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TRANSFERS AND INCOME INEQUALITY IN OECD COUNTRIES**

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

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Abstract

In this paper, we have revised the estimates of the effect of social transfers on income inequality. We have accounted for reverse causality using an instrumental variable derived by a theoretical model, which identifies the main driver of social transfers from the interaction between electoral system and coalition or party winning the elections, and have estimated in the OECD countries that a 1% increase of the share of social transfers reduces the income inequality by half 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 seems to make this empirical regularity questionable; our estimates show that bureaucratic inefficiencies by corruption are identified as responsible of the benefit lacks of social transfers on economic inequality.

Keywords: Welfare policy; Social spending; Income inequality; Instrumental variable estimation.

JEL Classification: H530; I380; C260.

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 remains why rich countries show this long-term trend. The debate has focused on the growing role of finance - and increasing returns to capital - including wealth (Piketty 2014; Roine, Vlachos and Waldenström 2009), and globalisation and skill-biased technological change (Acemoglu 2002; Alderson and Nielsen 2002; Bergh and Nilsson 2010; Freeman 2009). These factors in the Western economies are generally associated with market deregulation, weaker labour market institutions and the transfer of power to supranational institutions which, in turn, have reduced the room of manoeuvring of governments (Glyn 2006; Koster 2014; Pontusson 2013, OECD 2015).

Another strand of the economic literature suggests that rising economic inequality is not inevitable and the inadequate or inefficient government intervention in the redistribution of resources to poor through taxes, social transfers and provision of public services represents in most OECD countries the ultimate cause of the increase in the inequality of disposable (post-fiscal) income (Atkinson Piketty and Saez 2011; Brandolini and Smeeding 2009; Causa and Hermansen 2017; Doerrenberg and Peichl 2014). In particular, 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, we have little evidence on the causal impact of social spending on income inequality. Empirical estimates are not easy to interpret, for example, when the ordinary least square estimator is used, because unobserved confounding factors - as government institutional quality, are potentially at playing, driving both social spending and income inequality which, in turn, produces misleading estimates (Miguel, Satyanath and Sergenti 2004). Endogeneity issues also arise in the relationship between social spending and income inequality because of possible reverse causality (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 reducing economic inequality. On the other hand, 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 account¹. Doerrenberg and Peichl (2014) deal with the problem of endogeneity using an instrumental variable (IV) approach with the initial level of the policy variables as instruments for the explanatory variables of interest, and they do confirm that social spending has inequality reducing effects. Niehues (2010) tries to disentangle causality by applying the System GMM Estimator and finds that a larger redistributive budget is strongly related to lower income inequality levels. Similarly, Martínez-Vázquez *et al.* (2012) use a GMM Estimator to show that higher shares of GDP on social welfare have a positive impact on income distribution.

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

The present paper contributes to this literature by estimating the causal relationship 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 deal adequately with the key variable characterization. The model suggests that the electoral systems and government partisanship affect redistribution policies when heterogeneous optimising behaviours of parties or coalitions are included which, in turn, generate cross-country differences in income inequality. We exploit the interaction between electoral systems and the coalitions winning the elections to instrument the cited relationship in an IV framework. Empirically, we focus on the 'pure' effect of social spending implemented through its cash components on income inequality, whereas the in-kind social spending (i.e., the provision of health care, education spending and other services) was accounted only indirectly.

Clearly, confounding factors are always at work. For this reasons, we choose a sample of OECD countries that assures a homogeneous institutional background and we control for additional sources of bias in our estimates.

The empirical results suggest that a larger social transfer spending is related to a lower income inequality. The estimated elasticities indicate that an increase by 1% in social transfers reduces income inequality by about a half (0.5%). More in-depth, this analysis also reveals significant heterogeneous results conditionally to pervasive corruption, whereas tax progressiveness and the strength of unions appear to be not discriminant. Finally, sensitivity tests are implemented, confirming the robustness of our estimates.

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

2. Theoretical model: basic assumption

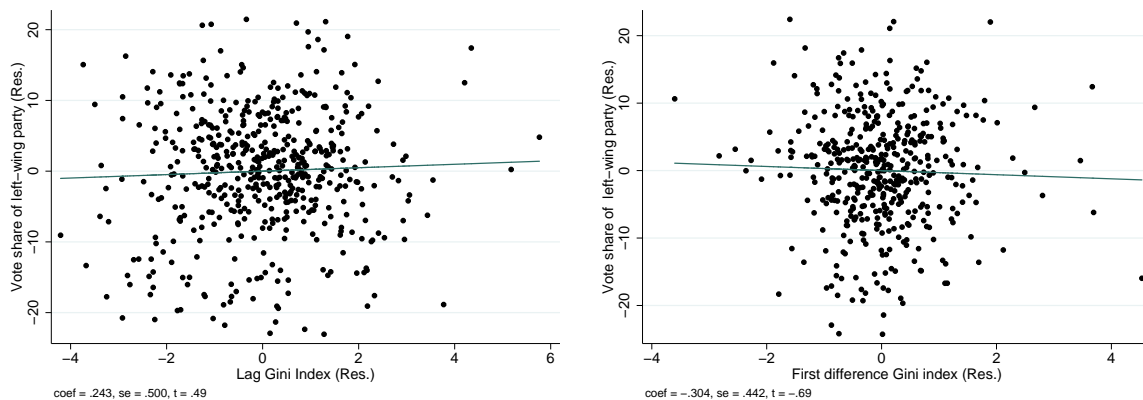
In this section, we provide a brief description of the model (see Appendix A for details). We highlight the main propositions behind the model as in Iversen (2005) and Iversen and Soskice (2006) and show the links that connect the electoral rules and government partisanship to social transfers and, in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

