_10\_gdp), update 25/05/22).

Table 6 Determinants of income inequality, by country

FACTORS		GREECE	PORTUGAL	SPAIN	ITALY
Institutional	Imposition of EDP	EDP (+)	Lagged EDP (-)		Lagged EDP (-)
<b>ECONOMIC</b>	<b>Income inequality</b>	(EDP(GR))	(EDP-1(PO))	Lagged income inequality (+)	(EDP-1(IT)) Lagged income inequality (+)
	<b>External balance</b>		(GINI-1(PO)) Lagged current account balance (-)	(GINI-1(PO)) Lagged current account balance (-)	(GINI-1(IT)) Lagged current account balance (-)
	<b>Government balance</b>		(CAB-1(PO))	Actual budget balance (-)	(CAB-1(IT))
	<b>Economic growth</b>			(ABB(SP)) GDP growth rate (+)	
	<b>Labor income share</b>	Labor income share (-)			Lagged labor income share (-)
	<b>Unemployment</b>	(WSPY(GR))	Lagged unemployment rate (+)		(WSPY-1(IT))
<b>POLITICAL</b>	<b>Elections</b>	Elections (-)	(UNR-1(PO))	-	-
		(ELE(GR))			
<b>INTERACTION</b>	<b>Elections and imposition of EDP</b>	Elections and EDP (+)	-	-	-
		EDP(GR) x ELE(GR)			

confirms that Greece is a unique case of severe PBCs among EU countries. By taking advantage of the electorate's 'political myopia' or by cashing in on temporary 'informational asymmetries', Greek politicians frequently chose to maximize their own 'voting function' instead of a social welfare function, as is commonly assumed in economic policy (Petraikos et al. 2021a). These cycles, although detrimental for public debt and the stability of the aggregate economy (Petraikos et al. 2022a), had a short-term positive effect on income inequality, mainly because they materialize through a raise of social transfers during the election years (Petraikos et al. 2021b). However, in the years of elections under the EDP, such PBC-related transfers were mostly cut, resulting in a worse income distribution.

In the case of Portugal, the income distribution of the current year was affected by the value observed in the previous year, as well as by specific economic and institutional factors, namely the unemployment rate, UNR(PO), the current account balance of the previous year, CAB-1(PO), and by whether the country was subjected to the EDP procedure in the previous year, EDP-1(PO). Increases of CAB in the previous year, CAB-1(PO), positively affected the income distribution of the current year. This finding was indicative, first, of the persistence of income inequalities in the country and, second, of the negative effect of trade openness on inequality. The latter is a common, albeit not unanimous result in empirical research on developed economies.<sup>16</sup> Submission to the EDP affected the Gini index mainly via the variable EDP-1(PO), corresponding to the implementation of the EDP procedure in the previous year. Again, this is an indication of stickiness in the income distribution, which adjusted slowly to evolving (economic and institutional) environments. The coefficient of EDP-1(PO) was found negative, in opposition with what has been observed in Greece, EDP(GR). Finally, job market shares did not appear to be significant, but labor market efficiency affected the income distribution through unemployment, UNR(PO), since an increase in UNR(PO) was found to worsen income distribution.

In the case of Spain, income distribution of the current year was affected by its value of the previous year, exhibiting a persistence condition similar to Portugal. Additionally, it was also influenced by macroeconomic factors, namely the actual budget balance, ABB(SP), and the growth rate of total real GDP, TYGR(SP). The economic growth rate affected income distribution negatively, which is a familiar result for developed economies.<sup>17</sup> On the contrary, government intervention, as measured by ABB(SP) reduced the Gini coefficient, meaning that, in times of increasing economic inequalities, governments implemented expansionary fiscal policies. The labor market's role in shaping income inequality was only manifested indirectly, e.g. through its relationship with economic growth and the actual budget balance.

Regarding the EDP, we find that both EDP(SP) and EDP-1(SP), when added separately to Model 3, had positive but statistically insignificant coefficients.<sup>18</sup> When using EDP as a unique predictor together with GINI-1(SP), we get a weakly significant and positive coefficient and the overall goodness of fit of that model was

<sup>16</sup> See among many others Castells-Quintana et al. (2015).

<sup>17</sup> See, for instance, Doorley et al. (2021); Furceri and Ostry (2019), and Cysne and Turchick (2012).

