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Giorgio d'Agostino
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Margherita Scarlato

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Further evidence of the relationship between social transfers and income inequality in OECD countries

Giorgio d'Agostino[†]
Roma Tre University, Italy

Luca Pieroni
University of Perugia, Italy

Margherita Scarlato
Roma Tre University, Italy

Abstract

In this paper, we have revised the estimates of the effects of social transfers on income inequality. We have accounted for reverse causality using an instrumental variable derived via a theoretical model, which identifies the main driver of social transfers from the interaction between the electoral system and the coalition or party winning the election, and have estimated, in the OECD countries, that a 1% increase in the share of social transfers reduces income inequality by one-half of a percentage point. This result appears to be robust to different components of expenditure, alternative model specifications and falsification tests. Only countries with a high corruption level appear to violate this empirical regularity. Our estimates show that bureaucratic inefficiencies caused by corruption are responsible for the lack of benefit of social transfers on economic inequality.

Keywords: Welfare policy, social spending, income inequality, instrumental variable estimation.

JEL Classification: H53, I38, C26.

[†]**Contact details**: Department of Economics, Roma Tre University, Rome (Italy), E-mail: giorgio.dagostino@uniroma3.it.

1. Introduction

Income inequality has increased significantly in most OECD countries over the past three decades (Alvaredo et al. 2018, Smeeding and Grodner 2000, OECD 2011, OECD 2015) and an open question of why rich countries show this long-term trend remains. The debate has focused on the growing role of finance - and increasing returns to capital - including wealth (Piketty 2014; Roine, Vlachos and Waldenstrum 2009), globalisation and skill-biased technological change (Acemoglu 2002; Alderson and Nielsen 2002; Bergh and Nilsson 2010; Freeman 2009). These factors are generally associated with market deregulation, weaker labour market institutions and the transfer of power to supranational institutions in Western economies , which, in turn, have reduced the room for government manoeuvring (Glyn 2006; Koster 2014; Pontusson 2013, OECD 2015).

Another strand of the economic literature suggests that increasing economic inequality is not inevitable and that the inadequate or inefficient government intervention in the redistribution of resources to the poor through taxes, social transfers and provision of public services represents the ultimate cause of the increase in the inequality of disposable (post-fiscal) income in most OECD countries (Atkinson Piketty and Saez 2011; Brandolini and Smeeding 2009; Causa and Hermansen 2017; Doerrenberg and Peichl 2014). Specifically, disentangling government spending, cash transfers have been found to account for the largest proportion of redistribution, playing a key role in ensuring income adequacy among vulnerable groups (Causa and Hermansen 2017).

However, little evidence exists on the causal impact of social spending on income inequality. Empirical estimates are not easy to interpret. For example, when the ordinary least squares estimator is used, unobserved confounding factors may potentially drive both social spending and income inequality, which, in turn, results in misleading estimates (Miguel, Satyanath and Sergenti 2004). In addition, reverse causality may also arise in the relationship between social spending and income inequality (Sturm, 2017). In fact, policy makers may respond to an increase in income inequality by implementing more government spending policies (Meltzer and Richard 1981), and, in this case, the relationship may underestimate the impact of social spending on reducing economic inequality. By contrast, reverse causality may overestimate the true effect of the relationship between social spending and income inequality. If, for instance, very rich people have more weight in the political process, they may decide to implement a reduced redistribution policy, under high income inequality (Pecoraro 2017). A number of contributions estimate the impact of social spending, or its components, on income inequality, taking reverse causality into account[1]. Doerrenberg and Peichl (2014) address the problem of endogeneity using an instrumental variable (IV) approach. They use the initial level of the policy variables as instruments for the explanatory variables of interest, and confirm that social spending has inequality-reducing effects. Niehues (2010) attempts to disentangle causality by using a GMM estimator and finds that a larger redistributive budget is strongly related to lower income inequality levels. Similarly, Martinez-Vasquez, Vulovic and Moreno-Dodson (2012) show that higher shares of GDP on social welfare have a positive impact on income distribution.

The present paper contributes to this literature by estimating the causal relationship

[1]See Anderson et al. (2017) for a review of the literature.

between social transfers and disposable income inequality for a large panel of OECD countries. We refer to the theoretical framework proposed by Iversen (2005) and Iversen and Soskice (2006) to address the key variable characterization. The model suggests that electoral systems and government partisanship affect redistribution policies when heterogeneous optimising behaviours of parties or coalitions are included, which, in turn, generates cross-country differences in income inequality. We exploit the interaction between electoral systems and the coalitions winning an election to instrument the cited relationship in an IV framework. Empirically, we focus on the 'pure' effect of social spending on income inequality implemented through its cash components, whereas the effect of in-kind social spending (i.e., the provision of health care, education spending and other services) is accounted for only indirectly.

Clearly, confounding factors are always present. We reduce this issue choosing a sample of OECD countries that ensure a homogeneous institutional background, and control for additional sources of bias in our estimates.

The empirical results suggest that greater social transfer spending is related to lower income inequality. The estimated elasticities indicate that an increase of 1% in social transfer decreases income inequality by approximately one-half of a percentage point (0.5%). More specifically, this analysis reveals significant heterogeneous results conditional on pervasive corruption, whereas tax progressiveness and the strength of unions appear to be not discriminant. Finally, sensitivity tests are performed to confirm the robustness of our estimates.

The remainder of this paper is organised as follows: Section 2 presents the theoretical model, and Section 3 describes the empirical model, whereas Section 4 discusses the dataset and the variables. Section 5 provides the estimates of the benchmark model specification, heterogeneous effects and robustness analysis. Concluding remarks are presented in Section 6.

2. Theoretical model: basic assumption

In this section, we provide a brief description of the model (see Appendix A for details). We highlight the main propositions behind the model, as in Iversen (2005) and Iversen and Soskice (2006), and show the links that connect the electoral rules and government partisanship to social transfers and, in turn, to income inequality. We also anticipate some empirical evidence.

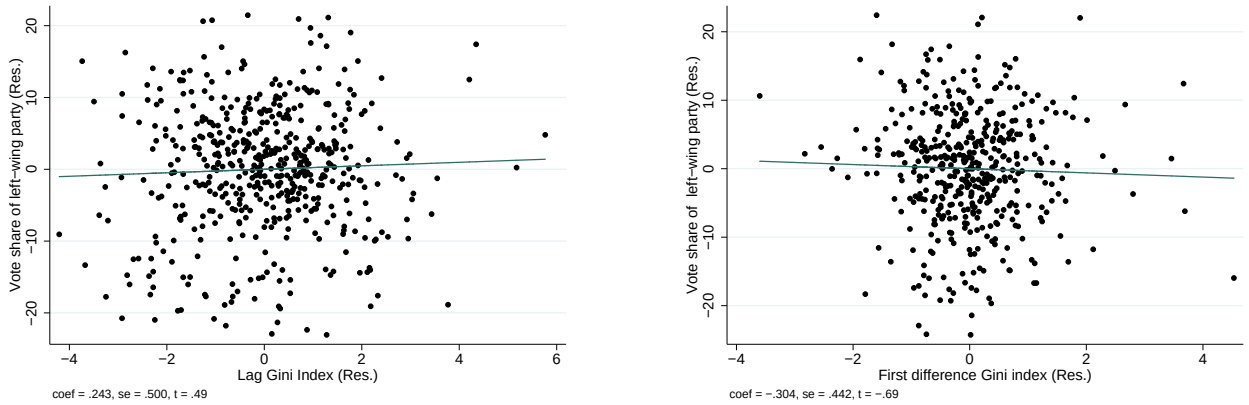
The model supposes a society of individuals who can be classified into three classes or social groups defined by income. These classes represent low-income L, middle-income M and high-income H groups. The model links these three income groups to different preferences about the relevant policy choices and to the political parties that compete in elections. In this view, the low-income group is the major constituency for the left-wing party, and the high-income group is the major constituency for the right-wing party. The critical assumption of the model is that the voting population is equally distributed between the three income groups. As no group or constituency has the majority vote of the electorate, the elections will be won by coalitions (or coalition parties) that are formed between either the poor and the middle-income group or between the affluent and the middle-income group. Thus, the

ruling coalition, which includes the constituency of the middle-income group, will set the social transfer policies (AS1).

This assumption rules out the possibility that the social transfer policy may be set according to the preferences of only one class and that variation in the level of economic inequality may influence the composition of the winning coalition and the government transfers policy. Hence, the model assumes that an increase in economic inequality does not imply *per se* an increase in the probability of left-wing ruling coalitions nor a shift in the electorate's preferences towards more generous social spending.

Figure 1 (panel a) plots the correlation between the lagged value of the Gini index (measured in terms of disposable income) and a variable describing the vote share of left-wing parties ($left\_v$) in national elections[2], and Figure 1 (panel b) plots the correlation between the variation in the Gini index and $left\_v$. A significant correlation between the lagged level or variation in income inequality and the vote share for left-wing parties could be interpreted as a violation of assumption AS1. We do not find a significant correlation between these variables, neither when considering the lagged level of the Gini index ($\beta = 0.243,\ s.e. = 0.500$) nor its contemporary variation ($\beta = -0.304,\ s.e. = 0.442$). This result does not contradict assumption AS1 as the basis of the theoretical model proposed by Iversen (2005) and Iversen and Soskice (2006).

Figure 1: Correlation between income inequality and the vote share left-wing parties



Notes: The graph plots the residual of a regression between the vote share of left-wing party, and the residual of the lagged value of the Gini index (panel a), and the residual of the first difference of the Gini index (panel b). The estimates include time and country fixed effects. The errors are clustered at the country level.