The model supposes a society of individuals that can be classified in three classes or social groups defined by income. These classes represent the 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 to be elected. In this view, the low-income group is the major constituency for the left-wing party, whereas 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) which are formed between either the poor and the middle-income group or between the affluents 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 decided according only to the preferences of one class and that variations 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 it implies 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 the left-wing parties (*left_v*) in the national elections², whereas Figure 1 (panel b) plots the correlation between the variation of the Gini index and *left_v*. A significant correlation between the lagged level or variation of income inequality and the vote share for left-wing parties could be interpreted as a violation of assumption AS1. We do not find any significant correlation between these variables, neither 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 is not in contrast with assumption AS1 at the base of the theoretical model proposed by Iversen (2005) and Iversen and Soskice (2006).

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



Notes: The graph plots the residual of a regression between the vote share of left-wing parties, the residual of the lagged value of the Gini index measured on disposable income (panel a) and the residual of the first difference of the Gini index measured on disposable income (panel b). The estimate includes time and country fixed effects. The errors are clustered at the country level.

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

Indeed, the social transfers are supposed to be mostly financed 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 imposes an upper limit to the progressive tax, defined as G^3 . The propor-

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

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

tional income tax is payed by all the income groups, whereas the progressive tax is paid for a non non-negligible share ϵ by people in M , and for the residual amount $1 - \epsilon$ by people in H . Furthermore, a constant fraction α ($\alpha > 0$) on g is assumed to represent some administrative costs of the fiscal system, which include red tape costs. Introducing the administrative costs in the model may be relevant in some contexts, since it allows us to consider explicitly a measure of efficiency of the government policy which includes the quality of the provision of public goods and, in the extreme case, corruption of the public sector.

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

The voting choice of the middle class depends also on the ability of parties to make credible commitments on the social transfers policies under different electoral rules. We know that in the 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 problem of platform commitment. Differently, 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). It is worth noting that, in the majoritarian electoral system, it is not guaranteed that coalition parties will pursue the 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

Table 1: Expected coalitions in a proportional system

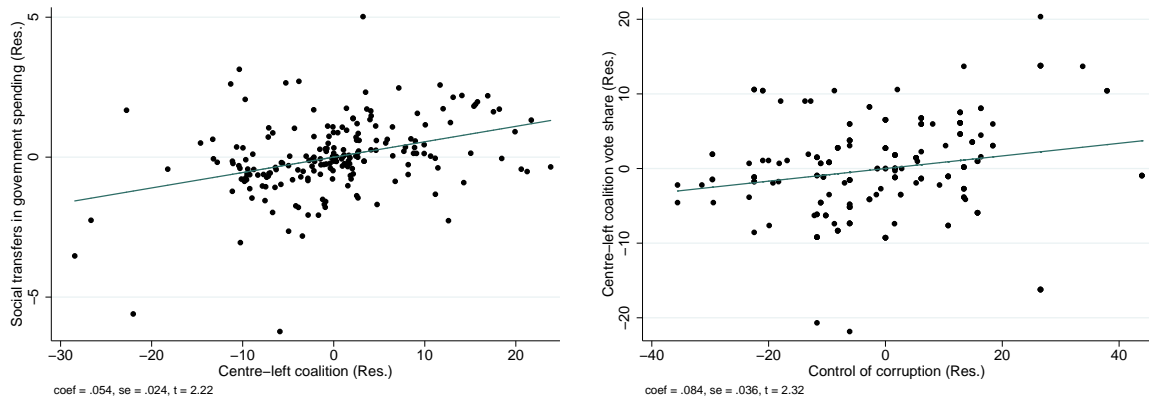
	Condition on ϵ	Condition on α	Probability of LM coalition	Tax system
1a	If $\epsilon \rightsquigarrow 0$	$\alpha > 0$	$Pr(LM) \rightsquigarrow 1$	Strongly Progressive tax rate
1b	If $\epsilon \rightsquigarrow 0$	$\alpha \rightsquigarrow 0$	$Pr(LM) \rightsquigarrow 1$	
2a	If $\epsilon \rightsquigarrow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

In a proportional representation system, government ruled by centre-left coalitions are more likely than ruling coalitions between the middle- and high-income groups. As shown in the Appendix A (equation 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 (equation A.12 and A.13). Table 1 summarises the probabilities for a given coalition to win the elections, for different values of ϵ and α , and for different level of

change it.

progressiveness of the tax system in a proportional representation system⁴. As clearly shown in table 1, the probability to have 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 zero⁵. When the administrative costs α are negligible, the centre party will increase its utility in a coalition with the left party, except than in the regressive tax system. For countries with an inefficient public sector, a reversed probability can be found. In this case, a significant 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 this result of expected LM coalition under progressive taxation and realistic tax parameters ($\epsilon = 0.5$ and $\alpha > 0$).

Figure 2: Correlation between social transfers and centre-left coalitions vote share, proportional representation system



(a) Social spending and centre-left coalitions vote share (b) Probability of centre-left coalitions and corruption

Notes: The graph plots the residual of a regression between the share of social transfers in government spending on the centre-left coalitions vote share in the 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 GDP and the vote share of the centre-left coalitions in the proportional representation system⁶, and lists the estimated parameters of the regression. We document that there is a positive and significant correlation between the aforementioned variables, confirming that government ruled by centre-left coalitions are prone to implement social transfers. In addition, the right panel of Figure 2 shows the correlation between the

⁴We remind that the coalition between the 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 involving the middle-income group.