<sup>18</sup> The model with EDP(SP) displayed a remarkable goodness-of-fit ( $R^2_{adj}=0.722$ ) and the model with EDP-1(SP) performed slightly better ( $R^2_{adj}=0.729$ ).

moderately worse than Model 3. We concluded that EDP had a weak negative effect on income inequality in Spain.

In the case of Italy, the income distribution of the current year was affected by its value of the previous year as well as by additional economic and institutional factors, namely the current account balance of the previous year, CAB-1(IT), the share of wages and salaries to GDP in the previous year, WSPY-1(IT), and the implementation of the EDP in the previous year, EDP-1(IT). Similarly to the Portuguese and the Spanish cases, income distribution in Italy also displayed stickiness, being mainly affected by delayed variables. The external sector negatively impacted inequality and this finding is in line with what has been observed in the Portuguese case. Moving on to how the EDP has shaped the Italian income distribution, the delayed variable EDP-1(IT) had a positive effect on income distribution, in line with what has been observed for Portugal.

The role of the job market share in the Italian case should be investigated more carefully. WSPY-1(IT) resulted to be among the most relevant determinants of the income distribution. However, as opposed to the Greek model, the increase in WSPY-1(IT) was associated with a sudden increase in income inequality. This result seems counterintuitive, given that an increasing labour share is usually considered a driver of income equalization (Ciommi et al. 2022). Following the seminal works by Karabarbounis and Neiman (2014), Piketty and Zucman (2014) and Dao et al. (2017), a vast literature on job income share has documented its continuous decline worldwide. This recent trend has been explained with a variety of driving forces, such as biased technological change (Acemoglu 2003; Oberfield and Raval 2021), advances in information and communication (Karabarbounis and Neiman 2014), increasing capitalists' savings (Piketty and Zucman 2014), and market concentration (Ciommi et al. 2019; Autor et al. 2020; Barkai 2020; De Loecker et al. 2020). Political economy explanations included the effects of globalization and financialization (Chelli et al. 2022), the evolution of the bargaining power of labor and cost-cutting in the welfare state.<sup>19</sup>

EU countries, on average, have been found to follow such trend very weakly. Cette et al. (2020) and Gutierrez and Piton (2020) have documented a long-term stability in the labor income share in Europe, with few countries including Italy that have even witnessed a moderate increase. Figure 2 showed the evolution of WSPY assumed as a rough measure of labor income share. A clear upward trend emerged in the case of Italy and Greece, the two PIGS economies where labor share appears to matter for income inequality; a decreasing trend was observed for both Portugal and Spain.

Increasing labor shares in both Greece and Italy have been increasing explained the negative linkage between WSPY(GR) and the Greek Gini coefficient but provided little assistance with our understanding of the positive relationship between WSPY-1(IT) and the Italian Gini coefficient. Brandolini et al. (2018) reached a similar conclusion stating that, after 2008, labor shares in Italy increased, but income inequality also increased slightly.

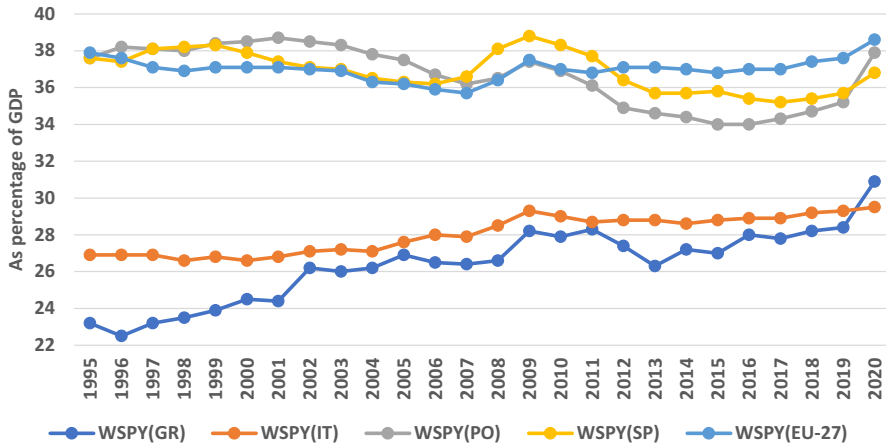
<sup>19</sup> See for example Dühaupt (2017), Elsby et al. (2013), Harrison (2005), Kohler et al. (2019), Pariboni and Tridico (2019) and Stockhammer (2017).