A relevant point that should be clarified is whether middle-income voters will ally with the poor constituency or the affluent constituency (see also Lupu and Pontusson 2011). Middle-income voters suffer part of the cost of the redistribution policy through the tax system.

Indeed, social transfers are financed mostly by the middle- and high-income groups and redistributed between the middle- and low-income groups. The government finances these transfers through a proportional income tax, τ and a progressive income tax, g. The model

[2]For an extensive description of the variables, see Section 3.

imposes an upper limit on the progressive tax, defined as G[3]. The proportional income tax is paid by all the income groups, whereas the progressive tax is paid as follows: a non non-negligible share ϵ is paid by people in M, and the remaining $1-\epsilon$ is paid by people in H. Furthermore, a constant fraction α ($\alpha > 0$) of g is assumed to represent the administrative costs of the fiscal system, which include red-tape costs. The introduction of administrative costs into the model may be relevant in some contexts since it enables us to explicitly consider a measure of the efficiency of government policy, which includes the quality of the provision of public goods and, in extreme cases, corruption of the public sector.

The choice parameters driving the model are the proportional income tax τ ($0 \geq \tau \geq 1$) and the progressive income tax g ($g \leq G$). The middle-income group shares the preference for a $\tau > 0$ with the low-income group, since it receives a fraction of social transfers; however, it also shares the preference for a $g \to 0$ with the high-income group, since it has to pay a non non-negligible share ϵ of the progressive tax (see Appendix A, equations A.5, A.6 and A.7).

The voting choice of the middle class also depends on the ability of parties to make credible commitments to the social transfers policies under different electoral rules. We know that in a proportional representation system, each income group is represented by a separate party. This means that all parties can pursue the preferences of their constituents with no platform commitment issues. By contrast, under a two party majoritarian system, the middle-income group can choose to support either the left or the right party and, consequently, government is a coalition party (centre-left or centre-right). Notably, in the majoritarian electoral system, the coalition parties are not guaranteed to pursue their electoral promises, and there is always a chance that left and right parties will follow their constituency preferences after winning the election.

2.1. Identification issues

In a proportional representation system, governments ruled by centre-left coalitions are more likely than are ruling coalitions between the middle- and high-income groups. As shown in the Appendix A (equations A.8 and A.9), the middle-income group obtains an higher utility when the proportional income tax rate (τ) is greater than zero because it benefits from the social transfers policies (equations A.12 and A.13). Table 1 summarises the probabilities that a given coalition wins an election for different values of ϵ and α and for different levels of progressiveness of the tax system in a proportional representation system[4]. As shown in table 1, the probability of having a centre-left coalition depends on the share of resources paid by the middle-income group (ϵ). We exclude the extreme cases of a strong progressive tax system with administrative costs equal to one and a regressive tax system with administrative costs equal to zero[5]. When the administrative costs α are negligible, the middle group will increase its utility in a coalition with the left party, except

[3]It is supposed that this upper limit can be modified only if the three income groups jointly decide to change it.

[4]We note that a coalition between two extreme parties (LH) is not allowed by the hypotheses of the model and that only two coalitions can be in charge, both of which involve the middle-income group.

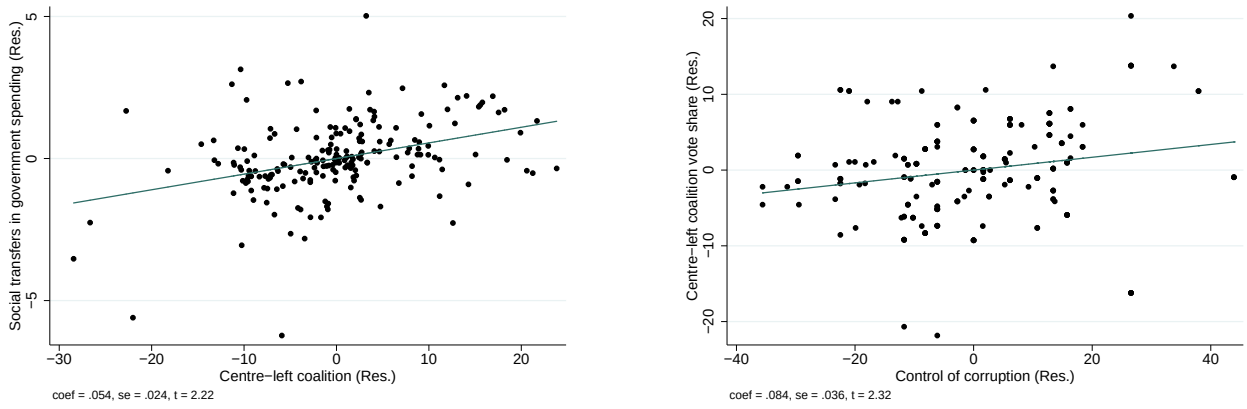
[5]The model in Appendix A shows that, in these cases, the probability of an LM coalition tends to zero and one, respectively.

in a regressive tax system. For countries with an inefficient public sector, the reversed probability is observed. In this case, a considerable waste of resources increases the share of administrative costs α and the overall burden of taxation ϵ, which, in turn, decreases preferences for redistribution. The table lists the results of the expected LM coalition under progressive taxation and realistic tax parameters ($\epsilon = 0.5$ and $\alpha > 0$).

Table 1: Expected coalitions in a proportional system

	Condition on ϵ	Condition on α	Probability of LM coalition	Tax system
1a	If $\epsilon \rightsquigarrow 0$	$\alpha > 0$	$Pr(LM) \rightsquigarrow 1$	Strongly progressive tax rate
1b	If $\epsilon \rightsquigarrow 0$	$\alpha \rightsquigarrow 0$	$Pr(LM) \rightsquigarrow 1$	
2a	If $\epsilon \rightsquigarrow \frac{1}{2}$	$\alpha > 0$	$Pr(LM) \rightsquigarrow 0$	Progressive tax rate
2b	If $\epsilon \rightsquigarrow \frac{1}{2}$	$\alpha \rightsquigarrow 0$	$Pr(LM) \rightsquigarrow 1$	
3a	If $\epsilon \rightsquigarrow 1$	$\alpha > 0$	$Pr(LM) \rightsquigarrow 0$	Regressive tax rate
3b	If $\epsilon \rightsquigarrow 1$	$\alpha \rightsquigarrow 0$	$Pr(LM) \rightsquigarrow 0$	

Figure 2: Correlation between social transfers and the vote share of the centre-left coalition in a proportional representation system



(a) Social transfers and centre-left coalition vote share

(b) Centre-left coalition vote share and corruption

Notes: The graph plots the residual of a regression between the share of social transfers in government spending on the vote share of the centre-left coalition in a proportional representation system. The estimate includes time and country fixed effects. The errors are clustered at the country level. When corruption is accounted for, the time fixed-effect is excluded to account for the low time variation of corruption in the analysed countries.

In the left panel of Figure 2, we plot the residual of a regression between the share of government social transfers in government spending and the vote share of the centre-left coalition in a proportional representation system[6] and lists the estimated parameters of the

[6]For the centre-right coalition the graph is specular to that in Figure 2, showing the association with a lower share of government transfers.

regression. We observe a positive and significant correlation between the aforementioned variables, confirming that governments ruled by centre-left coalitions are likely to implement social transfers. In addition, the right panel of Figure 2 shows the correlation between the probability that a centre-left coalition wins an election in a proportional representation system and the level of efficiency of the government action using as a proxy of administrative efficiency (i.e., the anti-corruption index from the International Country Risk Guide). The graph suggests that there is an inverse relationship between centre-left governments and corruption.

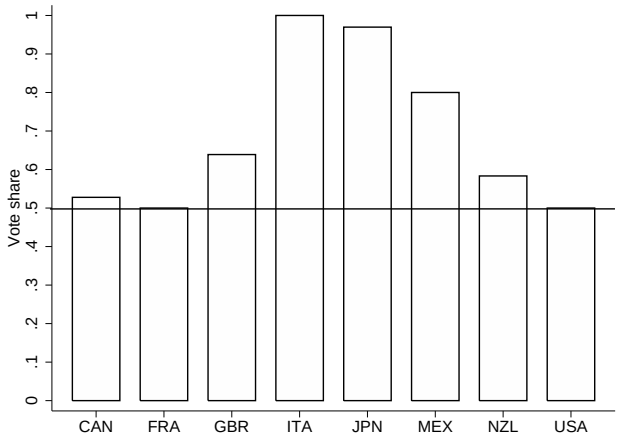
A majoritarian electoral system is characterised by a winner-take-all approach for a restricted number of competing parties. When centre-left or centre-right coalition parties are in charge, they are inclined to diverge from the middle class preferences and to adopt policies that reflect the needs of their own constituency (see also Persson, Ronald and Tabellini 2004; Milesi-Ferretti, Perotti and Rostagno 2002). Thus, the middle-income group suffers a considerable decrease in expected utility. The model in Appendix A includes the utility loss for the middle-income group with two cost functions, defined as T_{LM} and T_{MH}, which measure the extent to which the social transfers policies diverge from the preferences of the middle-income group in the case of centre-left and centre-right government coalitions, respectively (equations A.15 and A.16). Additionally, the ruling centre-left/centre-right coalitions face costs in terms of reputation loss, which may reduce the possibility of winning future elections by attracting the middle class. Thus, the model includes the costs of deviation from the platform of the middle class with the functions c_{LM} and c_{MH}.