⁵The model in Appendix A shows that, in these cases, the probability to obtain a LM coalition will tend to zero and one, respectively.

⁶By construction, the vote share of the centre-right coalitions is specular to the reported one. For this reason, we omit the graph showing that centre-right coalitions are associated with lower redistribution in the proportional electoral system.

probability for a centre-left coalition to win the elections in a proportional representation system and the level of efficiency of the government action using as a proxy of the 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.

The 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 their own constituency needs (see also Persson, Ronald and Tabellini 2004; Milesi-Ferretti, Perotti and Rostagno 2002). Thus, the middle-income group would suffer of a considerable decrease in its 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 case of centre-left and centre-right government coalitions, respectively (equation A.15 and A.16). Also the ruling centre-left/centre-right coalitions face a cost in terms of loss of reputation, which may reduce the possibility to win future elections by attracting again the middle class. The model includes the costs of deviation from the platform of the middle class with the functions c_{LM} and c_{MH} .

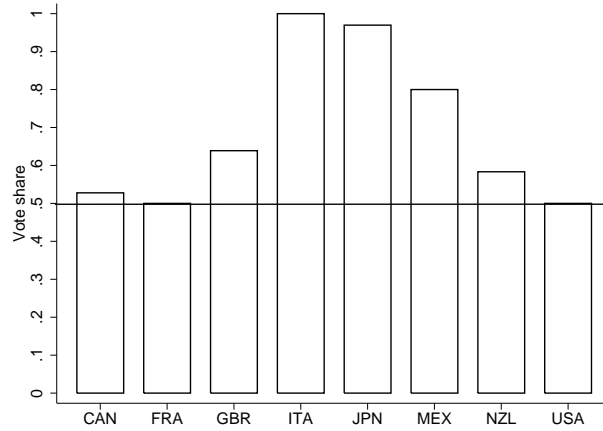
Table 2: Expected coalitions in a majoritarian system

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 the election for centre-left and centre-right coalition parties in the majoritarian electoral system. As shown by the 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 deviation from the platform of the middle class (c_{LM} and c_{MH}). However, as shown by the model, the affluent party has less incentives 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 the majoritarian electoral system, the centre-right coalition party has the higher probability to win the elections. Furthermore, the model shows that the policy promoted by the elected political coalition (both centre-right and centre-left) in the majoritarian electoral system will be less redistributive than the policy 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., $\tau > 0$, $g \rightarrow 0$).

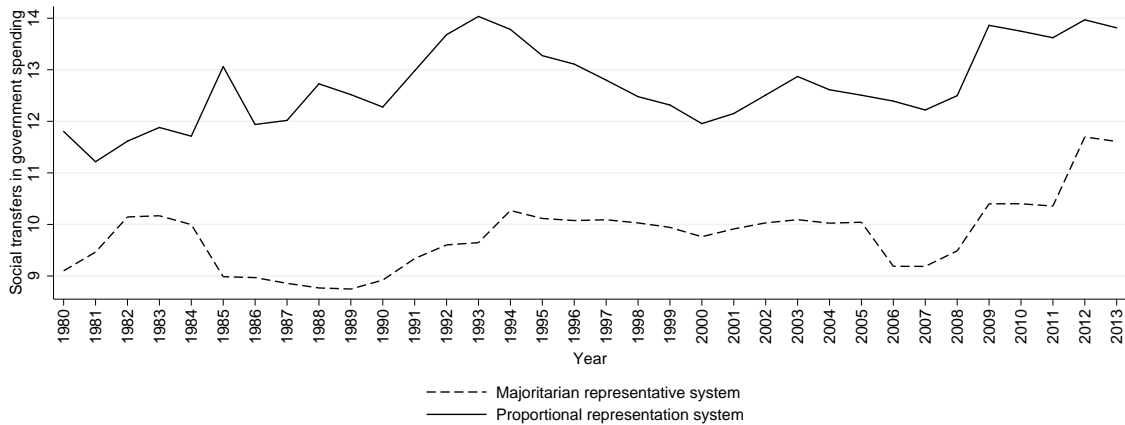
Specularly to the proportional representation system, we report the descriptive analysis for the result that the centre-right coalition party has the higher probability to win the

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



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

Figure 4: Social transfers in the majoritarian and proportional representation systems



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

elections and that countries with a majoritarian electoral system will spend less in social transfers than countries with a proportional representation system. Figure 3 lists the results for eight countries involved in the majoritarian electoral system suggesting a significant probability to win elections for the centre-right. In addition, Figure 4 indicates that aggregating countries with majoritarian and proportional representative electoral system, a large gap in social transfers appears, which supports the findings of the theory.

2.2. The empirical model

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

$$GINI_{it} = \beta_0 + \beta_{1,GINI}ST_i + \beta_2X_i' + T_t + S_i + v_{it} \quad (1)$$

where $GINI_{it}$ measures the level of inequality in terms of disposable income for the country i and ST_i indicates social transfers, 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 would, however, ignore useful information from time variation in the data and to overcome this problem, much recent empirical work has applied this form of model to panel data (see, d'Agostino et al. 2018). In fact, using panel data methods to deal with unobserved heterogeneity will control for some types of omitted variables and can help solving some identification problems. Institutional differences across countries, for example, will have time-invariant characteristics as Fordham and Walker (2005) show in other context. In addition, it has been found that 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), using panel data methods will deal with this issue.