One possible explanation is that this could reflect the mismeasurement of the labour share of self-employment, as suggested by D'Elia and Gabriele (2018), among others. In particular, official statistics do not distinguish between labour and capital income components of the self-employed; rather, their income is recorded as capital income. This creates a distortion of the labour share measurement which remains a crucial source of bias that is difficult to remove. Keeping in mind that Italy is the country with the second highest self-employment share, second only to Greece, and that all four PIGS countries have a self-employment share above the EU average,<sup>20</sup> this bias is particularly evident in the economies under consideration and, therefore, we should take our results on the role of labour shares with a pinch of salt. This is also true for the cases of Portugal and Spain where the coefficients of the labour share have been found insignificant. For Italy in particular, Gabbuti (2021) reports that different corrections of the self-employment share lead to different trends of the labor share.

Another possible explanation for the positive coefficient of WSPY-1(IT) is the low elasticity of transmission between labour share and income inequality compared e.g. with the United States (US). In Italy, the wage share of the top percentiles was relatively stable despite an aggregate trend toward increasing labour share, whereas in the US, the labour share has declined but this downward trend has been exacerbated by an increasing component of compensation for the top incomes (Gabbuti 2021). This assumption is even clearer in Iacono and Ranaldi (2021). They studied the evolution of inequality in income composition in terms of capital and labour income in Italy during 1989–2016 and found that the share of capital income accruing to the bottom of the distribution has risen, and, at the same time, it was the top of the distribution of labour income that has increased its share. They interpreted this result as a proof that “Italy is moving away from being an economy composed of poor laborers and rich capitalists”. They concluded that fluctuations in the total labour income share are becoming an increasingly weak measure of income inequality in Italy.

We go on to analyse what is, in our opinion, our key outcome. That is, the imposition to the EDP of the SGP has significantly affected the income distribution of the over-indebted Eurozone countries in the case of Greece, Portugal and Italy, and more weakly in the case of Spain. For Portugal and Italy, their submission to the EDP has positively affected their income distribution, while in the case of Greece, and to a lesser degree Spain, submission to the EDP has negatively affected their income distribution. Consequently, it is impossible to argue that the mere submission of a European country to the EDP affects income inequality in a statistically significant (positive or negative) way. Given that EDP is a step-by-step procedure that materializes through a complicated, country- and time-specific mix of measures, we argue that the impact of EDP on income distribution depends precisely on that specific mix and cannot be evaluated a priori. Although a reduction in GDP is possible, brought about by the austerity measures taken in the context of the EDP,

<sup>20</sup> Self-employment rate (indicator). <https://doi.org/10.1787/fb58715e-en> (Accessed on 09/06/2022).



**Fig. 2** The evolution of the share of wages and salaries as percentage of GDP in Greece, Italy, Portugal, Spain and the European Union (27 member countries) between 1995 and 2020. Source: Eurostat, GDP and main components (output, expenditure and income), (nama\_10\_gdp, update: 03/06/2022)

EDP is not necessarily associated with a worsening of income distribution, as long as income cuts affect society in a balanced way.

In the case of Greece, the mechanism through which EDP has affected income distribution is clear. Especially for the period 2010–2017, during which the country faced a serious public debt crisis, the financial assistance granted to Greece was subject to strict austerity and structural measures implemented through three Economic Adjustment Programs (EAPs). These EAPs required sharp shrinkages of wages and salaries in the private and public sectors. As a result, although incomes fell, the reductions have been relatively greater at the lower incomes, leading to a worsened income distribution.<sup>21</sup>

Portugal featured the highest inequality of all PIGS during the period 1995–2010 (Fig. 1), displaying the highest inequality across all EU countries.<sup>22</sup> In fact, income inequality was growing in Portugal at least until the late-2000s (Pereira 2021). Earlier studies have provided some possible explanations, based on changes in the structure of employment, employment polarization, and modernization of the labor market.<sup>23</sup> Hence, it seems that the specific measures taken in the context of compliance with the rules of the EDP have improved income distribution in Portugal.

In the case of Italy, the EDP could have reduced income inequality for similar reasons, although inequality in the country was clearly of a multifaceted nature.<sup>24</sup>

<sup>21</sup> If we divide population into quintiles starting from the lowest (Q1) to the highest (Q5), although all quintiles appear to have been negatively affected by the program measures, the relative negative effect was more intense in the population quintiles with lower incomes (Revuelta 2021).

