Inequality and redistribution: evidence from Scandinavian and Mediterranean countries

Oscar Claveria
AQR-IREA, Department of Econometrics, Statistics and Applied Economics, University of Barcelona, Barcelona, Spain, and

Petar Sorić
Faculty of Economics and Business, University of Zagreb, Zagreb, Croatia

Received 9 June 2023
Revised 13 September 2023
29 September 2023
2 October 2023
9 October 2023
Accepted 16 October 2023

Abstract

Purpose – The purpose of this paper is to investigate the adjustment of government redistributive policies in Scandinavian and Mediterranean countries following changes in income inequality over the period 1980–2021.

Design/methodology/approach – The authors first modelled the time-varying dynamics between income inequality and redistribution and then used a non-linear framework to test for the existence of asymmetries and cointegration in their long-run relationship. The authors used two complementary measures of inequality – the share of total income accruing to top percentile income holders and the ratio of the share of total income accruing to top decile income holders divided by that accumulated by the bottom 50% – and computed redistribution as the difference between the two inequality indicators before and after taxes and transfers.

Findings – The authors found that the sign of the relationship between income inequality and redistribution is mostly positive and time-varying. Overall, the authors also found evidence that the impact of increases in inequality on redistributive measures is higher than that of decreases. Finally, the authors obtained a significant long-run relationship between both variables in all countries except Denmark and Spain. These results hold for both Scandinavian and Mediterranean countries.

Originality/value – To the best of the authors' knowledge, this is the first paper to account for the potential existence of non-linearities and to examine the asymmetries in the adjustment of redistributive policies to increases in income inequality using alternative income inequality metrics.

Keywords Taxes, Income inequality, Government transfers, Redistributive policy

Paper type Research paper

1. Introduction

There is a complex relationship between income inequality and redistribution. On the one hand, high levels of income inequality can create social and economic problems such as poverty, social unrest and decreased economic growth. In response, many governments have implemented redistributive policies such as progressive taxation, social welfare

The authrs want to thank the Editor and two anonymous referees for their useful comments and suggestions. This research was supported by the project PID2020-118800GB-I00 from the Spanish Ministry of Science and Innovation (MCIN) / Agencia Estatal de Investigación (AEI). DOI: http://dx.doi.org/10.13039/501100011033.

programmes and minimum wage laws to address these issues (Granger *et al.*, 2022). On the other hand, the effectiveness of redistributive policies can be limited by political and economic factors. For example, political resistance from those who would have their wealth redistributed and the potential for unintended consequences such as disincentivising work or reducing economic growth (Stiglitz, 2012, 2015).

Over the past decade, and especially as a consequence of the 2008 financial crisis, the level of inequality in income distribution has become one of the fundamental social priorities and occupies an increasingly prominent place on the political agenda. There is a shared perception of the need to correct the growing inequalities in income distribution, not only between countries but also within countries. The result of this is an increasing implementation of progressive tax systems and social spending to cushion the negative effects of the growing income disparity. However, against this background, it is shocking that, despite the application of redistributive measures, income inequality continues to steadily rise.

In a recent review of the literature examining the link between income inequality and government spending, Anderson *et al.* (2017) found a moderate negative relationship between government spending and income inequality, and that the redistribution effect tends to be more beneficial for the middle class and is more effective in developed countries. Overall, the authors highlighted that the complex relationship between both variables – which is affected by both "first-round" and "second-round" effects – and stressed the importance of both the estimation method used and the variable chosen to measure inequality. This last aspect has been pointed out by various authors, among others Perotti (1996) and Luebker (2014). Borge and Rattsø (2004) also advocated for the empirical analysis of this nexus in samples where countries can be clustered into institutionally homogeneous groups that favour comparability.

The main motivation of this paper is to address these issues in the analysis of the long-term relationship between income inequality and the redistributive effect of government policies via taxes and transfers. The contribution of this study is threefold. Firstly, the research focuses on two sets of relatively homogeneous economies during the period between 1980 and 2021: the Scandinavian countries and the main four Mediterranean countries of the European Union (Greece, Italy, Portugal and Spain). Secondly, given that the length of the series allows us to implement different time series analysis techniques, we have chosen to combine two modelling strategies to evaluate both the time-varying dynamics and the long-run relationship accounting for the potential existence of non-linearities. Finally, we have additionally used two alternative measures of inequality to the Gini index, which allows capturing different dimensions of the phenomenon.

There are different metrics to quantify the level of income inequality. Among them, the most used is the Gini index. However, in recent years, it has been highlighted how income inequality is particularly concentrated in the highest income groups. (Atkinson *et al.*, 2011; Piketty and Saez, 2014). Consequently, our analysis focuses on two complementary measures of income inequality: the share of total income accruing to top percentile income holders, as well as the ratio of the share of total income accruing to top decile income holders divided by that accumulated by the half bottom of the distribution, which can be regarded as a metric of inequality at the aggregate level.

Regarding the effect of the redistributive measures, we have calculated it as the difference between the two inequality indicators before and after taxes and transfers. This has been possible thanks to the information that the world inequality database (WID) project has been generating in recent years, which is freely available to researchers. Despite the inherent limitations of any proxy metric, this database offers numerous advantages over previously available information. On the one hand, it not only provides estimates of the level

of inequality for long periods of time but also does so before and after taxes and transfers. This contribution is what makes it possible to approximate the government effort in mitigating inequality. In addition, the historical series are available for a wide range of countries and on an annual basis, making possible both international comparisons and the application of econometric techniques characteristic of time series analysis.

Thus, we first analyse the differences in the long-run evolution of both income inequality and the redistributive impact of taxes and transfers during the sample period. Secondly, we apply a longitudinal analysis by combining different time series techniques to model the dynamic relationship between income inequality and redistribution accounting for the potential existence of non-linearities and an asymmetric adjustment in the face of increases in inequality.

In Section 2, we review the existing literature on the link between inequality and redistribution and provide a theoretical framework. Next, we present the data and carry out a graphic and descriptive analysis to shed light on the evolution of both variables since the 1980s in Section 3. In Section 4, we describe the methodology used in the empirical analysis. Next, the results are presented in Section 5. Finally, we report the main conclusions of the study in Section 6.

2. Literature review

The seminal work of Kuznets (1955) put the issue of inequality in the distribution of income at the centre of public debate. The perception during the following decades of equality as an obstacle to economic growth favoured the implementation of non-interventionist policies, consolidating an increasingly diminishing role of governments in the fight against inequality, and relegating interest in this pressing issue. Since then, most of the emphasis has been placed on contrasting Kuznets' hypothesis that during economic growth, per capita income inequality first increases, reaches a peak and then declines. For example, Dawson (1997) found support to Kuznets' hypothesis using data for 36 less developed countries, and Cevik and Correa-Caro (2020) also obtained an inverted U-shaped relationship between income inequality and economic development in China and the panel of BRIC+ countries.

Using a panel data of 21 high-income organisation for economic co-operation and development (OECD) countries during the period 1972–2006, Munielo-Gallo and Roca-Sagalés (2013) found that distributive expenditures and direct taxes produced significant reductions in economic growth, reflecting the standard efficiency–equity trade-off associated to certain fiscal policy measures. More recently, using data for 130 countries over the period 1965–2010, Woo (2020) presented evidence that redistribution involved a non-trivial trade-off between equity and long-term growth, which varied with the initial level of market income inequality and the size of redistribution itself.

Despite this, there is a growing body of studies questioning this trade-off and presenting new evidence of a positive relationship between equality and growth. Using the Deininger–Squire data set, Tanninen (1999) obtained a negative relationship between inequality and growth on the basis of reduced-form growth equations. In their seminal paper, using data for 140 countries, Berg *et al.* (2012) showed that growth duration was positively related to the degree of equality of the income distribution, the quality of democratic institutions, commercial openness and macroeconomic stability. Ravallion (2014) showed that high inequality in developing countries attenuates growth prospects, which in turn makes it harder to reduce inequality. All of this reflects that this is still an open debate.

Similarly, there is no consensus regarding the nexus between income inequality and redistribution. Although Berg *et al.* (2018) and Milanovic (2000) found evidence that redistributive efforts tend to be greater in countries with higher income inequality, de Mello and Tiongson (2006) and Benabou (2000) obtained evidence to the contrary. Rational choice

theory provides a theoretical corpus in which to frame this issue. Meltzer and Richard (1981) create a formal model of taxation and income redistribution to test whether more unequal income distribution would create a majority for more redistribution. The rationale behind the Meltzer–Richard (MR) hypothesis is that both voters and politicians are rational self-interested agents. Voters try to maximise their utility, whereas politicians try to maximise their probability of (re)election. Applying the median voter theorem, the model postulates a positive association between income inequality and redistribution in democratic countries, which is supposed to hold both over time and across countries. From an econometric perspective, this implies that no control variables are required when empirically testing the hypothesis (Luebker, 2014).

This last implication has given rise to an enormous number of studies focused on testing the hypothesis at an empirical level. Using US data, Meltzer and Richard (1983) found evidence favourable to their conceptual model. Rodríguez (1999) provided a similar empirical study, insisting on the robustness of results through both a time series and a cross-section analysis of US data. However, the author found negligible evidence in favour of the inequality-redistribution relationship.