Table 2: Expected coalitions in a majoritarian system

Condition for LM	Condition for MH	Probability for MH win
If $T_{LM} < C_{LM}$	$T_{MH} < C_{MH}$	$Pr(MH) = \frac{1}{2}$
If $T_{LM} > C_{LM}$	$T_{MH} < C_{MH}$	$Pr(MH) \rightsquigarrow 1$
If $T_{LM} > C_{LM}$	$T_{MH} > C_{MH}$	$Pr(MH) \rightsquigarrow 1$
If $T_{LM} < C_{LM}$	$T_{MH} > C_{MH}$	$Pr(MH) \rightsquigarrow 0$

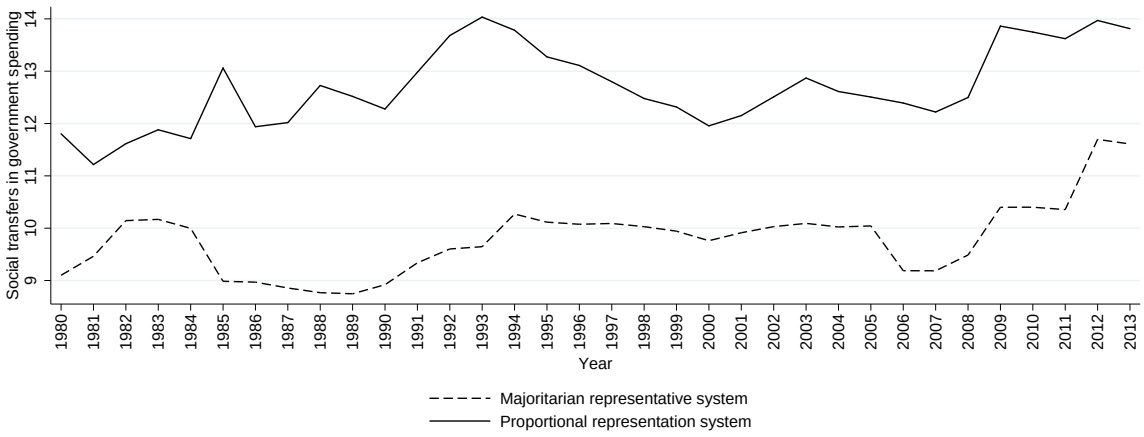
Table 2 summarises the probabilities of winning an election for centre-left and centre-right coalition parties in a majoritarian electoral system. As shown in this table, the model predicts four possible outcomes depending on whether the loss for the middle-income group T_{LM} and T_{MH} is higher (lower) than the costs of deviating from the platform of the middle class (c_{LM} and c_{MH}). However, as shown by the model, the affluent party has less incentive to diverge from the middle-group preferences and, hence, $T_{LM} > T_{MH}$. In turn, under the condition that $c_{LM} = c_{MH}$, the model predicts that, in a majoritarian electoral system, the centre-right coalition party has a higher probability of winning elections. Furthermore, the model suggests that the policies promoted by the elected political coalition (both centre-right and centre-left) in a majoritarian electoral system will be less redistributive than the policies in a proportional representation system (see also Persson, Roland and Tabellini 2007) because both the low- and high-income groups will converge to the preferences of the middle-income group (i.e., $\tau > 0$, $g \rightarrow 0$).

Figure 3: Scores of the centre-right coalition party, by country



Notes: The graph plots the share of votes of the centre-right coalition party in a majoritarian electoral system. The continuous line marks the median value of the distribution.

Figure 4: Social transfers in majoritarian and proportional representation systems



Notes: The graph reports the average shares of government social transfers in government spending in majoritarian and proportional electoral systems.

Specularly to the proportional representation system, we report the descriptive analysis for the result that the centre-right coalition party has a higher probability of winning an election and that countries with a majoritarian electoral system will spend less on social transfers than countries with a proportional representation system. Figure 3 lists the results for eight countries with a majoritarian electoral system, suggesting a significant probability that the centre-right wins an election. In addition, Figure 4 indicates that a large gap in social transfers appears when aggregating countries with majoritarian and proportional representative electoral systems, which supports the findings of the theory.

3. The empirical model

The cross-country relationship between social transfers and income inequality can be specified as:

$$GINI_{it} = \beta_0 + \beta_{1,GINI} ST_i + \beta_2 X_i' + T_t + S_i + v_{it} \quad (1)$$

where $GINI_{it}$ measures the level of inequality in terms of disposable income for country i (i.e., Gini index), and ST_i indicates the share social transfers in government spending for the country i. S_i and T_t are the country and time fixed effects, and X_i is a vector of control variables that will be described in the next section. This specification ignores useful information of the time variation in the data; to overcome this problem, recent empirical works have generally applied this form of model to panel data (see, for example, d'Agostino et al. 2018). In fact, using panel data methods to address unobserved heterogeneity controls for some types of omitted variables and can help with solving some identification problems. Institutional differences across countries, for example, will have time-invariant characteristics, as shown by Fordham and Walker (2005) in another context. In addition, corruption and public spending are positively correlated, with corruption acting directly on inequality in a positive way. Since corruption is a persistent and time-invariant phenomenon within a country (Mauro 2004), panel data methods can be used to address this issue.

There remain possible identification problems because, as argued previously, social transfers may be influenced by feedback effects, as increased income inequality may lead policy makers to increase social spending or its components. This potential reverse causality can be formalised to identify the expected negative sign for the parameter reflecting the effect of social transfers on income inequality (i.e., $\beta_{1,\ GINI} < 0$) with feedback effects of income inequality on social transfers, which, in this case, are expected to be positive. This result implies that social transfers cannot simply be assumed to be exogenous, which means the OLS empirical estimates are not easy to interpret. Appendix B provides a formal exposition of the reverse causal effects applied to social transfers and income inequality.

Although an IV approach can be used to address these issues, the main problem is identifying suitable instruments. We exploit the theoretical model, illustrated above and discussed extensively in Appendix A, that implicitly suggests the instrument to be used. In fact, the model determines different propensities to social transfers from the types of electoral systems and the partisanships of the government coalition and allows for ordering the strength of this relationship by interacting the electoral system of a country with the expected coalition that will win the election. The model shows that under a proportional representation system, the centre-left coalition (PS_{LM}) will redistribute more resources than the centre-right coalition (PS_{MH}) and that the majoritarian electoral system (MS) is less redistributive, independent of which coalition wins the election [7]. Thus, our empirical strategy builds an ordinal instrumental variable ($ESPPO$) that increases the modalities with respect to the propensity to implement social spending policies. This variable ranges from 0 to 2 encoded as 0, countries with a majoritarian system (MS); 1, countries with a proportional system and a centre-right

[7] One may argue that the electoral system may itself be endogenous to other variables, including attitude toward income inequality. However, as Alesina, Glaeser and Sacerdote (2001) note, electoral laws have a certain stickiness and do not change often. Hence, it is plausible to focus on the direct effect of the electoral system, interacted with partisanship, on social spending.

coalition (PS_{MH}); and 2, countries with a proportional system and a centre-left coalition (PS_{LM}), which are, based on the assumption of the model, correlated with the strength of social transfers and uncorrelated with the residual of income inequality. We leave the discussion of the variable construction to the next section.

We identify and propose a structural model as a derivation of the relevant income inequality and social transfers reduced forms, specified as:

$$ST_{it} = \theta_0 + \theta_1 ESPPO_{it} + \theta_2 X_{it} + S_i + T_t + \epsilon_{it} \tag{2}$$

$$GINI_{it} = \delta_0 + \delta_1 ESPPO_{it} + \delta_2 X_{it} + S_i + T_t + u_{it} \tag{3}$$

in which $ESPPO_{it}$ is the instrumental variable used to identify the relationship between the share of social transfers in government spending and income inequality, and the estimates of θ_1 and δ_1 account for time-varying unobserved effects (T_t), with X_{it} and S_i defined as above.

The structural form used to obtain the causal estimates is then:

$$GINI_{it} = \Phi_0 + \Phi_1 ST_{it} + \Phi_2 X_{it} + S_i + T_t + d_{it} \tag{4}$$

where the IV estimate of the coefficient in equation (4) is the ratio of the reduced form of the coefficients on social transfers and income inequality, that is, $\Phi_1 = \delta_1/\theta_1$[8]. This result implies that if parameter Φ_1 is statistically significant, the impact of social transfers on income inequality reflects the correction attributable to the instrumental variable because this correlation is transmitted mainly through the social transfers channel (i.e., $\theta_1 > 0$). In other words, if $ESPPO_{it}$ is a determinant of social transfers, it can legitimately be omitted from equation (1).

4. Data

The empirical analysis draws from the World Income Inequality Database (WIID), which collects information on income inequality for developed, developing, and transitioning countries. We used data based on disposable income, measured as individual incomes and collected from household surveys, which is the standard measure utilised in cross-country research on inequality (Garfinkel, Rainwater and Smeeding 2006)[9]. The observations are calculated considering the full population and on the basis of an adult-equivalence scale. The strategy outlined above allows us to collect information on income inequality, based on the disposable income , We obtain a dataset for 26 OECD countries building for each country the Gini index ($GINI$) in each period from 1980 to 2015. Although there are several missing values in our dataset, it ensures a good cross-country comparability. Descriptive statistics are reported in Appendix C.

We then collected information related to the fiscal policies from the OECD Social Expenditure database, which provides information on social transfers (ST) as a share of government

[8]Note that in the just identified case, the IV estimator is identical to the ILS estimator. For the mathematical derivation and discussion, see Angrist and Pischke (2009, pg. 121).

[9]Disposable income is defined as post tax and transfer income and includes the effects of direct taxes and cash redistribution on market income.

expenditure[10]. The variable ST includes transfers related to five policy intervention areas: i) pensions, including early retirement pensions and other benefits; ii) family allowances, maternity and parental leave benefits; iii) survivor and incapacity pensions; iv) unemployment compensations, severance pay and early retirements for labour market reasons; and v) income maintenance and other benefits.