<sup>22</sup> Eurostat, Gini coefficient of equivalized disposable income, EU-SILC survey (ilc\_di12).

<sup>23</sup> See Centeno and Novo (2014), Barradas and Lagoa (2017), Pereira (2021).

<sup>24</sup> In Italy, younger individuals, women and inhabitants of its Southern regions are exposed to rising inequality (Guzzardi et al. 2022).



Another interesting insight can be found in Pavolini et al. (2015). Their paper compares the combination of EDP reforms in Italy and Spain and they found that the austerity plans in the two countries followed different paths. In Spain, the changes came as a shock, not only due to the size of cuts involved, but also because they entailed an important departure, compared to pre-existing conditions. In Italy, the austerity measures, despite being equally harsh, were on a reform path similar to the one that was already being followed by national authorities.

## 6 Conclusions

This paper tries to fill an important literature gap regarding our understanding of the effects of fiscal programs on income inequality. For this purpose, we delineated the factors shaping income distribution in the four over-indebted EU countries where the EDP of the SGP was imposed over the longest periods of time. These countries are Portugal, Italy, Greece and Spain (PIGS). In our empirical analysis, we regress the Gini coefficient of each one aforementioned economy over their income inequality drivers checking, besides the EDP, additional economic and political factors.

We contribute to the economic literature by showing that the income distribution in the PIGS countries, although shaped by heterogeneous variables, was decisively affected by the prolonged imposition to the EDP. However, the precise way in which EDP influences income inequality is a priori unknown and depends on the specific combination of measures undertaken. Nevertheless, it could result in the decline of income inequality, as in the case of Italy and Portugal. Future research could dig deeper into the specific measures of EDP that tend to increase equality and the possible existence of a trade-off, at least in the short run, between equality-boosting and debt-reducing policies, given that EDP is primarily a process of debt correction.

Our paper also adds to the literature on income inequality by specifying its causes in the four over-indebted Southern European countries. Income inequality was dependent on the external sector in Portugal and Italy, and on government intervention and growth in the case of Spain. For Greece, a variable that exerts a remarkable influence is the electoral cycle. This result reveals the structural discrepancies of the economies under consideration. Finally, our last contribution relates to the impact of the labor market on inequality conditions. The labor market, especially evaluated with the shape of the labor income share, comes up as a statistically significant predictor both for the Greek and the Italian Gini coefficient. However, the documented increase of the labor share in both countries appears to have boosted equality in the case of a Greece, whereas, in the case of Italy, it seems that it has been a force in the opposite direction. Again, as with EDP, the precise connection between the fluctuations in the labor share and income inequality are nuanced, depending on country-specific characteristics, including labor and capital market as well as the welfare state.

In line with our results, policy makers in the EU concerned with income inequality should, before deciding on the exact measures entailed in the EDP, carefully consider the possible inequality acceleration trends and a number of

important economic and socio-political issues. Labor market conditions, the level of openness to the rest of the world, the evolution of government spending and economic growth at large seem to be particularly important factors. We argue that, during the review process of the EDP, the matter of income inequality is one to be considered with extreme attention, so as to avoid any equality-suppressing effects.

**Acknowledgements** We are grateful to the two anonymous reviewers for their valuable comments and suggestions.

**Authors' Contributions** K.R. and C.V. wrote the paper; G.P. made the analysis; L.S. collected the indicators and designed the study; I.V. made the literature review.