Subsequent studies mostly focused on cross-country specifications (Perotti, 1996; Grossmann, 2003; Borge and Rattsø, 2004; Gründler and Köllner, 2017; Lee, 2022), obtaining mixed results. Grossmann (2003) expanded the MR framework, building a general equilibrium model with redistribution achieved through publicly provided goods and services rather than by tax transfer schemes, finding that growing income inequality could even negatively influence government size. Building on the MR model, Borge and Rattsø (2004), evaluated tax structure data of Norwegian local governments. Specifying a panel model with instrumental variables, the authors showed that tax distribution is highly sensitive to income distribution, supporting the MR postulate. The authors found that more income inequality motivates the majority to shift the tax burden from the poll tax to a property tax proportional to income, generating higher redistribution rates.

In spite of this mixed empirical evidence, the MR model still provides a useful framework for understanding the influence of income inequality on government spending, taxation and the size of public sector in general. An example are the recent works by Gründler and Köllner (2017) and Lee (2022). One of the reasons for the prevalence of the model lies in its flexibility, which has enabled quite a few theoretical extensions that have led to novel research directions. For example, Alesina and Rodrik (1994) extended the MR model by allowing two separate mechanisms: one from income inequality to redistributive policies and the second from redistribution to economic growth. The latter linkage postulates that redistributive taxation negatively affects growth by disincentivising savings and investment. The model was further developed by Perotti (1996) and empirically questioned in various contexts (Berg *et al.*, 2018; Panzera and Postiglione, 2022).

The debate on the relationship between income inequality and redistribution is still open. The lack of consensus regarding the validity of MR hypothesis has been attributed to several factors. One of the most interesting arguments is that the hypothesis should be tested in a more homogenous setting, with samples that can be split into groups of countries with comparable historical and institutional backgrounds instead of pooled estimates that might be severely biased (Borge and Rattsø, 2004). In addition, other authors such as Perotti (1996), Luebker (2014) or Anderson *et al.* (2017) have stressed the importance of the quality of income distribution data and the availability of proper and comparable income inequality metrics to carry on cross-country comparisons.

The objective of this work is precisely to address these issues. In a context in which the growing social awareness of the problems associated with inequality, together with the

increasing availability of accurate and detailed information on income distribution have given rise to a resurgence of the debate both from the political and academic spheres, the analysis of the long-term relationship between inequality and redistribution seems especially timely.

On the one hand, the estimation of historical series of income distribution for a large number of countries has made it possible to carry out comparative analysis of the evolution of inequality for different economies (Alvaredo *et al.*, 2013; Piketty and Zucman, 2014; Roine and Waldenstörm, 2011). On the other hand, the study of the determinants of inequality has also experienced a growing interest in recent years. Nolan *et al.* (2019) classified the determinants of income inequality in seven categories: globalisation, technological change, macroeconomic shocks and "financialization" – understood as the growing role of finance – labour institutions, product market power, demographics and household structure and finally the redistributive role of governments through taxes and transfers.

Munielo-Gallo and Roca-Sagalés (2013) found that distributive expenditures and direct taxes produced significant reductions in net income inequality. As stated by Joumard *et al.* (2012), taxes and transfers reduce inequality in disposable income relative to market income. In their study of OECD countries, the authors noted that the effect of taxes and transfers notably varies across countries, and that it depends on three components (size, mix and progressivity), based on which they group all economies in four groups: the Continental-European model, the Anglo-Saxon model, the Nordic model and a lower-income group. The Nordic model is characterised by large and mostly universal cash transfers, a high level of spending on in-kind services and a tax mix that promotes redistribution (Goulart *et al.*, 2022).

Unlike the USA, income inequality in European countries has not been as widely analysed. Regarding Scandinavian countries, Atkinson and Søgaard (2016) and Roikonen (2022) carried out a detailed study of inequality in Denmark and Finland, respectively. As for Sweden, Roine and Waldenström (2008, 2009) published longitudinal studies covering a long historical period. However, we have found no comparative studies between the four Scandinavian economies in the literature. The studies that include the different Scandinavian countries analyse them jointly with the rest of the developed countries but do not delve into the differences between them.

To cover this gap, in the present study, we analyse the time-varying dynamics and the long-run relationship between income inequality and redistribution:

- in two homogeneous groups of economies – Scandinavian countries and the main four Mediterranean countries of the European Union;
- using alternative metrics of income inequality and redistribution; and
- by means of different time series procedures. In the next section, we describe the data.

3. Data

In this section, we present the data that were used in the study. To measure income inequality and redistribution, we used annual data from the WID.world, which is the most extensive data set available on the historical evolution of income inequality. Regarding the choice of metric of inequality, we have used two alternative measures to capture different dimensions of the phenomenon. On the one hand, we have computed the ratio between the pre-tax income accumulated by the top 10% divided by that of the bottom 50% (INEQ_1), to

have an aggregate measure of income inequality different from the Gini index (Clementi *et al.*, 2019) that considers the other half of the distribution. On the other hand, we have used the pre-tax share of income accruing to top 1% income holders (INEQ_2), as many authors have stressed the key role of this segment of the distribution in perpetuating inequality (Stiglitz, 2012, 2015).

By computing both metrics for the post-tax shares, we were able to estimate redistribution (REDI) as the proportion subtracted via taxes and transfers. Therefore, the redistributive effect of taxes and transfers is calculated as the difference between inequality in primary income (i.e. before taxes and government transfers, except pensions and unemployment insurance among adults) and in disposable income (i.e. after taxes and transfers) for both measures of inequality, which are, respectively, denoted as REDI_1 and REDI_2.

The analysis focuses on two set of homogeneous economies (Scandinavian and Mediterranean countries), both to avoid the issues that arise when comparing very dissimilar economies, and to disentangle the differences between a group of apparently homogeneous economies regarding income inequality and redistribution. See Borge and Rattsø (2004) for a justification of this decision.

Figures 1 and 2 show the evolution of the long-term dynamics of income inequality (INEQ_1) and the redistributive effect of taxes and transfers both at the aggregate level (REDI_1). The evolution of INEQ_2 and REDI_2, (i.e. the share of income and redistribution among top 1% holders), as well as the graphs with distribution of all four variables can be found in Sorić and Claveria (2023).

The evolution of income inequality and redistribution seems to be heavily affected by the 2008 financial crisis in most countries, particularly in Iceland, Norway, Greece and Portugal. Notwithstanding, while in the majority of these economies the effect translated into decreases in both variables, in Iceland – after a sharp and sudden drop in inequality and in redistributive efforts – a subsequent rebound and stabilisation at lower levels is immediately observed. Prior to the crisis, Iceland had a rapidly growing economy and a thriving financial sector. However, when the global financial crisis hit, Iceland's economy collapsed. Overall, the 2008 financial crisis had a significant and long-lasting impact on Iceland, both economically and politically, which shows on the evolution of the share of income accruing to top income holders. This evidence is linked to the results recently obtained by Kohlscheen *et al.* (2021).

Today, Sweden is one of the least unequal countries in terms of income in the world (Chancel *et al.*, 2022). However, Sweden was one of the most unequal countries in the early 20th century. The expansion of democracy paved the way for the development of the Swedish welfare state, which led to a large-scale drop in inequality. Nevertheless, inequalities have been rising since the 1980s, and there has been little intergenerational mobility in top incomes (Björklund *et al.*, 2012). A similar pattern has been followed by Denmark (Atkinson and Søgaard, 2016) and many European countries. A case in point is Italy, where the top 10% has been rising since the early 1980s, whereas the bottom 50% share has dropped from 27% to 21%. Part of this decline is due to the austerity policies that followed the financial crisis and the European debt crisis of 2012–2014.

The graphs in Figure 2 highlight the growing role of governments in mitigating the effects of income inequality through progressive taxation and public transfers. However, this effort has not been enough to prevent sharp increases in income inequality since the 1980s, especially for top incomes shares in Denmark and Italy (Figure 1). Although countries such as Norway and Portugal have observed redistributive rates above the average during the past three decades, these show a decreasing trend since the 2008 financial crisis.

Table 1 contains the average, the standard deviation and the initial and the final value of all four variables over the period 1980–2021 for the eight countries included in the study. Spain is the country that shows the highest average share of income accruing to top 1% income holders, as opposed to Iceland. Regarding INEQ_1, Greece shows the highest ratio and