There still remain possible identification problems because, as argued before, social transfers may be influenced by feedback effects. For example, 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 the feedback effects of income inequality on social transfers, which, in this case, are expected to be positive. This implies that social transfers cannot simply be assumed to be exogenous, meaning that the OLS empirical estimates are not easy to interpret. Appendix B provides a formal exposition of the reverse causal effects applied to the social transfers and income inequality nexus.

To deal with these issues, an IV approach can be used, but the main problem is identifying suitable instruments. We exploit the theoretical model which 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 partisanship of the government coalition and allows ordering the strength of this relationship interacting the electoral system of a country with the expected coalition that will win the elections. The model shows that under the 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, independently from which coalition wins the elections ⁷. Thus, our empirical strategy builds an ordinal instrumental variable ($ESPPO$), which increases the modalities with respect to the propensity to implement social spending policies. This variable ranges from 0 to 2, where we encode: 0, countries with the majoritarian system

⁷One may argue that the electoral system may itself be endogenous to other variables, including attitude toward income inequality. However, as Alesina *et al.* (2016) points out, 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 redistribution.

(MS), 1, countries with the proportional system and a centre-right coalition (PS_{MH}), and 2, countries with the proportional system and a centre-left coalition (PS_{LM}) which are, for the assumption of the model, correlated with the strength of social transfers and uncorrelated with the residual of income inequality. We remind the discussion on 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:

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

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

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

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

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

where the IV estimate of the coefficient in equation (4) is the ratio of the reduced form coefficients on social transfers and income inequality, that is $\Phi_1 = \delta_1/\theta_1$ ⁸. This implies that, if the 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 mainly transmitted 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).

3. Data

The empirical analysis is drawn on the UNU-WIDER World Income Inequality Database (WIID) that collects information on income inequality for developed, developing, and transition countries. We used data based on disposable income, measured by 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. Despite this procedure produces several missing values in our dataset, it ensures a good comparability of the different countries and time periods. The strategy outlined above allows us to collect information on income inequality, based on the disposable income Gini index ($GINI$), for 26 OECD countries and for the time length from 1980 to 2015. Descriptive statistics, for each considered country, are reported in Appendix C.

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

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

We, then, collected information related to the redistributive policies from the OECD Social Expenditure database that provides information on social transfers (*ST*) as a share of government expenditure¹⁰. The variable (*ST*) includes transfers related to five policy intervention areas: i) pensions, including early retired pensions and other benefits, ii) family allowances, maternity and parental leave benefits, iii) survivors and incapacity pensions, iv) unemployment compensations, severance pays and early retirements for labour market reasons, 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). Firstly, we considered the legislative and executive indices of electoral competitiveness establishing whether electoral representation is based on a proportional or majoritarian system (Beck *et al.*, 2001). The proportional system is characterised by the condition that the candidates are elected on the basis of the percent of votes received from their political party, whereas in the majoritarian system the candidates are elected using a winner-take-all or first past the post rule. Using this definitions, we obtained a variable in a interval 0-1, where we recorded as 0 when there is a majoritarian system and with 1 when there is a proportional system (*ES*). Secondly, we considered the 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 coalition in the proportional representation system and information on the major party supporting government in the majoritarian system. When there is not a clear-cut composition of government parties, we excluded the country observation from the analysis. Within this framework, we defined a variable of political party orientation that records as 0 when a centre-right coalition or party is in charge and as 1 when a centre-left coalition or party is in charge (*PPO*).

From the same source of data, we collected further information on the structure of the government to improve the way in which we characterise how different political factors affect the redistributive policy through channels which 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 so as to consider the degree of fractionalisation of the society. We then introduced a variable (*Polar*) describing the polarisation between the executive party and the other main parties of 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 a range 0-3 and is zero if the chief executives 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 that distinguish the parliamentary political system with respect to the presidential political system (*Parl*).

¹⁰Following the insight of the theoretical model, we consider only "pure redistribution" and omit redistribution in kind - the provision of education, health care, and other services.

We collected information from the OECD dataset on several other control variables which are suggested by the theoretical model or are commonly used to explain cross-country and time variation in public expenditure and inequality (Anderson et al. 2017). We relied on per-capita GDP growth rate (γ_{GDP}) and the share of government spending in GDP (Gov) and the share of public health spending in GDP ($Health$), to take account of 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 the population which influence the dependency ratio and might increase social spending: the growth rate of population (γ_{pop}) and the share of elderly population in total population (Eld). We included another demographic variable, the ratio of female to male population (Fem), that might positively influence the preferences for redistribution because women are more likely to be economically disadvantaged than men and to show stronger preferences for redistribution. To account for the level of education, we include the shares of employment 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 by the share of union members in total labour force, which also captures partisanship 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 redistribution¹².

4. Results

4.1. 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 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, whereas column (2) also introduces the set of covariates described in the previous section.

Table 3 shows a significant and positive correlation between $ESPPO$ and ST . Given the $ESPPO$ ordering, a significant positive parameter means that government ruled by the centre-left coalition or parties under the proportional system (PS_{LM}) spends a greater amount of resources targeted to social transfers with respect to the other electoral systems and government coalitions.

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

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

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 *** (0.211)	0.679 *** (0.133)
Fixed effects	yes	yes
Covariates	no	yes
No. of observations	431	358

Notes: Clustered standard errors at country level are shown in brackets. The asterisks give 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 the covariates (column 1) and including them (column 2). The estimated coefficients show that the proportional system ruled by a centre-left government is significantly associated with a country-wide reduction of income inequality. Different specifications do not produce any statistically significant difference in the point estimates. Columns 3 and 4 list the point estimates of a false experiment adding the forward instrumental variable ($ESPPO_{t+1}$), in order to provide some preliminary evidences about the orthogonality hypothesis of the instrument¹³. We confirm the results obtained in the benchmark specification, showing that 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 sake of brevity, we discuss the point estimates which 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 estimator¹⁴ (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-

¹³We introduce $ESPPO_{t+1}$ to estimate specification in which futures values of the instrument, which should be orthogonal to the current value of the income inequality index conditional to the introduction of the control variables, are included as additional explanatory variables. See, in another context, Miguel, Satyanath and Sergenti (2004).