**Data Availability** Only official statistics from EUROSTAT were used here.

## Declarations

**Ethics Approval and Consent to Participate** No humans involved in this survey.

**Consent for Publication** All authors agree to submit the manuscript in the present version.

**Competing Interests** No competing interests to declare.

## References

- Aaberge R, Brandolini A (2015) Multidimensional poverty and inequality. *Handb Income Distrib* 3(2):141–216
- Acemoglu D (2003) Labor and capital-augmenting technical change. *J Eur Econ Assoc* 1(1):1–37
- Aiyar S, Ebeke C (2020) Inequality of opportunity, inequality of income and economic growth. *World Dev* 136(1–10)
- Agiropoulos C, Galanos G, Poufinas T (2021) Entrepreneurship, Income Inequality and Public Spending: A Spatial Analysis into Regional Determinants of Growing Firms in Greece. *Int Adv Econ Res* 27:197–218
- Aiyar S, Ebeke C (2020) Inequality of opportunity, inequality of income and economic growth. *World Dev* 136
- Alvarez MC (2021) Eurozone fiscal reform in light of Covid-19: A review of existing proposals. *Funcas Europe* 1–10
- Andriopoulou E, Karakitsios A, Tsakoglou P (2017) Inequality and Poverty in Greece: Changes in Times of Crisis, IZA Institute of Labor Economics, Discussion Paper Series, IZA DP No. 11006, September
- Arnold J, Rodrigues CF (2015) Reducing inequality and poverty in Portugal. *OECD Econ Dept Working Papers* (1258):0\_1
- Autor D, Dorn D, Katz LF, Patterson C, Van Reenen J (2020) The fall of the labor share and the rise of superstar firms. *Q J Econ* 135(2):645–709
- Barkai S (2020) Declining labor and capital shares. *J Financ* 75(5):2421–2463
- Barradas R, Lagoa S (2017) Functional income distribution in Portugal: The role of financialisation and other related determinants. *Soc Econ* 39(2):183–212
- Blanchard O (2019) Europe must fix its fiscal rules. *Proj Syndicate* 10th June
- Blanchard O, Leonardo A, Zettelmeyer J (2021) Redesigning EU fiscal rules: From rules to standards. Peterson Institute for International Economics (PIIE), Working Paper 21–1 February
- Bonhomme S, Hospido L (2013) Earnings inequality in Spain: new evidence using tax data. *Appl Econ* 45(30):4212–4225
- Brändle T, Colombier C, Hartwig J (2018) Are healthcare premium subsidies crowded out under fiscal rules? Evidence from Swiss cantons. Paper presented at the European Health Economics Association 2018 conference, July 12, Maastricht

- Brandolini A, Gambacorta R, Rosolia A (2018) Inequality amid income stagnation: Italy over the last quarter of a century. Bank of Italy Occasional Paper (442)
- Bubbico RL, Freytag L (2018) Inequality in Europe, European Investment Bank January
- Budria S (2010) Economic inequality in Portugal. *J Income Distrib* 19(2):79–110
- Castells-Quintana D, Ramos R, Royuela V (2015) Income inequality in European Regions: Recent trends and determinants. *Rev Reg Res* 35(2):123–146
- Centeno M, Novo A (2014) When supply meets demand: Wage inequality in Portugal. *IZA J Eur Labor Stud* 3(1):1–20
- Cette G, Koehl L, Philippon T (2020) Labor share. *Econ Lett* 188
- Chancel L, Piketty T (2021) Global income inequality, 1820–2020: the persistence and mutation of extreme inequality. *J Eur Econ Assoc* 19(6):3025–3062