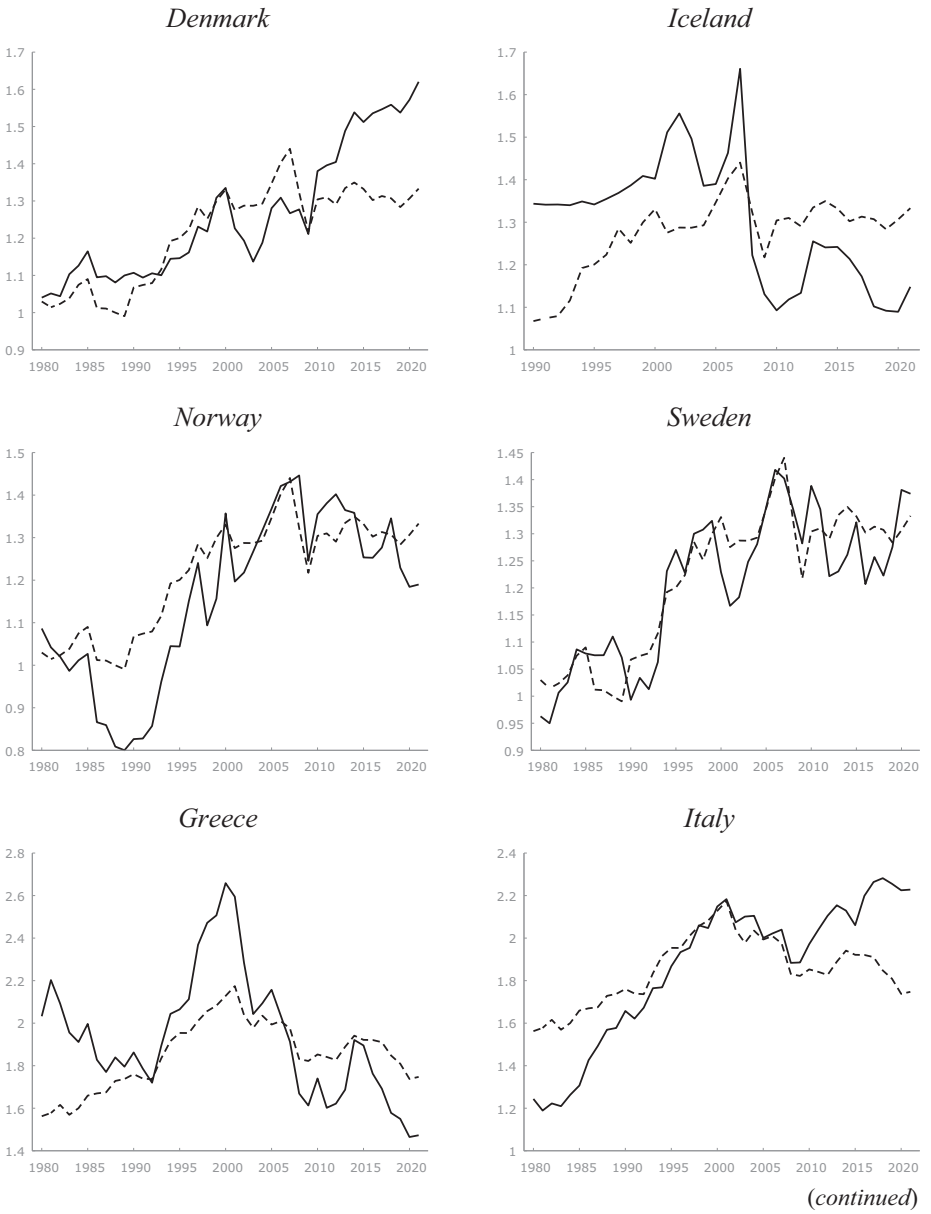
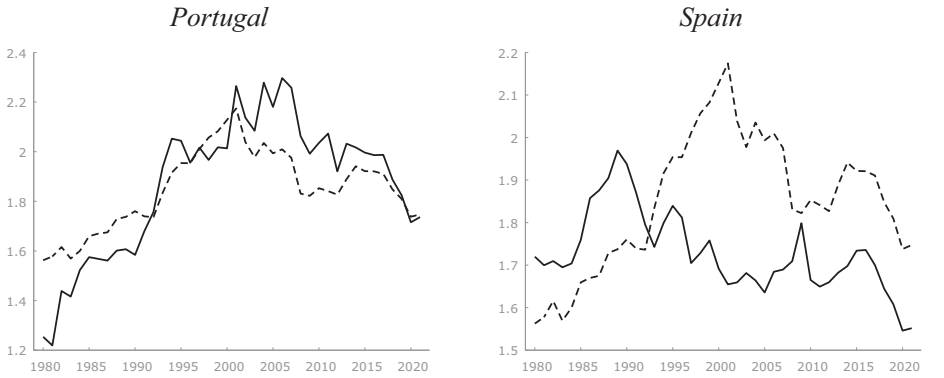


Figure 1.
Evolution of income inequality (1980–2021) – ratio top 10/bottom 50 (INEQ_1)

(*continued*)



Notes: The black line represents the evolution of INEQ_1, which denotes the ratio between the pre-tax income accumulated by the top 10% divided by that of the bottom 50% in each country, and the dashed black line the evolution of average INEQ_1 in Scandinavian and Mediterranean countries, respectively
Source: Figure created by authors

Figure 1.

Norway the lowest. Norway is the economy that shows the highest average redistributive effect for both metrics of income inequality in the Scandinavian countries, whereas Portugal displays a slightly higher mean for REDI_1. In contrast, Italy shows by far the lowest average redistribution, both at the aggregate level (REDI_1) and with respect to the top 1% income holders (REDI_2).

Overall, the graphs in Figure 2 highlight the persistence of governments in mitigating the effects of income inequality, although this effort seems not enough to prevent the prevalence of income inequality and its continuous growth. To determine whether these trends are deterministic or stochastic, we run the Kwiatkowski–Phillips–Schmidt–Shin test (Kwiatkowski *et al.*, 1992), which tests the null hypothesis that the time series is stationary around a deterministic trend against the alternative of a unit root. In Table 2, we present the results of the test. While in most cases the null hypothesis is rejected at the 5% significance level in the specification without trend, especially for the share of income among top 1% holders, we obtained mixed evidence, which justifies the choice of modelling approach presented in the next section. Our results are in line with a recent study by Makhlouf (2023), who found that inequality has either been increasing or stable in 15 developed countries.

4. Methodology

We apply two different methods to obtain a granular perspective on the long-run relationship between income inequality and redistribution: a regression model with time-varying parameters (TVPs) and the non-linear autoregressive distributed lag (NARDL) model. These procedures are advantageous for several reasons. Firstly, they consider the potential time-variability and asymmetric effects in the generating process of inequality (Huang *et al.*, 2015; Balcilar *et al.*, 2021).

Both issues seem equally important to adequately empirically test the validity of the MR hypothesis. Namely, the concept itself stems from the rational choice theory, which was often criticised for its over-restrictive assumptions such as time-invariability and universal validity of agents' preferences without considering the specific socio-economic and historic

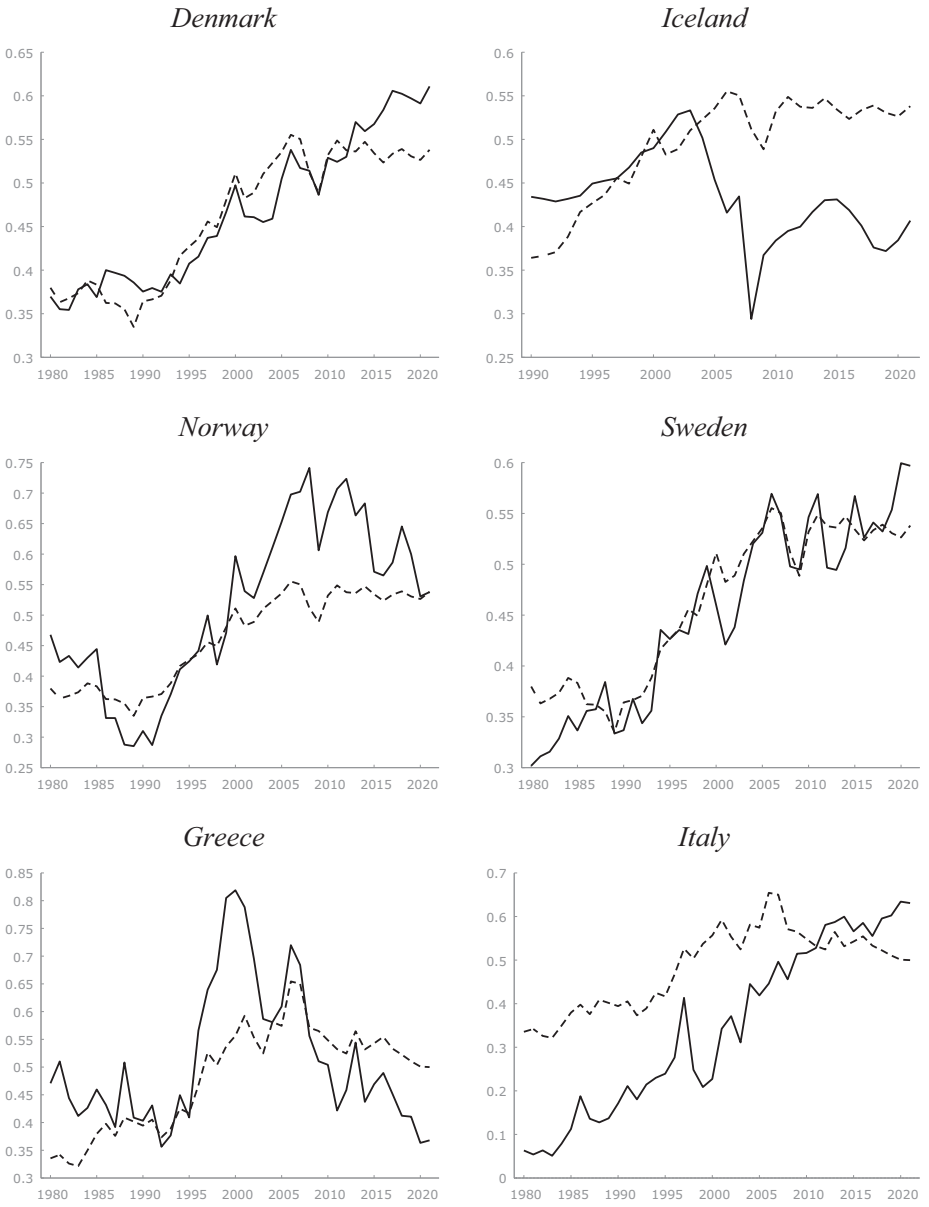
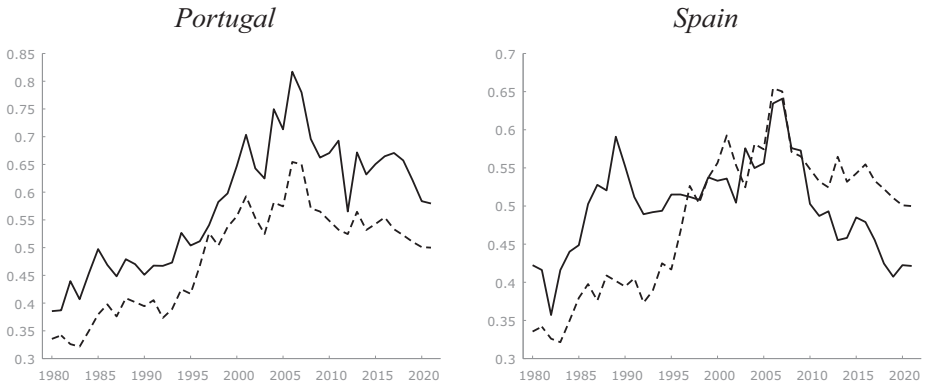