¹⁴We 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. 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 the redistributive policies.

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

	(1)	(2)	(3)
$ESPPO_t$	-0.525 ** (0.240)	-0.776 *** (0.201)	-0.705 *** (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 country level are shown in brackets. The asterisks give *p-value* significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

stage F statistics (Cragg and Donald 1993) (CD F -test) and Wald statistics (Kleibergen and Paap 2006) (KP F -test), a generalisation to non-independently and non-identically distributed errors¹⁵. The results obtained by the F -statistics are larger than the intervals of 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 the equation (2) and (3), i.e., indirect least square estimator (ILS), are equivalent of the IV estimator in the structural parameters estimates. Using the point estimates of Table 3 and 4 (column 2), the IV coefficient (-1.143) is also equal to their ratio, i.e., $\Phi_1 = \delta_1/\theta_1$, that is $-0.776/0.679 = -1.143$). Second, comparing the IV point estimates with the OLS estimates in column 3 of Table 5, we find an increase of the negative effect of the social transfers and income inequality implementing the IV approach. This implies that the instrument that we use corrects for the upward bias that, mainly, the positive reverse causality between income inequality and social transfers produces.

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

From a policy-oriented point of view, a country that would implement a reduction of income inequality may refer to these estimates to apply significant policies. Thus, if a representative country, say France, decides to increase to 20% the share of social transfers, equivalent to an increase by 3.3 percentage points, we expect that income inequality will be

¹⁵In 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 to the heteroskedasticity-robust first-stage F -statistics.

Table 5: Estimates of 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 ** (0.449)	-1.143 *** (0.270)	-0.557 ** (0.218)	-0.778 *** (0.201)	-0.092 (0.093)	-0.069 (0.109)
Elasticity (ST)	-0.428 ** (0.205)	-0.522 *** (0.124)	-0.249 ** (0.107)	-0.354 *** (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 country level are shown in brackets. The asterisks give 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 (*).

reduced by 10.4% (2.9 percentage points). This suggestion for policy-makers contains *per se* a trade-off with respect to high income people, and partly those with middle income, which suffer the increase of taxation at aiming of a greater social justice¹⁶.

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

4.2. Heterogeneous estimates

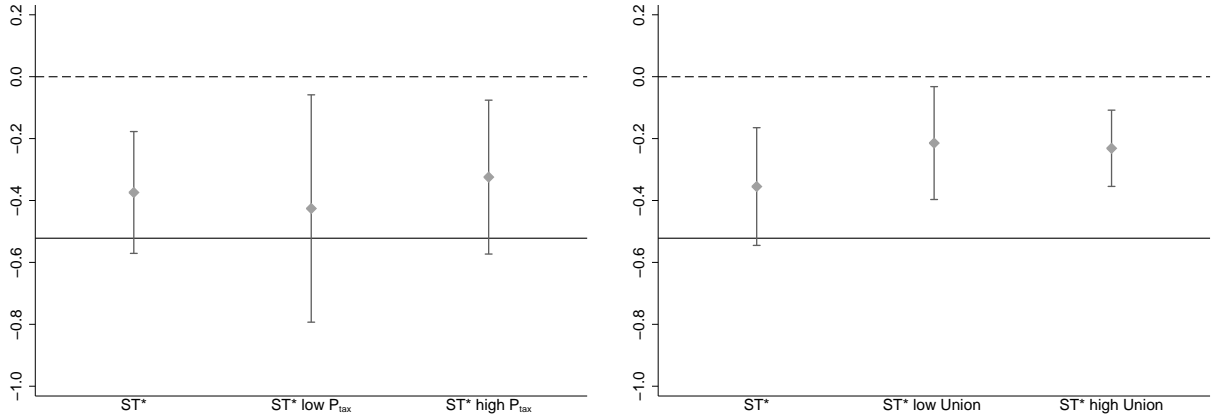
In this subsection, we test whether the main covariates that we included in the model specification could themselves affect the magnitude of the point estimates. In general, we could assume that different transmission channels may condition the social transfers, biasing the causal estimates on income 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 as 1 when the median value of the corresponding covariate exceeds the median value of the the sample.

Then, we estimate our model interacting social transfers with our covariate of interest and estimate differences in the parameters and elasticities of the generated sub-sample¹⁷. For

¹⁶Here we exclude that social transfers can be financed in deficit.

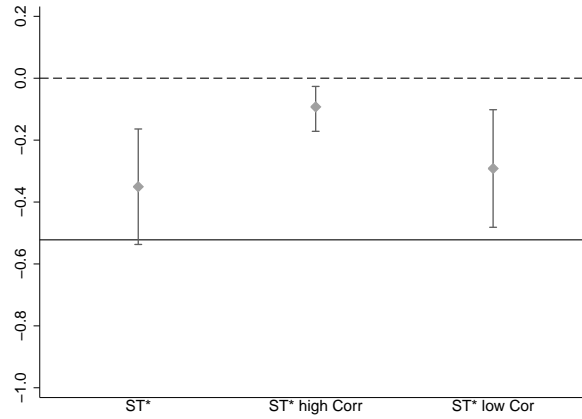
¹⁷As pointed out by Becker et al. (2013), introducing a term representing the interaction between an

Figure 5: Heterogeneity of the estimated parameters across select covariates



(a) Tax progressiveness

(b) Union density



(c) Corruption

Notes: The estimated elasticity measures are based on the specification reported in the second column of Table 5. The continuous line lists the elasticity measure estimated in Table 5 column 2, whereas the dash line indicates for the 95% confidence interval.

example, when evaluating the differential 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 IV estimator just-identified. The candidate which we include is the interaction between $ESPPO$ (the main instrument) and P_{tax} .