We extracted information related to the interaction between the electoral system and the political party orientation ($ESPPO$) from the World Bank database of Political Institutions 2015 (WBPI2015). First, we considered the legislative and executive indices of electoral competitiveness to establish whether electoral representation is based on a proportional or majoritarian system (Beck *et al.*, 2001). A proportional system is characterised by the condition that the candidates are elected on the basis of the percent of votes received for their political party, whereas in a majoritarian system, candidates are elected using a winner-take-all or first -past-the-post rule. Using this definitions, we obtained a variable on the interval 0-1, where 0 indicates a majoritarian system and 1 indicates a proportional system (ES). Second, we considered party orientation. We used a variable defined by the WBPI2015 and coded through the following criteria: i) right, for parties that are defined as conservative, Christian Democratic, or right-wing; ii) left, for parties that are defined as communist, socialist, social democratic, or left-wing; and iii) centre, for parties that are defined as centrist or when the party position can be described as centrist. Since we have no data on party coalitions, we used information on the two major parties supporting government to define centre-left and centre-right coalitions in the proportional representation system and information on the major party supporting government in the majoritarian system. When no clear-cut composition of government parties was available, we excluded countries from the analysis. Within this framework, we defined a variable of political party orientation that is 0 when a centre-right coalition or party is in charge and 1 when a centre-left coalition or party is in charge (PPO).

From the same source of data, we collected additional information on the structure of the government to improve the way in which we characterise how different political factors affect the social spending policy through channels that are not ascribable to centre-left and centre-right coalitions. We set up two dummy variables to distinguish when a nationalist (Nat) or a regional-based (Reg) party supports the government to consider the degree of fractionalisation of society. We then introduced a variable ($Polar$) describing the polarisation between the executive party and the other major parties in the legislature. The variable accounts for the maximum polarization between the executive party and the four parties of the legislature. The variable is recorded in the range of 0-3: zero if the chief executive's party has an absolute majority in the legislature. In addition, we considered how long the present government is due to remain in office (Ych). Finally, we introduced a dummy variable to distinguish a parliamentary political system from a presidential political system ($Parl$).

We collected information from the OECD dataset on several other control variables suggested by the theoretical model or commonly used to explain cross-country and time variation in public expenditure and inequality (Anderson et al. 2017). We relied on per capita

[10]Following the insight of the theoretical model, we consider only "pure social transfers" and omit in kind social transfers, i.e., the provision of education, health care, and other services.

GDP growth rate (γ_{GDP}), the share of government spending in GDP (Gov) and the share of public health spending in GDP ($Health$) to account for the relative size of government and to control for in-kind social spending. We also considered the share of direct tax in total tax as a proxy of tax progressiveness (P_{tax}). We added two variables to capture the demographic characteristics of a population that influence the dependency ratio and might increase social spending: the growth rate of the population (γ_{pop}) and the share of elderly in the total population (Eld). We included another demographic variable, the ratio of female to male population (Fem), which might positively influence the preferences for redistribution because women are more likely to be economically disadvantaged than are men and are more likely to show stronger preferences for social spending. To account for education levels, we included the shares of employed persons with tertiary education, distinguishing between young employees (Occ_ter_y) and adult employees (Occ_ter_a)[11] To take into account the features of the labour market that could lead to more political pressure for redistribution, we included unemployment rate ($Unemp$) and a measure of union density ($Union$), given as the share of union members in the total labour force, which also captures partisanship lean towards left-wing governments.

To complete the set of control variables, we chose the International Country Risk Guide anti-corruption index ($Corr$) as a proxy of the effectiveness of government spending and the administrative costs of redistribution[12].

5. Results

5.1. Main findings

Table 3 presents the OLS estimates of equation (2), showing the correlation between the instrumental variable ($ESPPO$), based on the interaction between the electoral representation system and the coalition winning the election, and the share of social transfers in government expenditure (ST). Column (1) reports the estimated coefficients when we include time and country fixed effects, and column (2) also introduces the set of covariates described in the previous section[13]. These control variables account for the effects of financing government expenditure and the level of in-kind welfare spending.

Table 3 shows a significant and positive correlation between $ESPPO$ and ST. Given the $ESPPO$ ordering, a significant positive coefficient means that a government ruled by a centre-left coalition or party under a proportional system (PS_{LM}) spends a greater amount of resources on social transfers than do a similar government in an electoral system and different government coalitions.

[11] We define as young employees those in the age range 15-29 years and as adult employees, those in the age range 30-65 years.

[12] We disregarded other covariates that could indirectly affect our estimates (e.g., globalisation, deregulation, voter turnout) because their inclusion in the regressions did not yield statistically significant results or due to a lack of reliable cross-country data. Since our estimates take into account omitted variables and country fixed effects in several ways, we expect that this decision should be only a minor source of potential estimation bias.

[13] Our key explanatory variable (ST) is measured as a share in government expenditure, whereas we include, as control variables, the share of government spending in GDP and the share of public health spending in GDP.

Table 3: Reduced form estimates of the relationship between the instrumental variable ($ESPPO$) and social transfers (ST) (Equation 2)

	(1)		(2)	
$ESPPO_t$	0.554	***	0.679	***
	(0.211)		(0.133)	
Fixed effects	yes		yes	
Covariates	no		yes	
No. of observations	431		358	

Notes: Clustered standard errors at the country level are shown in brackets. The asterisks give the *p-value* significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

The first two columns of Table 4 report the correlation between $ESPPO$ and the income inequality coefficient ($GINI$) (equation 3), excluding (column 1) and including (column 2) the covariates. The estimated coefficients show that a proportional system ruled by a centre-left government is significantly associated with a country-wide reduction in income inequality. Different specifications do not produce any statistically significant differences in the point estimates. Columns 3 and 4 list the point estimates of a false experiment in which the forward instrumental variable ($ESPPO_{t+1}$) is added to provide preliminary evidence about the orthogonality hypothesis of the instrument[14]. We confirm the results obtained in the benchmark specification, since the $ESPPO_{t+1}$ coefficient does not affect the statistical negative correlation with income inequality.

Table 5 reports the main results of the IV estimates. For brevity, we discuss the point estimates that include time and country dummies and control variables. The second column of the table reports the IV results. Column 4 lists the estimates with the generalised panel-IV estimator[15] (Chamberlain 1980), whereas in the last column, the table reports the OLS estimates. The standard error terms are robust and clustered at the country level to account for the violation of the i.i.d. hypothesis in the data. When the estimated parameters are significant, we report, in bold, the elasticities and the corresponding standard errors estimated using the delta method.

For the IV specification, we test for the existence of weak instruments and report the first-stage F-statistics (Cragg and Donald 1993) (CD F–test) and Wald statistics (Kleibergen

[14]We introduce $ESPPO_{t+1}$ to estimate specification in which future values of the instrument, which should be orthogonal to the current value of the income inequality index conditional on the introduction of the control variables, are included as additional explanatory variables.

[15]We use the generalised panel-IV estimator to account for linear unobserved effects under a fixed-effects assumption. Rather than differencing out the unobserved effect (i.e., the first-difference estimator), Chamberlain (1980) proposed to replace it with the linear projection of the explanatory variables in all time periods to reduce the importance of unobserved effects (Wooldridge 2002). In the present case, the unobserved effects are due to permanent differences across countries in terms of redistributive policies.

Table 4: Reduced form estimates of the relationship between an electoral representation system and the coalition winning the elections and the Gini index (Equation 3)

	(1)		(2)		(3)	
$ESPPO_t$	-0.525	**	-0.776	***	-0.705	***
	(0.240)		(0.201)		(0.222)	
$ESPPO_{t+1}$					0.232	
					(0.280)	
Fixed effects	yes		yes		yes	
Covariates	no		yes		no	
No. of observations	431		358		421	

Notes: Clustered standard errors at the country level are shown in brackets. The asterisks give the *p-value* significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

and Paap 2006) (KP F–test), a generalisation to non-independently and non-identically distributed errors[16]. The results obtained by the F-statistics are larger than the intervals of the null hypothesis, indicating that our estimates do not suffer from weak instrument issues.

Two main statistical confirmations emerge from Table 5. First, the reduced-form OLS point estimates of equations (2) and (3) equivalent results of the IV estimator in the structural estimates. Using the point estimates of Tables 3 and 4 (column 2), the IV coefficient ($\Phi_1 = -1.143$) is also equal to the ratio, i.e., δ_1/θ_1, that is, $-0.776/0.679 = -1.143$). Second, by comparing the IV point estimates with the OLS estimates in column 3 of Table 5, we find an increase in the negative effect of social transfers and income inequality when implementing the IV approach. This result implies that the instrument that we use corrects for the upward bias generated, mainly, by the positive reverse causality between income inequality and social transfers.

Table 5 also lists, in bold, the elasticities for the IV estimates. A 1% increase in social transfers reduces cross-country income inequality by approximately 0.52% (column 1). In addition, when we compare the IV estimates and the generalised panel-IV estimates, we find no statistical difference between the estimated elasticities. Therefore, the IV results are not driven by the heterogeneity caused by unobserved country characteristics, which we do not control for.

From a policy-oriented perspective, a country that plans to reduce income inequality might refer to these estimates to apply significant policies. Thus, if a representative country, say France, decides to increase the share of social transfers to 20%, equivalent to an increase of 3.3 percentage points, we expect that income inequality will be reduced by 10.4% (2.9 percentage points). This suggestion for policy makers includes a trade-off with respect to

[16]In the specific case of a single endogenous regressor, as in this paper, the Cragg-Donald and Kleibergen-Paap Wald statistics reduce, respectively, to the standard non-robust and heteroskedasticity-robust first-stage F-statistics.