Figure 2.
Evolution of redistribution (1980–2021) – ratio top 10/bottom 50 (REDI_1)

(*continued*)



Notes: REDI_1 is calculated as the difference between inequality in primary income (INEQ_1) and in disposable income (i.e. after taxes and transfers). The black line represents the evolution of REDI_1in each country and the dashed black line that of average REDI_1 in Scandinavian and Mediterranean countries, respectively
Source: Figure created by authors

Figure 2.

	Ratio top 10/bottom 50				Share of top income percentile			
Country	Mean	SD	Initial value	Final value	Mean	SD	Initial value	Final value
Inequality								
Denmark	1.263	0.176	1.040	1.620	0.103	0.019	0.069	0.134
Iceland	1.313	0.131	1.344	1.148	0.083	0.015	0.077	0.093
Norway	1.156	0.196	1.086	1.190	0.097	0.025	0.076	0.089
Sweden	1.205	0.134	0.963	1.374	0.102	0.014	0.072	0.117
Greece	1.936	0.295	2.033	1.473	0.102	0.014	0.099	0.100
Italy	1.862	0.337	1.244	2.228	0.092	0.021	0.060	0.122
Portugal	1.870	0.277	1.254	1.736	0.096	0.014	0.069	0.094
Spain	1.729	0.095	1.720	1.552	0.115	0.006	0.114	0.114
Redistribution								
Denmark	0.467	0.083	0.370	0.611	0.021	0.004	0.016	0.024
Iceland	0.432	0.050	0.434	0.407	0.014	0.003	0.013	0.020
Norway	0.513	0.135	0.468	0.538	0.037	0.013	0.029	0.036
Sweden	0.452	0.091	0.302	0.597	0.026	0.009	0.012	0.040
Greece	0.511	0.126	0.471	0.368	0.022	0.006	0.020	0.028
Italy	0.343	0.195	0.063	0.631	0.009	0.005	0.001	0.014
Portugal	0.577	0.112	0.385	0.580	0.024	0.005	0.017	0.022
Spain	0.499	0.062	0.422	0.421	0.024	0.007	0.016	0.023

Notes: SD stands for standard deviation. Initial value corresponds to year 1980, with the exception of Iceland, for which there is only available information from 1990 onwards. Final value corresponds to year 2021
Source: Table created by authors

Table 1.
Summary statistics – income inequality and redistribution (1980–2021)

Table 2. Test for stationarity – KPSS test statistics

Country	Ratio top 10/bottom 50				Share of top income percentile			
	Inequality		Redistribution		Inequality		Redistribution	
	With trend	No trend	With trend	No trend	With trend	No trend	With trend	No trend
Denmark	0.189 (0.02)	1.042 (<0.01)	0.162 (0.04)	1.112 (<0.01)	0.040 (>0.10)	1.068 (<0.01)	0.112 (>0.10)	0.888 (<0.01)
Iceland	0.193 (0.02)	0.487 (0.04)	0.096 (>0.10)	0.352 (>0.10)	0.097 (>0.10)	0.164 (>0.10)	0.119 (>0.10)	0.612 (0.03)
Norway	0.152 (0.04)	0.789 (<0.01)	0.146 (0.06)	0.808 (<0.01)	0.199 (0.02)	0.690 (0.02)	0.138 (0.07)	0.733 (<0.01)
Sweden	0.156 (0.04)	0.880 (<0.01)	0.125 (0.09)	1.109 (<0.01)	0.128 (0.09)	0.500 (0.04)	0.078 (>0.10)	1.128 (<0.01)
Greece	0.174 (0.03)	0.337 (>0.10)	0.198 (0.02)	0.206 (>0.10)	0.092 (>0.10)	0.199 (>0.10)	0.055 (>0.10)	0.455 (0.05)
Italy	0.228 (<0.01)	0.969 (<0.01)	0.088 (>0.10)	1.133 (<0.01)	0.104 (>0.10)	0.047 (<0.01)	0.182 (>0.03)	0.967 (<0.01)
Portugal	0.283 (<0.01)	0.661 (0.02)	0.204 (0.01)	0.843 (<0.01)	0.260 (<0.01)	0.843 (<0.01)	0.138 (0.07)	0.831 (<0.01)
Spain	0.089 (>0.10)	0.584 (0.03)	0.211 (0.01)	0.214 (>0.10)	0.136 (0.07)	0.417 (0.07)	0.176 (0.03)	0.401 (0.07)

Notes: Estimation period 1980–2021. Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test for stationarity (Kwiatkowski *et al.*, 1992). Critical values with trend = 0.122 (10%), 0.149 (5%), 0.212 (1%); with no trend: 0.352 (10%), 0.462 (5%), 0.720 (1%). Null hypothesis = time series is stationary around a deterministic trend (i.e. the process is trend-stationary), against the alternative of a unit root. Interpolated *p-values* between brackets
Source: Table created by authors

context that potentially might drive agents' decisions (Blossfeld, 1996; Luebker, 2014). As we were unable to find an existing study that addresses the issue of possible time-variability of the inequality-redistribution conundrum, we add to the literature in that respect. Regarding the potential non-linear effects, the observed relationship is found to be asymmetrically sensitive to behavioural concepts such as inequality aversion (Höchtl *et al.*, 2012) and voting patterns (Son Hing *et al.*, 2019). Therefore, we use the NARDL procedure to properly account for such effects.

Secondly, both TVP and NARDL frameworks allow for a mixture of I(0) and I(1) variables (Pesaran *et al.*, 2001), which is what we observed in the previous section. Besides, the NARDL model is robust to bi-directional feedback effects between dependent variable and regressors, conditioned to a correct specification of the lag order so that regressors become weakly exogenous (Chudik *et al.*, 2016). Finally, NARDL is specifically designed for limited data sizes, such as our data set (Narayan, 2005).

To examine the stability of the relationship between income inequality and redistribution over time, we used the TVP model proposed by Durbin and Koopman (2012). The model comprises an observation equation and a state equation:

$$Y_t = z_t'\beta_t + \varepsilon_t, \varepsilon_t \sim N\left(0, \sigma_{t,\varepsilon}^2\right) \tag{1}$$

$$\beta_{t+1} = \beta_t + \eta_t, \eta_t \sim \mathrm{N}(0, Q), t = 1, \ldots, T, \tag{2}$$

where T denotes sample size and Y_t is the observation vector containing the corresponding measure of redistribution. The unobserved state vector, $\beta_t\prime$, is defined as $\beta_t\prime = (\beta_{t,0} \quad \beta_{t,1} \ldots \quad \beta_{t,m})$, $Q = diag(\sigma_{t,1}{}^2, \sigma_{t,2}{}^2, \ldots, \sigma_{t,m}{}^2)$ is a diagonal covariance matrix, $z_t' = (1 \quad x_{t,1} \quad x_{t,2} \ldots x_{t,m})$ is the regressor vector and $\eta_t\prime = (\omega_{t,1}, \omega_{t,2} \ldots \omega_{t,m})$ the error term. In all cases, m denotes the number of state variables and $\beta_{t,0}$ is a potentially TVP often referred to as the local level.

We used the Broyden–Fletcher–Goldfarb–Shanno algorithm to estimate the unknown variances in the covariance matrix Q (Durbin and Koopman, 2012, p. 177). We obtained the unobserved state values of β_t using the diffuse Kalman filter (De Jong, 1991).

It is worth noting that we did not impose time-variability of the estimated parameters but rather allowed for it. Each variance in Q could be either deterministic or stochastic, yielding either a fixed or a TVP for each assessed regressor. We only allowed for time-variability, i.e. stochastic variance, of the income inequality parameter. We selected the optimal model specification for each country using the Akaike information criterion (Commandeur and Koopman, 2007). Following Koopman *et al.* (1999), after identifying the optimal model specification for each country, we applied standard diagnostic tests: the Doornik and Hansen (1994) version of the Bowman–Shenton normality test, a non-parametric heteroskedasticity test (Koopman *et al.*, 1999) and a standard Ljung–Box autocorrelation test of fourth order. If the null hypothesis was not rejected in all three procedures, it meant that the model passed all diagnostic tests.