Figure 5 shows the estimated elasticities conditionally to countries with high or low levels of the three covariates and the corresponding confidence intervals. In order to facilitate the results, we also include the mean elasticity estimated when introducing the interaction term between ST and a specific covariate. In Figure 5 is also designed, with a continuous reference line, the elasticity measure estimated in Table 5. When the country selection for tax progressiveness is accounted for, the elasticities of social transfers, conditional to the

endogenous and an exogenous variable is a preferable method to take into account potential heterogeneous effects.

inclusion of the interaction terms (ST^*), with respect to income inequality are shown to be in the confidence intervals, which overlap the full-sample elasticity estimated in Table 5. Thus, we can conclude that no-significant heterogeneous effects is channeled by tax progressiveness in the social transfers and income inequality relationship.

A similar result emerges also when union density is accounted for. Despite countries with high union density could capture partisanship 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 concerning the effect of ST on income inequality based on different levels of corruption shows that, on average, the point estimates of these elasticities are smaller, when high-corruption countries are considered, and statistically significant. This result is in line with our hypothesis that in countries where corruption is high, collective demand for redistribution is lower, due to lower trust in government interventions. (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 disproportionately on the poor population. Corruption leads to tax evasion, poor tax administration, and exemptions that favours the well-connected and wealthy population groups (Gupta, Davoodi, and Alonso-Terme 2002). This reduces 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 income distribution and poverty.

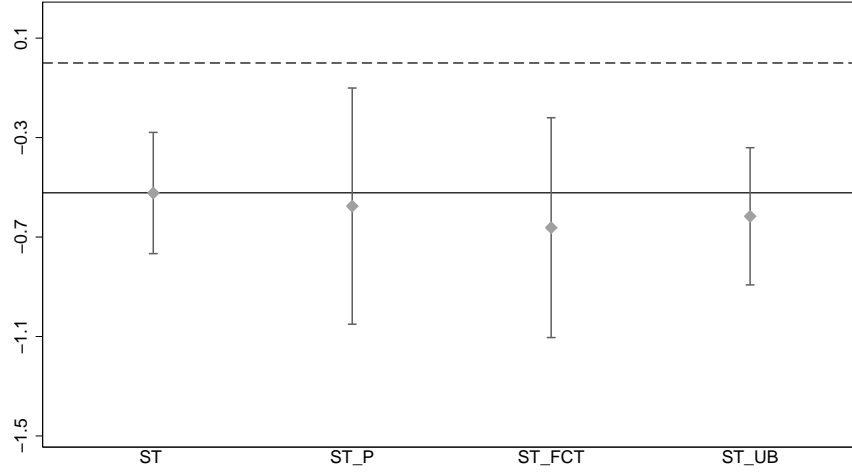
4.3. Robustness analysis

In this section, we propose some robustness checks. The first robustness check concerns the magnitude of the components of social transfers in government spending (ST), because it is not excluded that 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, it should be expected that our results crucially depend on the redistributive effect of the pension system. In line with this argument, Figure 6 compares the estimated elasticities of ST on income inequalities¹⁸ 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 suggests a homogeneous behaviour of income inequality when affected by different component of social transfers and close to the full aggre-

¹⁸In all the cases we use the specification proposed in column 2 of Table 5

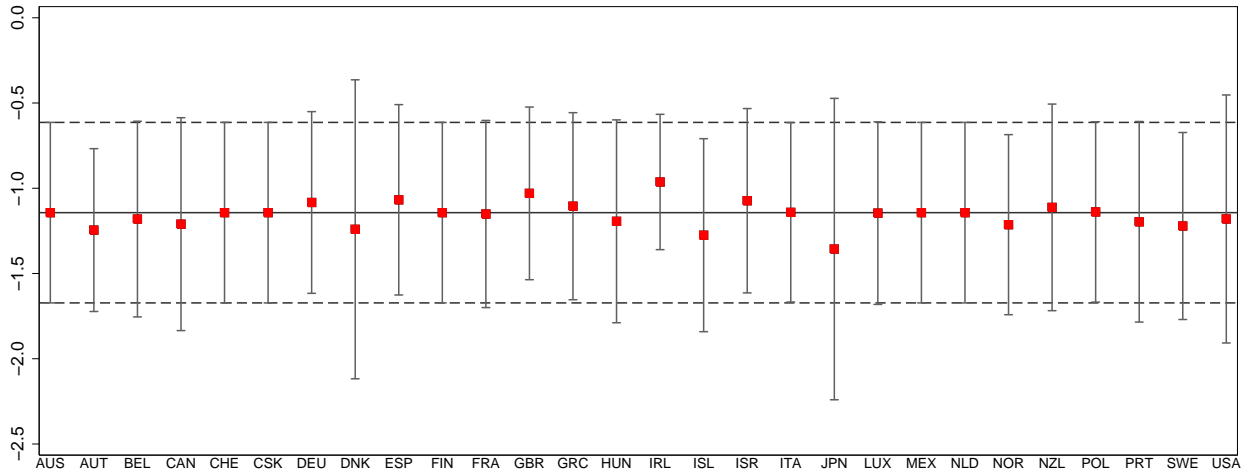
Figure 6: Robustness analysis on the components of social transfers



Notes: The estimated elasticity measures are based on the specification reported in the second column of Table 5. The figure reports the estimated elasticities of ST on income inequality the pension system ST_P , the family related cash transfers ST_{FCT} , and the unemployment benefits ST_{UB} . For the ease of the reader, we report the estimated elasticities of ST with a continuous reference line. The continuous line lists the elasticity measure estimated in Table 5 column 2, whereas the dash line indicates for the 95% confidence interval.

gate of social transfers, as also shown by the overlapping of the confidence intervals.