Table 5: Estimates of the structural parameters and elasticities of the relationship between social transfers and income inequality index (IV estimates, instrument: $ESPPO$)

	IV				Generalized panel-IV				OLS	
	(1)		(2)		(3)		(4)		(5)	(6)
ST_t	-0.947	**	-1.143	***	-0.557	**	-0.778	***	-0.092	-0.069
	(0.449)		(0.270)		(0.218)		(0.201)		(0.093)	(0.109)
Elasticity (ST)	**-0.428**	**	**-0.522**	***	**-0.249**	**	**-0.354**	***		
	(0.205)		**(0.124)**		**(0.107)**		**(0.105)**			
Fixed effects	yes		yes		no		no		yes	yes
Covariates	no		yes		no		yes		no	yes
CD F–test	7.005	⋆⋆	18.649	⋆⋆						
KP F–test	5.661	⋆	19.828	⋆⋆						
No. of observations	431		358		431		358		547	441

Notes: Clustered standard errors at the country level are shown in brackets. The asterisks give the *p-value* significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. The stars show the Stock-Yogo critical values for 10% maximal IV size (⋆⋆) and for a 15% maximal IV size (⋆).

high-income people, and partly those with middle incomes, who suffer the increase in taxation aimed at achieving greater social justice[17].

The point estimates and elasticities are in line with the findings of other comparative studies on the effects of social transfers on income inequality. For example, Doerrenberg and Peich (2014) estimate an elasticity measure of social transfers in GDP on the Gini index of approximately 0.3 percentage points in the OECD countries whereas Sànchez and Pérez-Corral (2018) find an elasticity for EU countries ranging between 0.2 and 0.4 percentage points. In the latter case, the estimated elasticities are only partially comparable with our estimates since the authors do not distinguish between components of social spending.

5.2. Heterogeneous estimates

In this subsection, we test whether the main covariates included in the model specification could themselves affect the magnitude of the point estimates. In general, we could assume that different transmission channels may condition the social transfers, biasing the causal estimates on income inequality. Coherently with our theoretical framework and the availability of reliable cross-country data, we construct exogenous dichotomous variables characterising countries with a high/low level in the progressiveness of income taxes (P_{tax}), union density (U_{dens}) and diffusion of corruption ($Corr$), recording the variables as 1 when the median value of the corresponding covariate exceeds the median value of the sample.

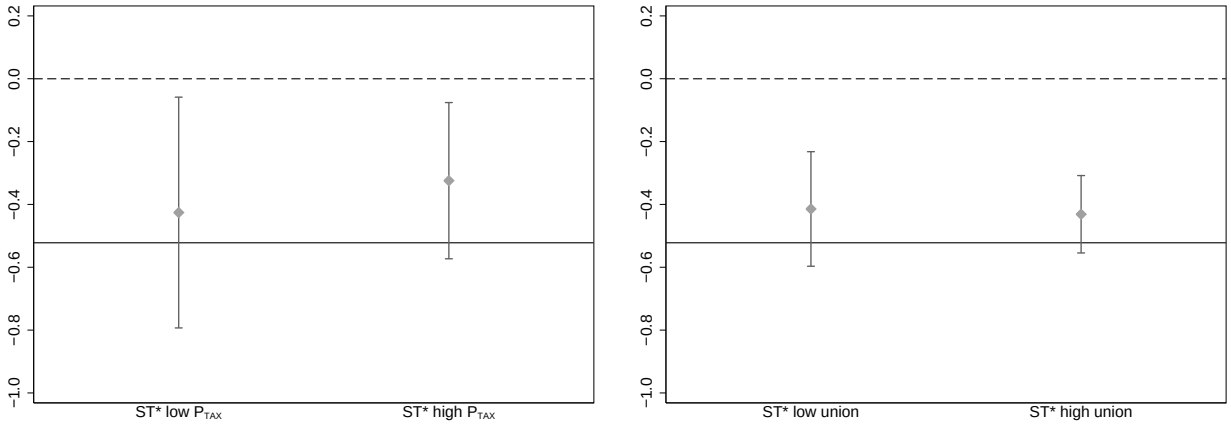
Then, we estimate our model, interacting social transfers with our covariate of interest, and estimate the parameters of the model[18]. For example, when evaluating the differential

[17]Here, we exclude the possibility that social transfers can be financed by a deficit.

[18]As noted by Becker et al. (2013), introducing a term representing the interaction between an endogenous and an exogenous variable is a preferable method to account for potential heterogeneous effects.

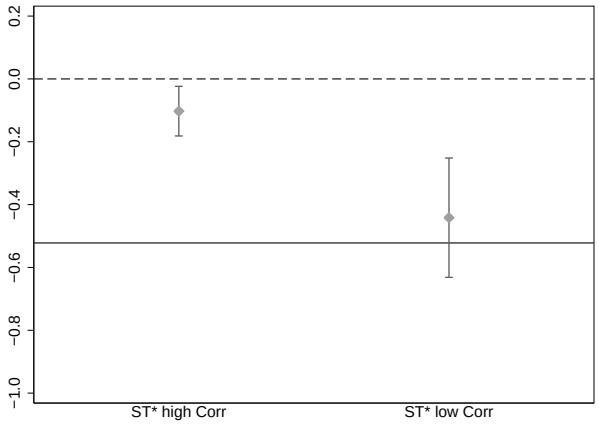
effect of the progressiveness of income taxes, we introduce, in equation (4), the interaction variable $ST * P_{tax}$, along with P_{tax}, which requires a second instrument to maintain the just-identified IV estimator. The candidate that we include is the interaction between $ESPPO$ (the main instrument) and P_{tax}. Figure 5 shows the estimated elasticities conditional on countries with high or low levels of the three covariates and the corresponding confidence intervals. The continuous reference line lists the estimated elasticity in Table 5. When the country selection for tax progressiveness is accounted for, the elasticities of social transfers, conditional on the inclusion of the interaction terms ($ST*$), with respect to income inequality are within the confidence intervals, which overlap the benchmark elasticity estimated in Table 5. Thus, no significant heterogeneous effects are channelled by tax progressiveness in the social transfers and income inequality relationship.

Figure 5: Heterogeneity of the estimated parameters across select covariates



(a) Tax progressiveness

(b) Union density



(c) Corruption

Notes: The figure reports conditional point estimate elasticities and 95% confidence intervals by bars. The continuous line lists the elasticity estimated in the benchmark model (Table 5 column 2), whereas the dashed line represents the 95% confidence interval.

A similar result emerges when union density is accounted for. Although countries with high union density could have a partisanship lean towards left-wing governments, biasing

the causal effect that the instrumental variable is called to recover, the estimated elasticities show no statistical differences with respect to the benchmark social transfers and income inequality elasticity.

The graph of the effect of ST on income inequality based on different levels of corruption shows that the point estimates of these elasticities are smaller, although still statistically significant when high-corruption countries are considered. This result is in line with our hypothesis that in countries where corruption is high, collective demand for redistribution is low due to the low trust in government intervention (Algan, Cahuc and Sangnier 2016; Bergh and Bjørnskov 2011; Bjørnskov and Svendsen 2013; Daniele and Geys 2015; Wulfgramm and Starke 2017). In addition, several channels can be suggested to corroborate the view that corrupt actions undermine the equalising effect of social transfers. The work of Dincer and Gunalp (2012) suggests that social spending is less effective in reducing income inequality when the level of corruption is high because the burden of corruption falls disproportionally on the poor population. Corruption leads to tax evasion, poor tax administration, and exemptions that favour the well-connected and wealthy population groups (Gupta, Davoodi, and Alonso-Terme 2002). These factors reduce the tax base and the progressiveness of the tax system, possibly leading to increased income inequality. In addition, corruption can affect the targeting of social programs to the truly needy (Goni, Lopez and Serven 2011). The use of government-funded programs to extend benefits to relatively wealthy population groups, or the siphoning of funds from poverty-alleviation programs by well-connected individuals, could diminish the impact of social programs on the income distribution and poverty.

5.3. Robustness analysis

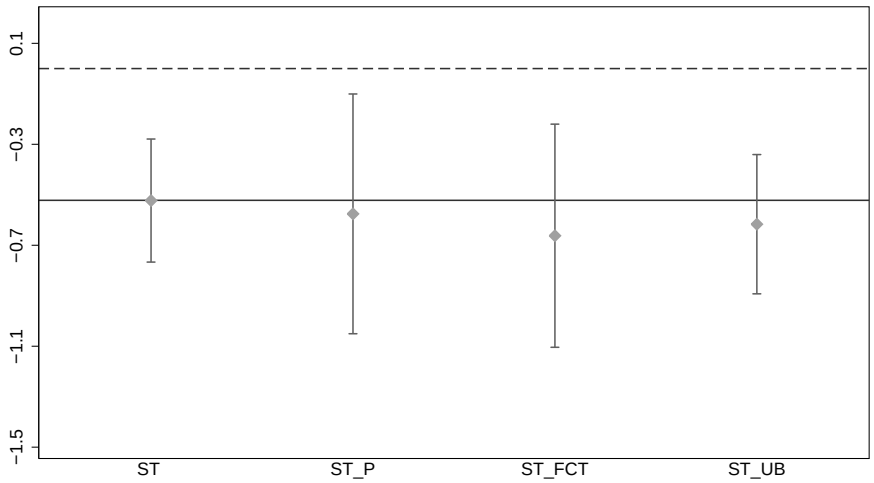
We propose robustness checks in this section. The first robustness check concerns the magnitude of the components of social transfers in government spending (ST) because their composition may drive the empirical results. For example, if the share of social transfers related to the pension system (i.e., old age-, disability- and incapacity-related pensions) is predominant, our results would depend on the redistributive effect of the pension system. In line with this argument, Figure 6 compares the estimated elasticities of ST on income inequalities[19] with its components excluding, one by one, the three major components of ST: pensions ST_P, family-related cash transfers ST_{FCT}, and unemployment benefits ST_{UB}. For the ease of the reader, we report the estimated elasticities of ST with a continuous reference line.