- Chelli F, Ciommi M, Mariani F, Polinesi G, Recchioni MC, Lamonica GR, Salvati L (2022) A Story of Strengths and Weaknesses in Tertiary Education: Evaluating ‘Mobility’ and ‘Opportunities’ in OECD Countries with Composite Indicators. *Sustainability* 14(24):16463
- Ciommi M, Chelli FM, Salvati L (2019) Integrating parametric and non-parametric multivariate analysis of urban growth and commuting patterns in a European metropolitan area. *Qual Quant* 53:957–979
- Ciommi M, Egidì G, Vardopoulos I, Chelli FM, Salvati L (2022) Toward a ‘Migrant Trap’? Local Development, Urban Sustainability, Sociodemographic Inequalities, and the Economic Decline in a Mediterranean Metropolis. *Soc Sci* 12(1):26
- Cueto B, Mayor M, Suárez P (2015) Entrepreneurship and unemployment in Spain: a regional analysis. *Appl Econ Lett* 22(15):1230–1235
- Cysne RP, Turchick D (2012) Equilibrium unemployment-inequality correlation. *J Macroecon* 34:454–469
- Dahan M, Strawczynski M (2013) Fiscal rules and the composition of government expenditures in OECD countries. *J Policy Anal Manage* 32:484–504
- Dao MC, Das MM, Koczan Z, Lian W (2017) Why is labor receiving a smaller share of global income? Theory and empirical evidence. International Monetary Fund
- Darvas Z, Martin P, Ragot X (2018) European fiscal rules require a major overhaul. *Bruegel, Policy Contribution, Issue No 18, October, 1–18*
- D’Elia E, Gabriele S (2018) Chi ha raccolto i frutti della crescita economica? La distribuzione funzionale dei redditi 1995–2016. Franzini, M. and M. Reitano, Il mercato rende diseguali
- De Jong JF, Gilbert ND (2020) Fiscal discipline in EMU? Testing the effectiveness of the Excessive Deficit Procedure. *Eur J Polit Econ* 61
- De Loecker J, Eeckhout J, Unger G (2020) The rise of market power and the macroeconomic implications. *Q J Econ* 135(2):561–644
- Doorley K, Callan T, Savage M (2021) What drove income inequality in EU crisis countries during the Great Recession? *Fisc Stud* 42(2):319–343
- Dünhaupt P (2017) Determinants of labor’s income share in the era of financialisation. *Camb J Econ* 41(1):283–306
- Elsby MW, Hobbijn B, Şahin A (2013) The decline of the US labor share. *Brook Pap Econ Act* 2013(2):1–63
- Erauskin I (2020) The labor share and income inequality: Some empirical evidence from the period 1990–2015. *Appl Econ Anal* 28(84):173–195
- European Commission (2019) Methodological Guidelines and description of EU-SILC target variables, 2019 operation (Version February 2020), DocSILC065 (2019 operation)
- Furceri D, Ostry JD (2019) Robust determinants of income inequality. *Oxf Rev Econ Policy* 35(3):490–517
- Gabbuti G (2021) Labor shares and inequality: insights from Italian economic history, 1895–1970. *Eur Rev Econ Hist* 25(2):355–378
- Garofalo A, Castellano R, Punzo G, Musella G (2018) Skills and labor incomes: How unequal is Italy as part of the Southern European countries? *Qual Quant* 52:1471–1500
- Ghosh S (2020) Impact of economic growth volatility on income inequality: ASEAN experience. *Qual Quant* 54(3):807–850
- Gini C (1912) Variabilità e Mutabilità (Variability and Mutability): Contributo allo Studio delle Distribuzioni e delle Relazioni Statistiche, Tipografia di Paolo Cuppini, Bologna