Figure 7: Robustness check: country specific effect

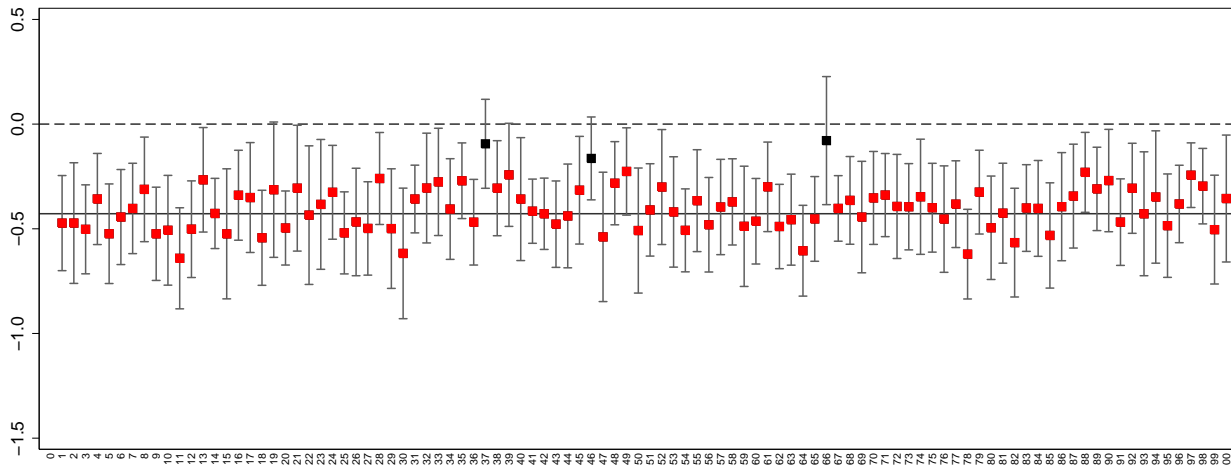


Notes: The estimated elasticity measures are based on the specification reported in the second column of Table 5. The continuous line lists the point estimate in the IV estimation which includes all countries, and the dotted lines indicate the confidence intervals. We mark, using a red square, when the estimated parameters rely in the 99% confidence interval.

In Figure 7, we provide a third robustness check to investigate whether our results are driven by a specific country. The continuous line lists the point estimate in the IV estimation which includes all countries, and the dotted lines indicate the confidence intervals, whereas bars show whether the estimates change when we subtract the country mentioned at the

basis of the horizontal axis. Without exceptions, our results appear largely robust to the poolability test of countries.

Figure 8: Robustness analysis: imputed measures of income inequality



Notes: The estimated elasticity measures are based on the specification reported in the second column of Table 5. 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 lists the elasticity measure estimated in Table 5 column 2, whereas the dash line indicates for the 95% confidence interval. We mark, using a red square, when the estimated elasticity rely in the 99% confidence interval.

The last robustness check concerns the comparability across-countries of income inequality by the disposable income (i.e., Gini index). This issue has been largely debated in the economic literature (Solt, 2016). To show 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 which are collected in the Standardized World Income Inequality Database (SWIID)¹⁹. Figure 8 shows the estimated elasticities and the corresponding confidence intervals for each of the 100 imputed series produced by the SWIID. Also in this case, we use a continuous reference line indicating the elasticity estimated in Table 5. The figure indicates that the elasticity estimated as a benchmark in Table 5 is outside the confidence interval of the imputed estimated elasticities only in the 3% of cases. In addition, it is worth noting that the estimated elasticities in these three cases are not statistically significant, as shown by the discontinuous reference line in Figure 8, confirming the goodness of our findings.

¹⁹The SWIID is composed by 100 imputed series produced by different combinations of the available data and 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. The data collected by the Luxembourg Income Study is employed as the standard.

5. Concluding remarks

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 a centre-right) winning the elections in the proportional and the majoritarian systems, which represent the raw variables of our instrument in the IV estimations of the social transfers and income inequality relationship.

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 can explain why some countries with relative 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 consistent with the predictions of the model proposed showing different mechanisms in which electoral systems and political representativeness lead social transfer policies and, in turn, in changes of 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.

Acknowledgments

We would like to thank Paolo Liberati and the participants at the the eighth ECINEQ meeting for their insightful comments. The usual disclaimers apply.

A. Theoretical model

A.1. Background

A society of individuals i is assumed to be classified in three classes: the low-income L , middle-income M and high-income H groups, and the voting population is equally distributed between these three groups and that they have different preferences about 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 the group i , such that $V^i(q^i) \geq V^i(q)$, with the single-peaked preferences assumption $V^i(q)$ strictly concave. Thus, transferring a given quantity of income from one group to another, the indirect utility functions $V^i(q^i)$ depends on the disposable income of each group $(1 - \tau)y^i$ and on the transfers received by the group i from the government (i.e., Tr^i). The indirect utility function reads:

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

where y^i is the gross income of group i and τ is a proportional tax on income ($0 \geq \tau \leq 1$).