The estimated elasticities in Figure 6 suggest homogeneous behaviour of income inequality when affected by different components of social transfers and close to the full aggregate of social transfers, as also shown by the overlapping of the confidence intervals.

In Figure 7, we provide a third robustness check to investigate whether our results are driven by a specific country. The continuous line represents the IV point estimates that includes all countries, the dotted lines represent the confidence intervals, and the bars show whether the confidence interval changes when we subtract the country listed on the horizontal axis. Without exception, our results are largely robust to the poolability test of countries.

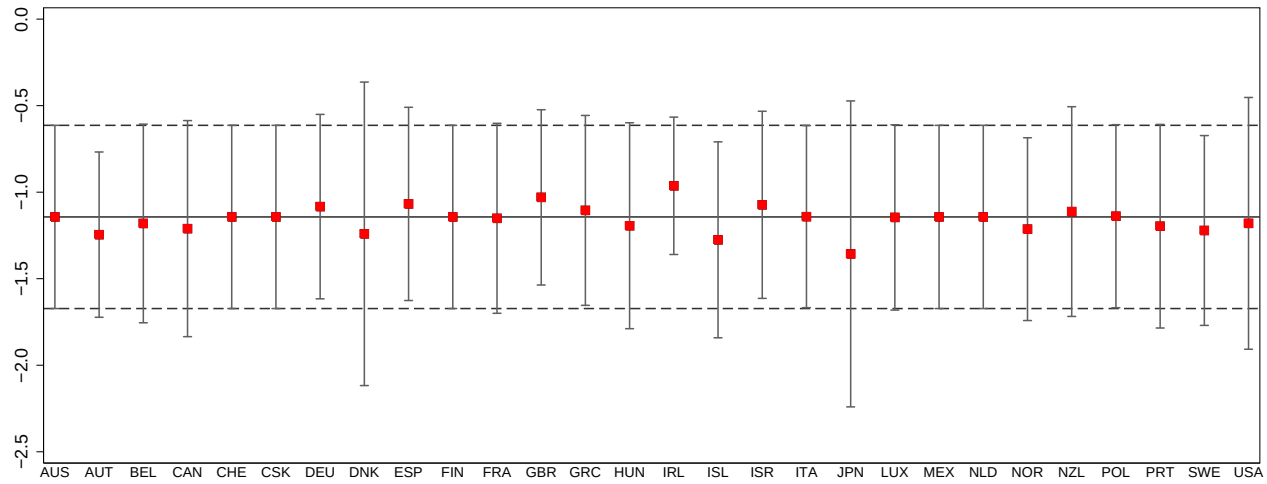
[19]In all cases, we use the specification proposed in column 2 of Table 5.

Figure 6: Robustness analysis of the components of social transfers



Notes: The figure reports the elasticity estimates and 95% confidence intervals. ST is the benchmark estimate whereas ST_P, ST_{FCT}, and ST_{UB} measure the impact in terms of income inequality elasticity excluding the componenets of social transfers related to the pensions, family-related cash transfers and unemployment benefits, respectively. For the ease of reading the graph, we report the estimated elasticities of ST with a continuous reference line.

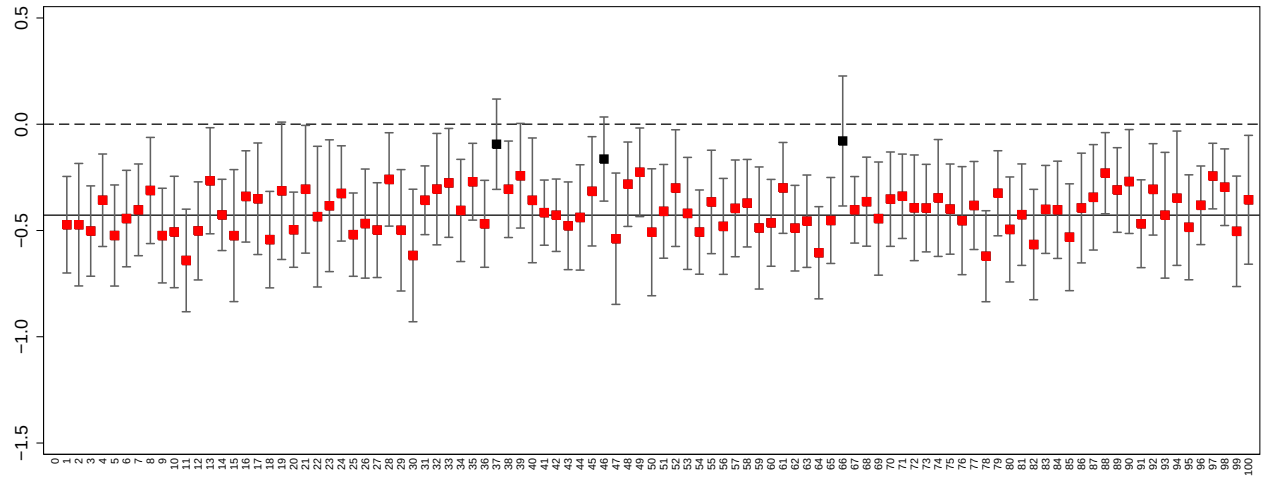
Figure 7: Robustness check: country-specific effect



Notes: The figure reports conditional point estimate elasticities and 95% confidence intervals by bars excluding each time the reference country. The continuous line lists the elasticity estimated in the benchmark model (Table 5 column 2), whereas the dashed lines represent the 95% confidence interval of the benchmark elasticity.

The final robustness check concerns the comparability across countries of income inequality by disposable income (i.e., Gini index). This issue has been largely debated in the economic literature (Solt, 2016). To illustrate the robustness of our result, we replicate the analysis (Table 5 column 2) using the 100 imputed series of the comparable Gini indices of disposable income collected in the Standardized World Income Inequality Database

Figure 8: Robustness analysis: imputed measures of income inequality



Notes: The figure reports elasticity measures and 95% confidence intervals by bars. As outcome variable, we use the 100 imputed series of the comparable Gini indices of disposable income collected in the Standardized World Income Inequality Database (SWIID). The continuous line represents the benchmark elasticity reported in column 2 of Table 5. We use a red square when the estimated elasticity is within the 99% confidence interval.

(SWIID)[20]. Figure 8 shows the estimated elasticities and the corresponding confidence intervals for each of the 100 imputed series produced by the SWIID. In this case, we also use a continuous reference line indicating the elasticity estimated in Table 5. The figure shows that the elasticity estimated as a benchmark in Table 5 is outside the confidence interval of the imputed estimated elasticities in 3% of the cases. In addition, these three cases are not statistically significant, as indicated by the discontinuous reference line in Figure 8, confirming the quality of our findings.

6. Concluding remarks

The results in this paper suggest a significant negative effect of social transfers on income inequality. Changes in social spending of OECD countries are predicted through the probability of coalitions (centre-left or centre-right) winning an election in a proportional or majoritarian system, which represent the raw variables of our instrument, estimating the relationship between social transfers and income inequality.

[20]The SWIID is composed of 100 imputed series produced by different combinations of available data that represent plausible values for the GINI index. The SWIID maintains the widest possible coverage across countries and over time by incorporating data from the OECD Income Distribution Database, the Socio-Economic Database for Latin America and the Caribbean generated by CEDLAS and the World Bank, Eurostat, the regional aggregation network (PovcalNet) of the World Bank, the United Nations Economic Commission for Latin America and the Caribbean, national statistical offices around the world, and academic studies while minimising reliance on problematic assumptions by using as much information as possible from proximate years within the same country. Data collected by the Luxembourg Income Study are employed as the standard.

When we analyse whether the effect varies according to the quality of institutions, we find that the negative impact of redistribution on income inequality is reduced in countries with high levels of corruption. This result explains why some countries with relatively high social transfers, such as Italy, Greece and Poland, are not able to significantly reduce income inequality, suggesting that a less unequal income distribution could be achieved by reducing corruption and increasing the efficiency of public spending.

Our results appear to be consistent with the predictions of the proposed model, showing mechanisms in which electoral systems and political representativeness lead to different social transfer policies and, in turn, to changes in income inequality. Although, we are unable to definitively rule out the possibility that electoral systems and winning coalitions could have some independent impact on income distribution beyond the channel working through social transfers, we show that our findings are robust to a variety of robustness checks and that other effects are likely to be minor.

A. Theoretical model

A.1. Background

A society is composed of individuals i who are assumed to be classified into three classes: low-income L, middle-income M, and high-income H groups. The voting population is assumed to be equally distributed between these three groups, which are assumed to have different preferences for the relevant policy choices. We consider an indirect utility function $V^i : Q \rightarrow \mathbb{R}$ in which Q is a set of possible policy choices. Q includes $q^i \in Q$, representing the subset of policies that maximise the value of the indirect utility function of group i, such that $V^i(q^i) \geq V^i(q)$, with the strictly concave single-peaked preference assumption $V^i(q)$. Thus, transferring a given quantity of income from one group to another, the indirect utility function $V^i(q^i)$ depends on the disposable income of each group $(1-\tau)y^i$ and transfers received by group i from the government (i.e., Tr^i). The indirect utility function is:

$$V^i(q^i) = (1-\tau)y^i + Tr^i \tag{A.1}$$

where y^i is the gross income of group i, and τ is a lump-sum tax on income ($\tau \leq 1$).