- Goerlich FJ, Mas M (2002) Intertemporal and Interprovincial variations in income inequality: Spain, 1973–1991. *Reg Stud* 36(9):1005–10015
- Gutiérrez G, Piton S (2020) Revisiting the global decline of the (non-housing) labor share. *Am Econ Rev: Insights* 2(3):321–338
- Guzzardi D, Palagi E, Roventini A, Santoro A (2022) Reconstructing income inequality in Italy: New evidence and tax policy implications from Distributional National Accounts. *World Inequality Lab, Working Paper No 2022/02*
- Halvorsen K (2016) Economic, financial, and political crisis and well-being in the PIGS-countries. *SAGE Open* 6(4):2158244016675198
- Harrison A (2005) Has globalization eroded labor's share? Some cross-country evidence
- Hartwig J, Sturm JE (2019) Do fiscal rules breed inequality? First evidence for the EU. *Econ Bull* 39(2):1508–1515
- Herwartz H, Theilen B (2022) Effectiveness and counter-cyclicality of fiscal consolidation under compliance regulation: The case of the Stability and Growth Pact. *Econ Pol.* <https://doi.org/10.1111/ecpo.12234>
- Iacono R, Ranaldi M (2021) The evolution of income composition inequality in Italy, 1989–2016. *Rev Income Wealth.* <https://doi.org/10.1111/roiw.12555>
- Jianu I, Dinu M, Huru D, Bodislav A (2021) Examining the relationship between income inequality and growth from the perspective of EU member States' stage of development. *Sustainability* 13:1–16, 5204 MDPI. <https://doi.org/10.3390/su13095204>
- Juuti T (2022) The role of credit constraints in the interplay between income inequality and economic growth. *Qual Quant* 56(3):985–1021
- Kaplanoglou G, Rapanos VT (2016) Evolutions in consumption inequality and poverty in Greece: The impact of the crisis and austerity policies. *Rev Income Wealth* 2018 64(1):105–126. <https://doi.org/10.1111/roiw.12287>
- Karabournis L, Neiman B (2014) The global decline of the labor share. *Q J Econ* 129(1):61–103
- Kimura K (1994) A micro-macro linkage in the measurement of inequality: Another look at the Gini coefficient. *Qual Quant* 28:83–97
- Kohler K, Guschanski A, Stockhammer E (2019) The impact of financialisation on the wage share: a theoretical clarification and empirical test. *Camb J Econ* 43(4):937–974
- Koutsampelas C, Tsakoglou P (2013) The distribution of full income in Greece. *Int J Soc Econ* 40(4):311–330
- Kuznets S (1955) Economic Growth and Income Inequality. *Am Econ Rev* 45(1):1–28
- Kuznets S (1963) Quantitative aspects of the economic growth of nations: VIII. Distribution of income by size. *Econ Dev Cult Change* 11(2):1–80
- Matsaganis M, Leventi C (2014) Poverty and inequality during the Great Recession in Greece. *Pol Stud Rev* 12(2):209–223
- McGregor T, Smith B, Wills S (2019) Measuring inequality. *Oxf Rev Econ Policy* 35(3):368–395
- Mdingi K, Ho S-Y (2021) Literature review on income inequality and economic growth. *MethodsX* 8:1–12
- Melidis M, Tzagkarakis SI (2021) The evolution of social vulnerability in Greece during the economic crisis (2008–2017). *Eur Soc.* <https://doi.org/10.1080/14616696.2021.2007973>
- Mitrakos T (2014) Inequality, poverty and social welfare in Greece: Distributional effects and austerity, Bank of Greece, Working Papers, No. 174, January
- Mitrakos T, Tsakoglou P (2012) Inequality and poverty in Greece: Myths, realities and crisis. In: Anastasakis O, Singh D (eds) *Reforming Greece: Sisyphean Task or Herculean Challenge?* SEESOX Book Series on Current Affairs, Oxford, pp 90–99
- Nerlich C, Reuter WH (2013) The design of national fiscal frameworks and their budgetary impact. *ECB Working Paper number 1588*
- Oberfeld E, Raval D (2021) Micro data and macro technology. *Econometrica* 89(2):703–732
- Pariboni R, Tridico P (2019) Labor share decline, financialisation and structural change. *Camb J Econ* 43(4):1073–1102
- Pavolini E, León M, Guillén AM, Ascoli U (2015) From austerity to permanent strain? The EU and welfare state reform in Italy and Spain. *Comparative European Politics* 13(1):56–76
- Penner RG (2001) Do State budget rules affect welfare spending? *The Urban Institute Occasional Paper number 43*
- Pereira JM (2021) Did wage inequality increase in Portugal? Yes, and for good reasons. *Appl Econ Lett* 28(12):973–977. <https://doi.org/10.1080/13504851.2020.1789057>