In addition to analysing how the relationship between pre-tax income inequality and redistribution changes over time, we also examined whether there are differences in the effects of positive and negative changes in inequality. To investigate this asymmetry, we used the NARDL methodology proposed by Greenwood-Nimmo and Shin (2013):

$$\Delta Y_t = a_0 + \theta_1^+ INEQ_t^+ + \theta_1^- INEQ_t^- + \rho Y_t + \sum_{j=1}^{p-1} a_j \Delta Y_{t-j} + \sum_{j=0}^{q_1^+ - 1} \pi_{1,j}^+ \Delta INEQ_{t-j}^+ + \sum_{j=0}^{q_1^- - 1} \pi_{1,j}^- \Delta INEQ_{t-j}^- + e_t \quad (3)$$

where $INEQ_t^+ = \sum_{j=1}^{t} max(\Delta INEQ_t, 0)$ and $INEQ_t^- = \sum_{j=1}^{t} min(\Delta INEQ_t, 0)$. The optimal lag structure of the model (p, q_1^+, and q_1^-) was determined using the general-to-specific approach (Shin *et al.*, 2014).

We started by estimating Model (3) with $p = q_1^+ = q_1^- = 4$, and then excluded all insignificant variables via a 5% significance stopping rule. We tested for cointegration using a standard Wald test ($\boldsymbol{H}_0: \rho = \theta_1^+ = \theta_1^- = 0$) and formally tested the significance of any non-linearities in both the long run (LR), $\boldsymbol{H}_0: \theta_1^+ = \theta_1^-$) and the short run (SR), $\boldsymbol{H}_0: \sum_{j=0}^{q_1^+ - 1} \pi_{1,j}^+ = \sum_{j=0}^{q_1^- - 1} \pi_{1,j}^-$. Whenever the null hypothesis was rejected, we included the underlying asymmetry to prevent estimation bias. When the null hypothesis of LR symmetry could not be rejected for $INEQ_t$, we re-estimated equation (3) with $\theta_1^+ INEQ_t^+ + \theta_1^- INEQ_t^-$ reduced to $\theta_1 INEQ_t$. Similarly, for the case of SR symmetry, Model (3) was estimated with $\sum_{j=0}^{q_1^+ - 1} \pi_{1,j}^+ \Delta INEQ_{t-j}^+ + \sum_{j=0}^{q_1^- - 1} \pi_{1,j}^- \Delta INEQ_{t-j}^-$ equalling $\sum_{j=0}^{q_1 - 1} \pi_{1,j} \Delta INEQ_{t-j}$. If the data did not reveal any asymmetry at all, the model became purely linear (ARDL).

After estimating the final version of the model for each economy, we performed the diagnostic tests: Ljung–Box test for autocorrelation of fourth order, Engle's autoregressive conditional heteroscedasticity test of fourth order and the Shapiro–Wilks normality test of model residuals. If we found statistically significant asymmetries (SR and/or LR), we illustrated them using dynamic multipliers, which show how inequality responds to positive and negative unit changes in inequality:

$$m_{h,\omega}^+ = \sum_{j=0}^{h} \frac{\partial Y_{t+j}}{\partial EPU_t^+} \quad \text{and} \quad m_{h,\omega}^- = \sum_{j=0}^{h} \frac{\partial Y_{t+j}}{\partial EPU_t^-}, \; h = 0, \quad 1, \quad 2, \quad \ldots \quad (4)$$

5. Results

In this section, we evaluate the relationship between income inequality and redistribution in the eight countries of the sample. As noted by Anderson *et al.* (2017), there is no consensus in the literature regarding the nexus between both variables. Following a similar approach to Claveria and Sorić's (2023), we combine two types of analyses. Firstly, we estimate the state-space model specified in equations (1) and (2) (TVP model), which captures the time-varying dynamics between both variables. Secondly, to account for potential asymmetries in the long-term relationship and to test for cointegration between both variables, we estimate equation (3) (NARDL model) and compute the dynamic multipliers contained in equation (4).

We start by conducting the analysis at the aggregate level (variables INEQ_1 and REDI_1). Then, we subjected our evaluation to a robustness check, re-estimating both models for a different measure of income inequality and redistribution, i.e. the share of income among top 1% holders (variables INEQ_2 and REDI_2). The results for variables INEQ_2 and REDI_2 can be found in Sorić and Claveria (2023).

Variables INEQ_1 and REDI_1 incorporate the bottom half of the income distribution, thus making it possible to consider the extent to which redistributive policies have a concentrated impact on the middle classes (as suggested, *inter alia*, by Joumard *et al.*, 2012).

Results of the TVP model are presented in Table 3 and Figure 3, whereas the results of the NARDL analysis are presented in Table 4 and Figure 4.

The analysis reveals that the relationship between both variables in this case is time-varying for all the economies except Sweden, where redistributive efforts were persistent, regardless of the phase of the cycle and the economic shocks at hand. The estimated inequality parameters are mostly positive and this is in keeping with previous research by Berg *et al.* (2018), Borge and Rattsø (2004) and Joumard *et al.* (2012). Figure 3 presents the evolution of the parameter that captures the relationship between both variables over time. The graphs mostly display a mild upwards trend in the intensity of the impact of income inequality on redistribution.

The estimated value of the parameter increases over time, although a turning point occurs around the global financial crisis (Denmark, Greece, Italy, Portugal and Spain) or the sovereign debt crisis (Norway), after which the impact of inequality either stabilises or gradually decreases. This pattern in the evolution of both variables can be seen in Figures 1 and 2, and it is firmly based in economic theory. On the one hand, as redistributive taxation dampens savings and investments (Alesina and Rodrik, 1994; Perotti, 1996), governments are less interested in intensifying such policies during recessions for fear that they could have a pro-cyclical impact, further aggravating the crisis. On the other hand, rational choice theory presumes time-invariability of agents' preferences regarding the optimal amount of fiscal redistribution (Blossfeld, 1996; Luebker, 2014). Figure 3 suggests that this may not be the case and other similar studies also offer evidence in that direction. For example, Sorić (2018) showed that the economic impact of consumer sentiment strongly intensified during recession episodes. A similar mechanism may be at play here.

We conducted a supplementary analysis to account for potential asymmetries in the relationship and to test for cointegration between both variables. Table 4 summarises the NARDL cointegration test results. The preferred model specifications were chosen via a general to specific modelling strategy, and they either do not incorporate any lags of income inequality, or the chosen lags are jointly significant (see the Granger causality row). All model assumptions were clearly met and the underlying error terms can be described as a white noise process.

All countries, except Denmark, Norway and Spain, exhibit a long-run relationship between income inequality and redistributive policies. In the case of Norway, we obtain short-run causality. In most cases, we observe some kind of asymmetry. This pattern is presented in a more intuitive manner in Figure 4, by computing and displaying the evolution

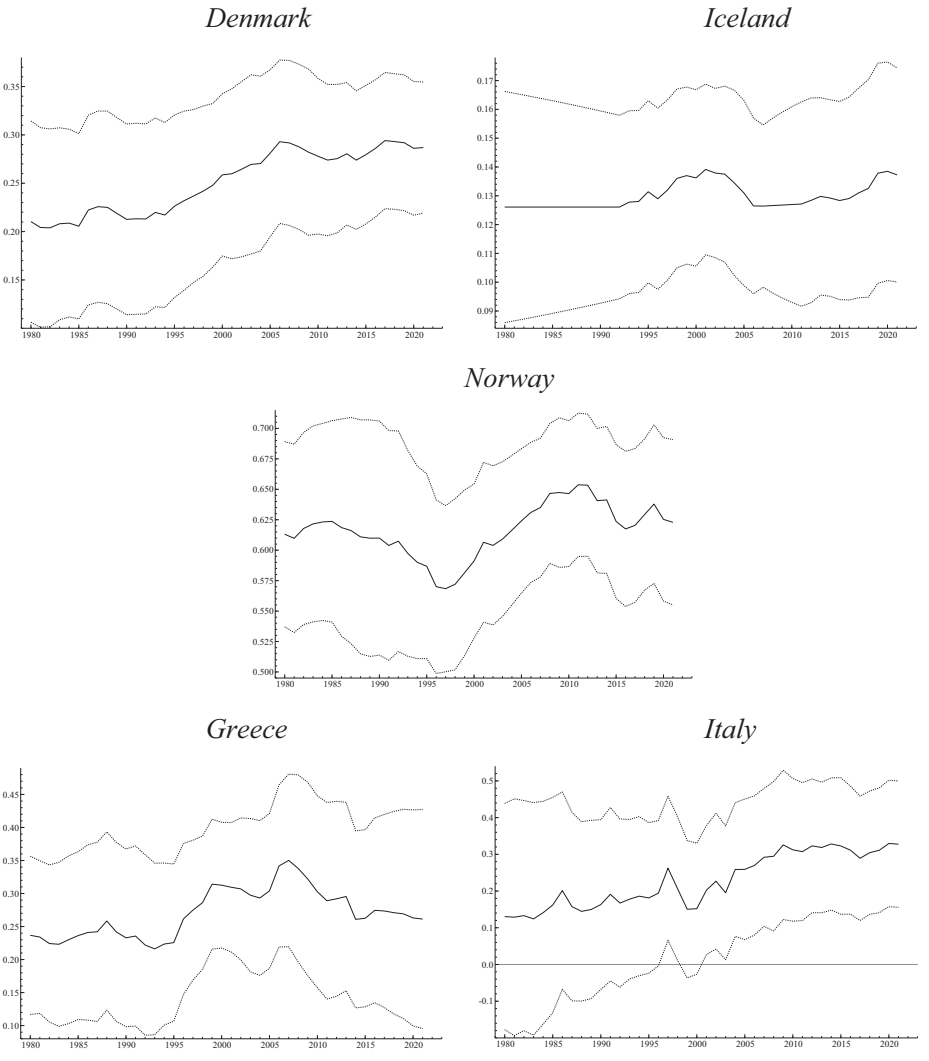
Country	Local level	Inequality coefficient	*H*	*BS*	*Q*
Denmark	0.146*	Time-varying	0.591	1.296	0.503
Iceland	0.058	Time-varying	0.880	1.199	0.941
Norway	−0.201	Time-varying	1.808	1.626	1.557
Sweden	0.051*	1.740**	0.454	0.992	4.431
Greece	−0.014	Time-varying	1.944	4.679	2.434
Italy	−0.099	Time-varying	0.484	1.899	4.887
Portugal	−0.046	Time-varying	1.543	0.131	2.648
Spain	−0.059	Time-varying	0.612	0.677	0.659