The redistributive policy is financed by progressive taxation. Following Iversen (2005), transfers G represent a cost for the higher-income groups M and H and a benefit for the low-income group L. Indeed, $1-\epsilon$ of these transfers are paid by the people in H, and the remaining ϵ is paid by those in M. We assume an upper limit G^*, which is not modifiable without agreement from the financing groups. Furthermore, a constant share α ($\alpha > 0$) in G is assumed to characterise several administrative costs, which include red-tape costs.

We assume that the government finances the expenditures with revenues (Γ^i) levied proportionally on each group with an income tax (τ) and imposes a progressive tax to finance social transfers, as discussed earlier. The budget constraint rules are:

$$\Gamma^L = \tau y^L \tag{A.2}$$

$$\Gamma^M = \tau y^M + (1+\alpha)\epsilon G \tag{A.3}$$

$$\Gamma^H = \tau y^H + (1+\alpha)(1-\epsilon)G. \tag{A.4}$$

Note that the three income groups have different goals concerning G and τ. Since progressive taxation is assumed, the high-income group will pay the largest share of G without receiving any transfer (see equation A.4). As a consequence, the optimal strategy for this group will be to reduce both G and τ to zero. On the other hand, the low-income group will receive the majority of transfers without paying G and hence will prefer setting G to G^* and τ to 1. The middle-income group, which is supposed to be equidistant between the other groups, has conflicting strategies concerning τ and G. When τ is considered, the preferences of M are more in line with L, whereas its preferences are closer to those of H when G is considered.

The optimality conditions for M will lead it to chose an intermediate level of taxation τ^{*m} (approximately 0.5) and to set G to zero. As shown by (A.3) and (A.4), when ϵ is negligible, H will pay the largest share of the cost of the social transfers policy, and the preferences of M and L will converge perfectly if $\epsilon = 0$. Following these arguments, we can formalise the

aims for each of the three income groups as a function of G and τ. For simplicity, we use the preferences v, expressed in terms of income shares, such that $g = G/y$, and we obtain:

$$v^L = g + \tau \tag{A.5}$$
$$v^M = -(\tau - \tau^{*m}) - g(1+\alpha)\epsilon \tag{A.6}$$
$$v^H = -\tau - g(1+\alpha)(1-\epsilon) \tag{A.7}$$

A.2. Modelling the proportional representation system

Intuitively, the basic model suggests that if one of the three income groups has the majority to be elected, it will impose its preferences concerning τ and g upon the other groups. To define the proportional representation system, we introduce two different sets of preference functions for the LM and MH coalitions.

$$Coalition\ LM \quad \begin{cases} \hat{v}^L = \tau + g - \tau^{*m} \\ \hat{v}^M = (1 - \tau^{*m}) - (\tau - \tau^{*m}) - g(1+\alpha)\epsilon \end{cases} \tag{A.8}$$

$$Coalition\ MH \quad \begin{cases} \hat{v}^M = -(\tau - \tau^{*m}) - g(1+\alpha)\epsilon \\ \hat{v}^H = -\tau - g(1+\alpha)(1-\epsilon) \end{cases} \tag{A.9}$$

In contrast to equations A.5, A.6 and A.7, the preference functions in equations A.8 and A.9 depend on the preferences of the counterpart. For example, let us denote by $\hat{v}^L_{LM}$ the preferences of L when there is an LMcoalition; this value includes $\tau + g$, which represents the preferences of L, and τ^{*m}, which is the optimal tax rate for M. By aiming to find the solution of a multidimensional bargaining game, each group must satisfy the condition for each coalition, which is symmetric for each player. For example, when we consider the coalition LM, where L is the "first player", the Rubinstein bargaining solution is obtained, thereby equalising the own preference for choice variables (g, τ) with those of M. Technically, this result implies substituting the key variables in the preference functions of each group with those of the other group forming the coalition and maximising under this constraint. Following this scheme, L is available to contract g and τ, which makes L willing to accept a coalition and *vice versa*. In summary, the payoffs for each coalition are as follow:

$$Coalition\ LM \quad \begin{cases} \textbf{L play} \Longrightarrow (1 - \tau^{*m}) - (\tau^L - \tau^{*m}) - [g^* - g^L(1+\alpha)\epsilon = \\ \delta\left[(1 - \tau^{*m}) - (\tau^M - \tau^{*m}) - [g^* - g^M(1+\alpha)\epsilon\right] \\ \textbf{M play} \Longrightarrow \tau^M + g^M - \tau^{*m} = \delta\left[\tau^L + g^L - \tau^{*m}\right] \end{cases} \tag{A.10}$$

$$Coalition\ MH \quad \begin{cases} \textbf{M play} \Longrightarrow -\tau^M = -\delta\tau^H \\ \textbf{H play} \Longrightarrow -(\tau^H - \tau^{*m}) = -\delta(\tau^M - \tau^{*m}) \end{cases} \tag{A.11}$$

where τ^L, τ^M and τ^H are the preferred tax rates for each group, and δ is a discount factor. Solving A.10 and A.11, we obtain a value of τ and g that allows the players to setup a given

coalition. When $\delta \rightsquigarrow 1$, these parameters are:

$$Coalition\ LM \quad \left\{\tau = \frac{1+\tau^{*m}}{2} - \frac{g}{2} + \frac{(1+\alpha)(g^*-g)\epsilon}{2} \quad and \quad g = g^* \right. \tag{A.12}$$

$$Coalition\ MH \quad \left\{\tau = \frac{\tau^{*m}}{2} \quad and \quad g = 0 \right. \tag{A.13}$$

where (A.12) depends on the cost of the social spending policy α, the share of resources collected from the middle-income group ϵ and the values of transfers costs g, whereas (A.13) depends only on the optimal tax rate of the middle-income group. On the basis of the second condition, we find that in the MH coalition, the tax rate is one-half of the optimal tax rate for M, and the middle-income group will obtain a constant utility from this coalition that does not maximise its preferences. By contrast, from the LM coalition, we see that when $g = g^*$, M obtains a higher utility from the redistributive policy. To determine when the LM coalition will be preferred to the MH coalition, we run some comparative static analyses on g by introducing the optimal values of τ obtained by (A.12) in the preference function of player M. The comparative statics are:

$$Coalition\ LM \quad \left\{\frac{\partial \hat{V}^M}{\partial g} > 0 \quad if \quad \epsilon < \frac{1}{1+\alpha} \right. \tag{A.14}$$

From (A.14), we see that M obtains positive utility from the social spending policy, but the share of resources that M is willing to pay must not be higher than the inverse of the administrative costs of the social transfers policy. When there are no administrative costs ($\alpha = 0$), M will always obtain a positive utility from the redistributive policy, but when these costs become relevant, individuals in group M will be willing to pay a lower amount of resources for redistribution. The progressiveness of the social spending policy and the administrative costs represent the crucial parameters in determining the coalition between low- and middle-income groups.

A.3. Modelling the majority representation system

A majority electoral system is characterised by a winner-take-all approach for a restricted number of competing parties (or coalition parties). We simplify the model by supposing that only a centre-right and a centre-left political party can take part in the election; that is, in a majority electoral system, each party must attract the vote of M to win an election. To achieve that goal, the parties will converge to the policy preferences of the M constituency, that is, $\{g, \tau\} = \{0, \tau^{*m}\}$. As in proportional representation, the M constituents share with H the same preferences on g but are more similar to L when τ is considered. As a consequence, H and L will converge to the preferences of M, with corresponding preferences as in equation (A.7).

When in charge of the government, the left- and right-wing parties have incentives to diverge from the preferences of M, adopting policies that reflect the needs of their own constituencies (Persson *et al.*, 2004; Iversen, 2005). The voters in the M constituency may suffer a considerable loss of utility, but at this stage, he/she has no instruments to influence the redistributive policy promoted by the government. We can summarise the costs of a policy deviation from the electoral preferences for a voter in M in a centre-left or centre-right government, respectively, as:

$$T_{LM} = g^* + \tau^{*m} \tag{A.15}$$
$$T_{MH} = -\tau^{*m} \tag{A.16}$$

In turn, this deviation may reduce the credibility of the ruling party. Indeed, the loss of reputation may be important for the government since it makes it more difficult to address its constituency in the future. These costs, defined by c_{LM} and c_{MH}, constitute the payoffs for a centre-left or centre-right party to diverge from its electoral promises.