- Petersen T, Schoof U (2015) The impact of income inequality on economic growth. *Bertelsmann Impulse* 5:1–12
- Petrakos G, Rontos K, Vavoura C, Vavouras I (2022a) The destabilizing effects of political budget cycles: The case of Greece. *Advances in Quantitative Economic Research, 2021 International Conference on Applied Economics (ICOAE)*, Tsounis, N., Vlachvei, A. (eds.), Springer Proc Business Econ p 129–141
- Petrakos G, Rontos K, Vavoura C, Vavouras I (2022b) Quantifying the Effects of recent Economic and Fiscal Crises on Income Inequality in Greece, *Advances in Empirical Economic Research, Springer Proceedings in Business and Economics, International Conference in Applied Economics (ICOAE)*, forthcoming
- Petrakos G, Rontos K, Salvati L, Vavoura C, Vavouras I (2021a) Toward a political budget cycle? Unveiling long-term latent paths in Greece. *Qual Quant*. <https://doi.org/10.1007/s11135-021-01260-1>
- Petrakos G, Rontos K, Vavoura C, Salvati L, Vavouras I (2021) Political budget cycles and the effects of the Excessive Deficit Procedure: The case of Greece. *Regional Statistics* 11(2):1–20
- Pijoan-Mas J, Sánchez-Marcos V (2010) Spain is different: Falling trends of inequality. *Rev Econ Dyn* 13(1):154–178
- Piketty T, Zucman G (2014) Capital is back: Wealth-income ratios in rich countries 1700–2010. *Q J Econ* 129(3):1255–1310
- Pisani-Ferry J (2021) Europe needs a new fiscal framework. Project Syndicate 29th April
- Ram R (1988) Economic development and income inequality: further evidence on the U-curve hypothesis. *World Dev* 16(11):1371–1376
- Revuelta J (2021) The effects of the Economic Adjustment Programmes for Greece: A quasi-experimental approach. *Sustainability* 13:4970. <https://doi.org/10.3390/su13094970>
- Rey SJ, Montouri BD (1999) US regional income convergence: a spatial econometrics perspective. *Reg Stud* 33(2):143–156
- Rogoff K (1990) Equilibrium political budget cycles. *American Economic Review* 80(1):21–36
- Rogoff K, Sibert A (1988) Elections and macro-economic policy cycles. *Rev Econ Stud* 55(1):1–16
- Rontos K, Grigoriadis E, Sateriano A, Syrmali M, Vavouras I, Salvati L (2016) Lost in protest, found in segregation: Divided cities in the light of the 2015 “Οχι” referendum in Greece. *City Cult Soc* 7(3):139–148
- Rontos K, Vavouras I, Ciommi MT, Salvati L (2019) Two faces of the same coin? A comparative, global approach to corruption and socioeconomic development. *Qual Quant* 53:1875–1894
- Salvati L (2022) Exploring long-term urban cycles with multivariate time-series analysis. *Environment and Planning B: Urban Analytics and City Science* 49(4):1212–1227
- Salvati L, Ciommi MT, Serra P, Chelli FM (2019) Exploring the spatial structure of housing prices under economic expansion and stagnation: The role of socio-demographic factors in metropolitan Rome, Italy. *Land Use Policy* 81:143–152
- Schurz RR (1951) On the measurement of income inequality. *American Economic Review* 41(1):107–126
- Sever C, Emekcan Y (2021) Electoral cycles in Inequality. Bogazici University. Dept Econ Working Paper No 2021/01
- Shin I (2012) Income inequality and economic growth. *Econ Model* 29(5):2049–2057
- Stockhammer E (2017) Determinants of the wage share: A panel analysis of advanced and developing economies. *Br J Ind Relat* 55(1):3–33
- Szeles MR (2013) Re-examining the relationship between economic growth and inequality in the New Member States. *Qual Quant* 47:2799–2813
- Tsakloglou P (1990) Aspects of poverty in Greece. *Review of Income and Wealth* 36(4):381–402
- Tsakloglou P (1993) Aspects of inequality in Greece: Measurement, decomposition and inter-temporal change. *J Dev Econ* 40(1):53–74
- Truger A (2020) Reforming EU fiscal rules: More leeway, investment orientation and democratic coordination. *Intereconomics* 2020, Leibniz Information Centre for Economics (ZBW) Forum 277–281. <https://doi.org/10.1007/s10272-020-0915-z>
- Tsakloglou P, Mitrakos T (2006) Inequality and poverty in Greece in the last quarter of the twentieth century. In: Mossialos E, Petmesidou M (eds) *Social Policy in Greece*. Ashgate, Aldershot, pp 126–143
- Tsakloglou P, Panopoulou G (1998) Who are the poor in Greece? Analysing poverty under alternative concepts of resources and equivalence scales. *J Eur Soc Policy* 8(3):213–2236

Voitchovsky S (2005) Does the profile of income inequality matter for Economic Growth? Distinguishing between the effects of inequality in different parts of income distribution. *J Econ Growth* 10:273–296

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.

## Authors and Affiliations

George Petrakos<sup>1</sup> · Kostas Rontos<sup>2</sup> · Luca Salvati<sup>3</sup> · Chara Vavoura<sup>4</sup> · Ioannis Vavouras<sup>5</sup>

George Petrakos  
petrakos@panteion.gr

Kostas Rontos  
k.rontos@soc.aegean.gr

Chara Vavoura  
cvavoura@econ.uoa.gr

Ioannis Vavouras  
vavouras@panteion.gr

<sup>1</sup> Department of Public Administration, Panteion University of Social and Political Sciences & Director General, Research Institute for Tourism, Athens, Greece

<sup>2</sup> Department of Sociology, University of the Aegean, Mytilene, Greece

<sup>3</sup> Department of Methods and Models for Economics, Territory and Finance, Sapienza University of Rome, Rome, Italy

<sup>4</sup> Department of Economics, University of Athens, Athens, Greece

<sup>5</sup> Panteion University of Social and Political Sciences, Athens, Greece