Table 3.
TVP model – income inequality and redistribution – ratio top10/bottom50

Notes: *, **Indicates significance at 5 and 1% level. *H, BS* and *Q* entries are test values of the Koopman *et al.* (1999) heteroskedasticity test, Doornik and Hansen (1994, 2008) normality test and the Ljung–Box autocorrelation test, respectively
Source: Table created by authors

of the dynamic multipliers. It can be seen how positive shocks in income inequality show a greater impact on redistribution than unexpected decreases.

The existence of a long-run relationship between income inequality and redistribution is in line with previous research. Although a positive association between higher levels of inequality in income distribution and greater redistributive efforts has been found in previous research (Borge and Rattsø, 2004; Granger *et al.*, 2022; Jestl and List, 2023; Ostry *et al.*, 2014), there are also studies that have found evidence to the contrary (Grossmann, 2003; Rodríguez, 1999). The



(*continued*)

Figure 3.
Time-varying impact of income inequality on redistribution (TVP) – ratio top10/bottom50

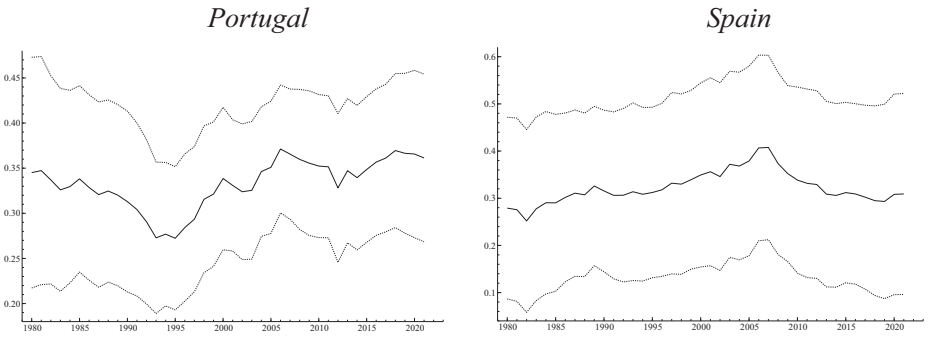


Figure 3.

Note: Dotted lines represent the 95% confidence interval
Source: Figure created by authors

Scandinavian countries	Denmark	Iceland	Norway	Sweden
Asymmetry	–	LR	SR	LR
$INEQ_t^+$	0.080	0.072	0.376**	0.274**
$INEQ_t^-$	–	0.084	–	0.182**
Causality	–	15.800**	63.170**	–
Cointegration	0.830	1.610	12.600**	6.440*
SW	0.911	1292	0.108	−0.480
ARCH	9.580	3.571	6.168	6.636
Q	2.472	3.957	1.110	6.079
Mediterranean countries	Greece	Italy	Portugal	Spain
Asymmetry	LR	LR	LR	–
$INEQ_t^+$	0.227**	0.160**	0.090*	−0.008
$INEQ_t^-$	0.200**	−0.262**	0.055	–
Causality	12.770**	–	13.340**	–
Cointegration	6.080	6.840*	2.860	1.630
SW	−0.348	0.769	0.308	0.755
ARCH	5.808	2.467	6.860	3.745
Q	1.912	1.074	1.243	3.334

Table 4.
NARDL cointegration tests – income inequality and redistribution – ratio top10/bottom50

Notes: *, **Indicates significance at 5 and 1% level. Entries in the "causality" row refer to Granger causality and are the corresponding F test statistics for the null hypothesis of all lags of inequality being insignificant. Entries in the "Cointegration" row are the corresponding F test statistics of the NARDL cointegration test. Narayan (2005) small sample critical values were used. SW, ARCH and Q row entries are test values of the Shapiro–Wilks normality test, Engle's ARCH test and the Ljung-Box autocorrelation test (respectively). Specifications with significant ARCH effects were estimated with HAC standard errors
Source: Table created by authors

obtained results may be indicating that the segments of the population that benefit the most from the transfers are not necessarily those with a lower level of income but rather the middle classes. Some previous studies point to the existence of this phenomenon (Anderson *et al.*, 2017), which highlights that to achieve a more equitable distribution of income, it is not enough just to increase the tax level and the magnitude of the transfers but it is also necessary to put special emphasis on the progressivity of taxes and on the type and ultimate recipient of the transfers (Joumard *et al.*, 2012).

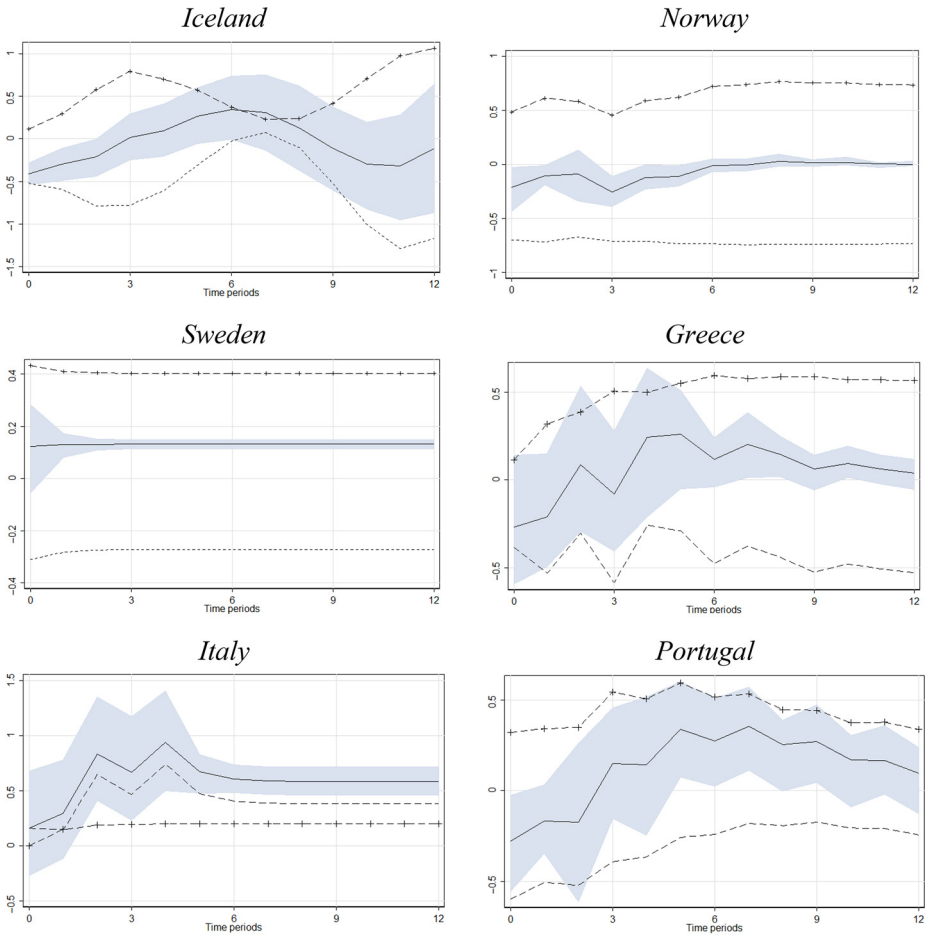


Figure 4.
Impact of income inequality on redistribution (NARDL) – ratio top10/bottom50

Notes: Dashed lines represent the impact of negative changes in income inequality. Lines marked with plus signs capture the impact of positive changes in inequality. Full lines are differences between the two (asymmetry). Shaded areas correspond to 95% confidence intervals

Source: Figure created by authors

Overall, our results suggest the existence of a positive and significant relationship between income inequality and redistribution. This evidence in favour of the MR hypothesis is in line with previous research by Berg *et al.* (2018), Joumard *et al.* (2012) and Milanovic (2000), who also found that redistributive efforts tend to be greater in countries with higher income inequality. Furthermore, the similarity of the results obtained for both the Scandinavian and Mediterranean countries is consistent with Borge and Rattsø's (2004) claim – that a key reason for the lack of support for the MR hypothesis in previous comparative empirical studies could come from of the heterogeneity between the countries analysed. In addition, we found that this nexus is time-varying, and that there is a predominance of positive over

negative shocks of income inequality on redistribution. This result is particularly relevant from an economic policy point of view, as sudden increases in income inequality could end up generating greater social demand for redistribution.