B. Reverse causality in the relationship between social transfers and income inequality

Suppose that we have a simultaneous system for cross-section $i = 1, 2, ..., N$

$$ST_i = \alpha_{1,st} GINI_i + \epsilon_{st,i} \tag{B.1}$$
$$GINI_i = \alpha_{1,GINI} ST_i + \epsilon_{GINI,i} \tag{B.2}$$

where we define ST_i as the share in government spending of social transfers and, again, $GINI_i$ is the Gini index in terms of disposable income. Assume that $\alpha_{1,st} > 0$ (i.e., in more unequal economies there is a higher demand for redistribution) and that $\alpha_{1,GINI} < 0$ (i.e., a larger share of social transfers reduces income inequality). We assume that $E(\epsilon^2_{st,i}) = \sigma_{ss}$, $E(\epsilon^2_{GINI,i}) = \sigma_{gg}$ and $E(\epsilon_{st,i}\epsilon_{GINI,i}) = \sigma_{sg}$. Then, if we have already concentrated out all the exogenous regressors, using the Frisch-Waugh theorem, the reduced forms are

$$ST_i = \left[1 - \alpha_{1,GINI}\alpha_{1,st}\right]^{-1} \left(\alpha_{1,st}\epsilon_{GINI,i} + \epsilon_{st,i}\right) \tag{B.3}$$
$$GINI_i = \left[1 - \alpha_{1,GINI}\alpha_{1,st}\right]^{-1} \left(\alpha_{1,GINI}\epsilon_{st,i} + \epsilon_{GINI,i}\right). \tag{B.4}$$

Note that $[1 - \alpha_{1,GINI}\alpha_{1,st}] > 0$ since $\alpha_{1,GINI} < 0$ and $\alpha_{1,GINI}\alpha_{1,st} < 0$, such that the sign of $GINI_i$ on ST_i depends on

$$\begin{aligned} \chi_{GINI,ST} &= \left(E\left[(\alpha_{1,st}\epsilon_{GINI,i} + \epsilon_{st,i})(\alpha_{1,GINI}\epsilon_{st,i} + \epsilon_{GINI,i})\right]\right. \\ &= \alpha_{1,st}\sigma_{gg} + \alpha_{1,GINI}\sigma_{ss} + \left[1 - \alpha_{1,GINI}\alpha_{1,st}\right]\sigma_{sg} \end{aligned} \tag{B.5}$$

Now, suppose $\sigma_{sg} = 0$, and that demand and supply shocks are independent, which is a common assumption. Then, $\chi_{GINI,ST} > 0$ if

$$\alpha_{1,st}\sigma_{gg} + \alpha_{1,GINI}\sigma_{ss} > 0 \tag{B.6}$$
$$\alpha_{1,st}\sigma_{gg} > -\alpha_{1,GINI}\sigma_{ss} \tag{B.7}$$

where both terms are positive since $\alpha_{1,GINI} < 0$.

Thus, as argued by Pecoraro (2014, 2017), the regression coefficient will be positive if the effect of income inequality on social transfers is greater than the effect of social transfers on income inequality and *viceversa*. This result also implies that, given our empirical framework, the effect of the reverse causality reduces the (expected) negative effect of social transfers on income inequalities.

C. Descriptive statistics

Country	GINI	ST	ESPPO	γ_{GDP}	Gov	Health	P_{tax}	Corr	γ_{pop}	Fem	Eld	Unemp	Union	Occ_ter_y	Occ_ter_a	Parl	Nat	Reg	Polar	Ych
AUS	31.72	8.12	.	3.18	17.92	7.30	61.98	71.68	1.39	1.01	17.98	8.91	-0.00	35.66	30.05	1.00	0.00	0.00	0.94	4.39
AUT	26.34	17.85	1.81	1.98	18.91	8.48	67.59	71.08	0.35	1.08	23.24	8.05	0.11	33.54	24.10	1.00	0.00	0.00	1.78	5.00
BEL	26.67	17.18	1.11	1.90	22.20	8.19	69.45	63.77	0.38	1.04	24.09	8.10	0.05	36.58	24.94	1.00	0.25	0.97	2.00	4.08
CAN	30.11	9.16	0.00	2.42	21.19	8.76	62.25	88.17	1.11	1.02	17.81	9.45	-0.02	43.66	33.49	1.00	0.00	0.00	0.44	4.33
CHE	29.97	9.81	1.50	1.73	10.81	8.98	69.80	81.19	0.73	1.05	22.43	8.20	0.13	30.90	27.32	1.00	0.00	0.00	.	2.61
CSK	25.18	11.20	1.63	1.85	20.09	6.17	66.40	30.28	0.09	1.05	20.67	8.31	0.03	16.40	12.96	0.92	0.00	0.20	1.65	2.58
DEU	27.63	14.66	1.28	1.72	19.28	9.55	69.25	74.90	0.09	1.06	25.73	10.30	-0.08	23.40	25.20	1.00	0.00	0.44	2.00	6.67
DNK	23.26	11.71	1.42	1.70	25.12	8.76	61.51	94.40	0.28	1.02	23.22	7.77	0.02	28.36	23.65	1.00	0.00	0.00	2.00	4.25
ESP	32.85	13.43	.	2.25	17.17	6.96	65.63	53.52	0.64	1.04	22.28	9.33	0.36	27.49	14.49	1.00	0.11	0.11	0.86	5.39
FIN	23.44	15.32	1.82	2.17	21.42	7.57	64.94	98.95	0.39	1.05	22.16	7.61	0.14	27.92	24.77	1.00	0.00	0.81	1.61	3.19
FRA	28.86	16.52	0.00	1.80	22.55	9.67	62.79	62.65	0.51	1.06	23.39	9.94	0.14	29.26	15.87	1.00	0.00	0.00	1.17	2.42
GBR	31.85	10.03	0.00	2.16	19.11	6.63	56.01	71.14	0.36	1.05	23.98	10.06	-0.04	35.24	28.58	1.00	0.00	0.00	0.28	4.72
GRC	34.01	11.99	1.64	0.86	18.71	7.99	54.20	41.72	0.44	1.03	23.74	7.69	0.76	23.00	14.18	0.81	0.00	0.00	0.22	2.94
HUN	28.28	13.78	1.14	1.92	22.07	7.18	57.13	48.48	-0.24	1.09	21.66	8.10	-0.13	19.41	15.90	0.69	0.00	0.00	0.33	9.22
IRL	31.25	10.09	1.00	4.92	17.85	7.32	54.97	51.64	0.90	1.01	17.50	7.06	-0.14	35.57	22.05	1.00	0.00	0.00	1.28	3.47
ISL	25.57	5.88	1.00	2.79	21.32	8.10	44.02	91.63	1.09	0.99	17.26	4.81	0.08	35.33	30.99	1.00	0.00	0.00	1.56	3.19
ISR	35.20	9.14	1.11	4.25	27.93	6.96	53.88	50.32	2.25	1.02	15.64	7.77	-0.17	43.20	44.89	0.86	0.33	0.00	1.92	2.92
ITA	31.71	15.91	0.71	1.23	18.79	7.85	66.25	30.27	0.25	1.06	25.40	9.64	0.19	14.27	9.93	1.00	0.14	0.14	0.81	1.97
JPN	31.82	8.22	0.00	2.07	16.50	7.64	72.74	54.54	0.25	1.04	23.85	10.83	0.04	55.87	43.32	1.00	0.00	0.00	0.39	2.36
LUX	27.18	13.72	.	4.00	16.25	5.74	65.96	85.43	1.19	1.03	20.24	5.40	0.18	40.35	26.34	1.00	0.00	0.00	1.00	7.08
MEX	.	1.38	0.00	2.69	10.82	5.40	51.51	15.57	1.75	1.03	8.16	9.91	0.05	18.24	12.34	0.00	0.00	0.00	0.58	3.33
NLD	26.58	13.44	1.22	2.06	22.99	8.12	66.99	89.59	0.52	1.02	19.95	8.71	0.06	31.99	25.05	1.00	0.14	0.00	2.00	4.94
NOR	25.50	9.57	1.56	2.54	20.34	7.56	64.19	86.42	0.68	1.02	23.81	7.59	0.08	33.87	25.02	1.00	0.00	0.00	2.00	3.11
NZL	32.37	11.23	0.00	2.50	18.05	7.40	60.68	90.58	1.04	1.03	17.74	7.27	0.08	39.73	31.27	1.00	0.00	0.00	1.17	4.31
POL	31.46	15.68	1.89	3.69	19.03	5.68	59.72	39.39	0.25	1.06	17.15	9.35	-0.30	23.39	13.08	0.00	0.06	0.00	0.42	4.61
PRT	35.37	11.13	1.47	1.93	17.34	7.42	53.36	58.52	0.21	1.08	22.87	8.10	0.11	18.66	9.99	0.92	0.00	0.00	1.03	3.00
SWE	23.74	14.01	1.61	2.14	25.66	8.20	70.63	91.50	0.44	1.02	27.19	8.27	0.14	32.75	24.81	1.00	0.00	0.00	1.92	3.00
USA	36.09	8.08	0.00	2.64	15.44	12.79	70.82	62.41	1.00	1.04	18.89	11.66	-0.05	38.53	38.37	0.00	0.00	0.00	1.28	4.17
Total	28.97	11.76	0.97	2.39	19.43	7.85	62.48	66.34	0.65	1.04	20.97	8.53	0.07	30.20	22.96	0.85	0.04	0.09	1.19	4.19

Notes: $GINI$ is the Gini index measured in terms of disposable income; ST is the share in government spending of social transfers; $ESPPO$ is the instrumental variable, i.e., the interaction between electoral system and the party winning the elections; γ_{GDP} is the growth rate of per capita GDP; Gov is the share in GDP of government consumption; $Health$ is the share in GDP of public health expenditures; P_{tax} is the share in total direct tax; $Corr$ is the International Country Risk Guide anti-corruption index; $Union$ is the share of active union members in the population; the shares of employment with tertiary education, distinguishing between young employees (occ_ter_y) and adult employees (occ_ter_a); γ_{pop} is the growth rate of the population; Fem is the female to male population ratio; Eld is the share of elderly in the total population; $Unemp$ is the unemployment rate; Pol is a dichotomous variable indicating whether the political system is presidential or parliamentarian; Nat is a dummy variable for a nationalist party; Reg is a dummy variable for a regional-based party; $Polar$ is the degree of polarisation in the assembly; Ych represents how long the present government is due to remain in office.

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