6. Conclusions

To this day, and since the 1980s, income inequality is continuously rising in most developed countries, especially in countries with higher per capita income. Mediterranean and Scandinavian countries are no exception, in spite of being considered some of the least unequal countries in terms of income.

This paper analysed the adjustment of government redistributive policies in Scandinavian economies and the main Mediterranean countries in the European Union following changes in income inequality over the period 1980–2021. We used two complementary measures of inequality, to account for both the share of total income accruing to top percentile income holders and a more general measure computed as the ratio of the share of total income accruing to top decile income holders divided by that accumulated by the bottom 50%.

Firstly, we observed that the intensity of redistributive policies in most of the assessed economies was severely impacted by the 2008 financial crisis and the subsequent European debt crisis. Redistribution showed a growing trajectory since the 1980s up until the financial crisis, when it experienced a structural break, and then either diminished or stabilised. Secondly, we found a mostly positive and time-varying relationship between income inequality and redistributive measures. Although the obtained results somewhat depend on the model specification and the chosen measure of income inequality, we found minor differences in the obtained results between the Scandinavian and Mediterranean economies. This last finding somehow suggests that when homogeneous clusters of countries are analysed, it is more likely to find empirical support for the MR hypothesis.

Finally, we used an alternative framework to test for the existence of asymmetries and cointegration between both income inequality and redistribution. This approach allowed us to account for the potential existence of non-linearities. We obtained either a significant long-run relationship or short-run causality between income inequality and redistribution in a vast majority of the observed economies. We found significant evidence that redistributive measures in the form of taxes and government transfers react more intensively in an upwards than a downwards direction. This last result is particularly relevant for policymakers. Given that high increases in income inequality have been found to be associated with a greater demand for the implementation of more redistributive policies, these in turn could have long-term effects on potential economic growth. However, for taxes and transfers to end up having an effective role in reducing income inequality, it is key to combine an adequate design of fiscal policy – guaranteeing the progressivity of taxes and the optimal type of transfers – with efficient measures against tax evasion.

The present study is not without limitations. The findings might have been influenced by several biases derived from the measurement of income inequality and redistribution. In connection with this, the aggregate nature of the data did not allow us to analyse potential discrepancies between different socioeconomic groups. In addition, given the complex interplay between the very diverse factors that affect redistribution additional potential biases may have arisen. Finally, future researchers might consider applying dynamic models and using alternative techniques to account for the potential non-linear relationships between variables.

References

Alesina, A. and Rodrik, D. (1994), "Distributive politics and economic growth", *The Quarterly Journal of Economics*, Vol. 109 No. 2, pp. 465-490, doi: 10.2307/2118470.

Alvaredo, F., Atkinson, A., Piketty, T. and Saez, E. (2013), "The top 1% in international and historical perspective", *Journal of Economic Perspectives*, Vol. 27 No. 3, pp. 3-20, doi: 10.1257/jep.27.3.3.

Anderson, E., D'Orey, M.A.J., Duvendack, M. and Esposito, L. (2017), "Does government spending affect income inequality? A meta-regression analysis", *Journal of Economic Surveys*, Vol. 31 No. 4, pp. 961-987, doi: 10.1111/joes.12173.

Atkinson, A., Piketty, T. and Saez, E. (2011), "The top 1% in international and historical perspective", *Journal of Economic Literature*, Vol. 49 No. 1, pp. 3-71, doi: 10.1257/jep.27.3.3.

Atkinson, A.B. and Søgaard, J.E. (2016), "The long-run history of income inequality in Denmark", *The Scandinavian Journal of Economics*, Vol. 118 No. 2, pp. 264-291, available at: www.jstor.org/stable/45097654

Balcilar, M., Berisha, E., Gupta, R. and Pierdzioch, C. (2021), "Time-varying evidence of predictability of financial stress in the United States over a century: the role of inequality", *Structural Change and Economic Dynamics*, Vol. 57, pp. 87-92, doi: 10.1016/j.strueco.2021.02.002.

Benabou, R. (2000), "Unequal societies: income distribution and the social contract", *American Economic Review*, Vol. 90 No. 1, pp. 96-129, doi: 10.1257/aer.90.1.96.

Berg, A., Ostry, J.D. and Zettelmeyer, J. (2012), "What makes growth sustained?" *Journal of Development Economics*, Vol. 98 No. 2, pp. 149-166, doi: 10.1016/j.jdeveco.2011.08.002.

Berg, A., Ostry, J.D., Tsangarides, C.G. and Yakhshilikov, Y. (2018), "Redistribution, inequality, and growth: new evidence", *Journal of Economic Growth*, Vol. 23 No. 3, pp. 259-305, doi: 10.1007/s10887-017-9150-2.

Björklund, A., Roine, J. and Waldenström, D. (2012), "Intergenerational top income mobility in Sweden: capitalist dynasties in the land of equal opportunity?" *Journal of Public Economics*, Vol. 96 Nos 5/6, pp. 474-484, doi: 10.1016/j.jpubeco.2012.02.003.

Blossfeld, H.P. (1996), "Macro-sociology, rational choice theory, and time: a theoretical perspective on the empirical analysis of social processes", *European Sociological Review*, Vol. 12 No. 2, pp. 181-206, doi: 10.1093/oxfordjournals.esr.a018185.

Borge, L.-E. and Rattsø, J. (2004), "Income distribution and tax structure: empirical test of the Meltzer–Richard hypothesis?" *European Economic Review*, Vol. 48 No. 4, pp. 805-826, doi: 10.1016/j.euroecorev.2003.09.003.

Cevik, S. and Correa-Caro, C. (2020), "Growing (un) equal: fiscal policy and income inequality in China and BRIC", *Journal of the Asia Pacific Economy*, Vol. 25 No. 4, pp. 634-653, doi: 10.1080/13547860.2019.1699985.

Chancel, L., Piketty, T., Saez, E. and Zucman, G. (2022), World Inequality Report 2022. Harvard University Press. available at: www.wir2022.wid.world/

Chudik, A., Mohaddes, K., Pesaran, M.H. and Raissi, M. (2016), "Long-run effects in large heterogeneous panel data models with cross-sectionally correlated errors", in Hill, R.C., González-Rivera, G., Lee, T.H. (Eds), *Essays in Honor of Aman Ullah (Advances in Econometrics)*, Emerald Group Publishing, Bingley, Vol. 36, pp. 85-135, doi: 10.1108/S0731-905320160000036013.

Claveria, O. and Sorić, P. (2023), "Labour market uncertainty after the irruption of COVID-19", *Empirical Economics*, Vol. 64 No. 4, pp. 1897-1945, doi: 10.1007/s00181-022-02304-7.

Clementi, F., Gallegati, M., Gianmoena, L., Landini, S. and Stiglitz, J.E. (2019), "Mis-measurement of inequality: a critical reflection and new insights", *Journal of Economic Interaction and Coordination*, Vol. 14 No. 4, pp. 891-921, doi: 10.1007/s11403-019-00257-2.

Commandeur, J.J.F. and Koopman, S.J. (2007), *An Introduction to State Space Time Series Analysis*, Oxford University Press, Oxford, doi: 10.1017/CBO9780511617010.002.

Dawson, P.J. (1997), "On testing Kuznets' economic growth hypothesis", *Applied Economics Letters*, Vol. 4 No. 7, pp. 409-410, doi: 10.1080/135048597355159.

De Jong, P. (1991), "The diffuse Kalman filter", *The Annals of Statistics*, Vol. 19 No. 2, pp. 1073-1083, doi: 10.1214/aos/1176348139.

De Mello, L. and Tiongson, E. (2006), "Income inequality and redistributive government spending", *Public Finance Review*, Vol. 34 No. 3, pp. 282-305, doi: 10.1177/1091142105284894.

Doornik, J.A. and Hansen, H. (1994), "An omnibus test of univariate and multivariate normality", *Discussion Paper*, Nuffield College, Oxford.

Doornik, J.A. and Hansen, H. (2008), "An omnibus test of univariate and multivariate normality", *Oxford Bulletin of Economics and Statistics*, Vol. 70 No. s1, pp. 927-939, doi: 10.1111/j.1468-0084.2008.00537.x.

Durbin, J. and Koopman, S.J. (2012), *Time Series Analysis by State Space Methods*, Oxford University Press, Oxford, doi: 10.1093/acprof:oso/9780199641178.001.0001.

Goulart, P., Ferrittu, G. and Ramos, R. (2022), "Income inequality and effectiveness in redistribution", in Goulart, P. Ramos, R. and Ferrittu G. (Eds), *Global Labour in Distress, Volume II: Earnings, (in) Decent Work and Institutions*, Springer International Publishing, New York, pp. 13-25, doi: 10.1007/978-3-030-89265-4_2.

Granger, H., Abramovsky, L. and Pudussery, J. (2022), "Fiscal policy and income inequality: the role of taxes and social spending", *ODI Report*, ODI, London, available at: www.odi.org/fiscal-policy-and-income-inequality-the-role-of-taxes-and-social-spending

Greenwood-Nimmo, M. and Shin, Y. (2013), "Taxation and the asymmetric adjustment of selected retail energy prices in the UK", *Economics Letters*, Vol. 121 No. 3, pp. 411-416, doi: 10.1016/j.econlet.2013.09.020.

Grossmann, V. (2003), "Income inequality, voting over the size of public consumption, and growth", *European Journal of Political Economy*, Vol. 19 No. 2, pp. 265-287, doi: 10.1016/S0176-2680(02)00170-2.

Gründler, K. and Köllner, S. (2017), "Determinants of government redistribution: Income distribution, development levels, and the role of perceptions", *Journal of Comparative Economics*, Vol. 45 No. 4, pp. 930-962, doi: 10.1016/j.jce.2016.10.007.

Höchtl, W., Sausgruber, R. and Tyran, J.R. (2012), "Inequality aversion and voting on redistribution", *European Economic Review*, Vol. 56 No. 7, pp. 1406-1421, doi: 10.1016/j.euroecorev.2012.07.004.

Huang, H.C., Fang, W., Miller, S.M. and Yeh, C.C. (2015), "The effect of growth volatility on income inequality", *Economic Modelling*, Vol. 45, pp. 212-222, doi: 10.1016/j.econmod.2014.11.020.

Jestl, S. and List, E. (2023), "Inequality, redistribution, and the financial crisis: evidence from distributional national accounts for Austria", *Review of Income and Wealth*, Vol. 69 No. 1, pp. 195-227, doi: 10.1111/roiw.12589.

Joumard, I., Pisu, M. and Bloch, D. (2012), "Tackling income inequality: the role of taxes and transfers", *OECD Journal: Economic Studies*, Vol. 2012 No. 1, pp. 37-70, doi: 10.1787/eco_studies-2012-5k95xd6l65lt.

Kwiatkowski, D., Phillips, P.C., Schmidt, P. and Shin, Y. (1992), "Testing the null hypothesis of stationarity against the alternative of a unit root: how sure are we that economic time series have a unit root?" *Journal of Econometrics*, Vol. 54 Nos 1/3, pp. 159-178, doi: 10.1016/0304-4076(92)90104-Y.

Kohlscheen, E., Lombardi, M. and Zakrajšek, E. (2021), "Income inequality and the depth of economic downturns", *Economics Letters*, Vol. 205, p. 109934, doi: 10.1016/j.econlet.2021.109934.

Koopman, S.J., Harvey, A., Doornik, J.A. and Shephard, N. (1999), *Structural Time Series Analysis. Modelling, and Prediction Using STAMP*, Timberlake Consultants Press, London.

Kuznets, S. (1955), "Economic growth and income inequality", *American Economic Review*, Vol. 45 No. 1, pp. 1-28. available at: www.jstor.org/stable/1811581

Lee, I. (2022), "Revisiting the Meltzer-Richard hypothesis of pretax income inequality and income tax rate", *Applied Economics*, Vol. 54 No. 53, pp. 6108-6115, doi: 10.1080/00036846.2022.2057911.

Luebker, M. (2014), "Income inequality, redistribution, and poverty: contrasting rational choice and behavioural perspectives", *Review of Income and Wealth*, Vol. 60 No. 1, pp. 133-154, doi: 10.1111/roiw.12100.

Makhlouf, Y. (2023), "Trends in income inequality: evidence from developing and developed countries", *Social Indicators Research*, Vol. 165 No. 1, pp. 213-243, doi: 10.1007/s11205-022-03010-8.

Meltzer, A.H. and Richard, S.F. (1981), "A rational theory of the size of government", *Journal of Political Economy*, Vol. 89 No. 5, pp. 914-927, doi: 10.1086/261013.

Meltzer, A.H. and Richard, S.F. (1983), "Tests of a rational theory of the size of government", *Public Choice*, Vol. 41 No. 3, pp. 403-418, doi: 10.1007/BF00141072.

Milanovic, B. (2000), "The median-voter hypothesis, income inequality, and income redistribution: an empirical test with the required data", *European Journal of Political Economy*, Vol. 16 No. 3, pp. 367-410, doi: 10.1016/S0176-2680(00)00014-8.

Munielo-Gallo, L. and Roca-Sagalés, O. (2013), "Joint determinants of fiscal policy, income inequality and economic growth", *Economic Modelling*, Vol. 30, pp. 814-824, doi: 10.1016/j.econmod.2012.11.009.

Narayan, P.K. (2005), "The saving and investment nexus for China: evidence from cointegration tests", *Applied Economics*, Vol. 37 No. 17, pp. 1979-1990, doi: 10.1080/00036840500278103.

Nolan, B., Richiardi, M.G. and Valenzuela, L. (2019), "The drivers of income inequality in rich countries", *Journal of Economic Surveys*, Vol. 33 No. 4, pp. 1285-1324, doi: 10.1111/joes.12328.

Ostry, J., Berg, A. and Tsangarides, C. (2014), "Redistribution, inequality, and growth", IMF Staff Discussion Note, No. 14/02, International Monetary Fund, Washington, DC.

Panzera, D. and Postiglione, P. (2022), "The impact of regional inequality on economic growth: a spatial econometric approach", *Regional Studies*, Vol. 56 No. 5, pp. 687-702, doi: 10.1080/00343404.2021.1910228.

Perotti, R. (1996), "Growth, income distribution, and democracy: what the data say", *Journal of Economic Growth*, Vol. 1 No. 2, pp. 149-187, doi: 10.1007/BF00138861.

Pesaran, M.H., Shin, Y. and Smith, R.J. (2001), "Bounds testing approaches to the analysis of level relationships", *Journal of Applied Econometrics*, Vol. 16 No. 3, pp. 289-326, doi: 10.1002/jae.616.

Piketty, T. and Saez, E. (2014), "Income inequality in the long run", *Science*, Vol. 344 No. 6186, pp. 838-843, doi: 10.1126/science.1251936.

Piketty, T. and Zucman, G. (2014), "Capital is back: wealth-income ratios in rich countries 1700–2010", *The Quarterly Journal of Economics*, Vol. 129 No. 3, pp. 1255-1310, doi: 10.1093/qje/qju018.

Ravallion, M. (2014), "Inequality in the developing world", *Science*, Vol. 344 No. 6186, pp. 851-855, doi: 10.1126/science.1251875.

Rodríguez, F.C. (1999), "Does distributional skewness lead to redistribution? Evidence from the United States", *Economics and Politics*, Vol. 11 No. 2, pp. 954-1985, doi: 10.1111/1468-0343.00057.

Roine, J. and Waldenström, D. (2008), "The evolution of top incomes in an egalitarian society: Sweden, 1903-2004", *Journal of Public Economics*, Vol. 92 Nos 1/2, pp. 366-387, doi: 10.1016/j.jpubeco.2007.06.012.

Roine, J. and Waldenström, D. (2009), "Wealth concentration over the path of development: Sweden, 1873-2006", *The Scandinavian Journal of Economics*, Vol. 111 No. 1, pp. 151-187, doi: 10.1111/j.1467-9442.2008.01558.x.

Shin, Y., Yu, B. and Greenwood-Nimmo, M. (2014), "Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework", in Horrace, W.C. and Sickles R.C. (Eds), *Festschrift in Honor of Peter Schmidt: Econometric Methods and Applications*, Springer Science and Business Media, New York, NY, pp. 281-314, doi: 10.1007/978-1-4899-8008-3_9.

Son Hing, L.S., Wilson, A.E., Gourevitch, P., English, J. and Sin, P. (2019), "Failure to respond to rising income inequality: processes that legitimize growing disparities", *Daedalus*, Vol. 148 No. 3, pp. 105-135, doi: 10.1162/daed_a_01752.

Sorić, P. (2018), "Consumer confidence as a GDP determinant in new EU member states: a view from a time-varying perspective", *Empirica*, Vol. 45 No. 2, pp. 261-282, doi: 10.1007/s10663-016-9360-4.

Sorić, P. and Claveria, O. (2023), "Income inequality and redistribution in Scandinavian countries", IREA Working Papers 2023/10, available at: www.ub.edu/irea/working_papers/2023/202310.pdf

Stiglitz, J.E. (2012), *The Price of Inequality: How Today's Divided Society Endangers Our Future*, W.W. Norton and Company, New York, NY, available at: www.wwnorton.com/books/the-price-of-inequality/

Stiglitz, J.E. (2015), *The Great Divide: Unequal Societies and What Can we do about Them*, W.W. Norton, New York, NY, available at: www.wwnorton.com/books/9780393352184

Tanninen, H. (1999), "Income inequality, government expenditures and growth", *Applied Economics*, Vol. 31 No. 9, pp. 1109-1117, doi: 10.1080/000368499323599.

Woo, J. (2020), "Inequality, redistribution and growth: new evidence on the trade-off between equality and efficiency", *Empirical Economics*, Vol. 58 No. 6, pp. 2667-2707, doi: 10.1007/s00181-019-01815-0.

Further reading

Atkinson, A.B. and Leigh, A. (2013), "The distribution of top incomes in five Anglo-Saxon countries over the long run", *Economic Record*, Vol. 89 No. S1, pp. 31-47, doi: 10.1111/1475-4932.12004.

Roine, J., Vlachos, J. and Waldenström, D. (2009), "The long-run determinants of inequality: what can we learn from top income data?" *Journal of Public Economics*, Vol. 93 Nos 7/8, pp. 974-978, doi: 10.1016/j.jpubeco.2009.04.003.

Corresponding author

Oscar Claveria can be contacted at: oclaveria@ub.edu