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

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

$$\Gamma^L = \tau y^L \quad (\text{A.2})$$

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

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

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 amount 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 lower 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 conflictual strategies concerning τ and G . When τ is considered, the preferences of M are more in line with L , i.e., M may gain a higher utility from a positive τ , whereas its preferences are more closed to H when G is taken into account.

The optimality conditions for M will lead it to chose an intermediate level of taxation τ^{*m} (about 0.5) and to set G to zero. As it is clear by (A.3) and (A.4), when ϵ is negligible, H will pay the largest part of the cost of the redistributive 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:

$$v^L = g + \tau \quad (\text{A.5})$$

$$v^M = -(\tau - \tau^{*m}) - g(1 + \alpha)\epsilon \quad (\text{A.6})$$

$$v^H = -\tau - g(1 + \alpha)(1 - \epsilon) \quad (\text{A.7})$$

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, respectively.

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

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

Unlike equations A.5, A.6 and A.7, we note that the preference functions in equations A.8 and A.9 depend on the preferences of the counterpart. For example, let's denote by \hat{v}_{LM}^L , the preferences of L when there is a coalition between LM ; it 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 needs to satisfy the condition for each coalition which is symmetric for each player. For example, when we consider the coalition LM and L is the "first player", the Rubinstein bargaining solution is obtained equalising own preference on choice variables (g, τ) with those of M . Technically, this 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*. Summarising, the pay-offs for each coalition are as follow:

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

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

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

a given coalition. When $\delta \rightsquigarrow 1$, these parameters read:

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

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

where, (A.12) depends upon the cost of the redistributive policy α , the share of resources collected from the middle-income group ϵ and by the values of transfers costs g , whereas (A.13) depends only upon the optimal tax rate of the middle-income group. From the second condition, we find that in the coalition MH the tax rate is 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. On the contrary, from the LM coalition, we see that when $g = g^*$, M obtains a higher utility from the redistributive policy. To understand when the LM coalition will be preferred to the MH , we run some comparative static on g , by introducing the optimal values of τ , obtained by (A.12) in the preference function of the player M . The comparative statics reads:

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

From (A.14), we see that M will obtain a positive utility from the redistributive policy, but that the share of resources that M is willing to pay must not be higher than the inverse of the administrative costs of the redistributive 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 redistributive policy and the administrative costs represent the crucial parameters in determining the coalition between low- and middle-income groups.

A.3. Modeling the majority representation system

The 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 the majority electoral system each party needs to attract the vote of M to win the elections, and, to do that, they will converge to the policy preferences of the M constituency, that is $\{g, \tau\} = \{0, \tau^{*m}\}$. As in the proportional representation, the M constituent shares with H the same preferences on g , but is 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 the government is in charge, the left- and right- wing parties have incentives to diverge from the M preferences, adopting policies that reflect their own constituency needs (Persson *et al.*, 2004; Iversen, 2005). The voter 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 the voter in M, in a centre-left and in a 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 a matter for the government since it makes harder to deal with its constituency in the future. These costs, defined by c_{LM} and c_{MH} , constitute the pay-offs for the centre-left and a 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 $i = 1, 2, \dots, N$

$$ST_i = \alpha_{1,st}GINI_i + \epsilon_{st,i} \quad (B.1)$$

$$GINI_i = \alpha_{1,dispinc}ST_i + \epsilon_{dispinc,i} \quad (B.2)$$

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

$$ST_i = [1 - \alpha_{1,dispinc}\alpha_{1,st}]^{-1} (\alpha_{1,st}\epsilon_{dispinc,i} + \epsilon_{st,i}) \quad (B.3)$$

$$GINI_i = [1 - \alpha_{1,dispinc}\alpha_{1,st}]^{-1} (\alpha_{1,dispinc}\epsilon_{st,i} + \epsilon_{dispinc,i}). \quad (B.4)$$

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

$$\begin{aligned} C_{GINI,ST} &= (E[(\alpha_{1,st}\epsilon_{dispinc,i} + \epsilon_{st,i})(\alpha_{1,dispinc}\epsilon_{st,i} + \epsilon_{dispinc,i})]) \\ &= \alpha_{1,st}\sigma_{dd} + \alpha_{1,dispinc}\sigma_{ss} + [1 - \alpha_{1,dispinc}\alpha_{1,st}]\sigma_{sd} \end{aligned} \quad (B.5)$$

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

$$\alpha_{1,st}\sigma_{dd} + \alpha_{1,dispinc}\sigma_{ss} > 0 \quad (B.6)$$

$$\alpha_{1,st}\sigma_{dd} > -\alpha_{1,dispinc}\sigma_{ss} \quad (B.7)$$

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

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 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	ESPP0	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; *ESPP0* instrumental variable, interaction between electoral system and 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 tax of the direct tax; *Corr* is the International Country Risk Guide anti-corruption index; *Union* is the share of union members in active 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 population; *Fem* is the female to male population ratio; *Eld* is the share in total population of the elderly population; *Unemp* is the unemployment rate; *Pol* is a dichotomy variable describing when the political system is presidential, or parliamentary; *Nat* is a dummy variable for the nationalist party; *Reg* is a dummy variable for the regional-based party; *Polar* is the degree of polarisation in the assembly; We consider how long the present government is due to remain in office (*Ych*)

References

- ACEMOGLU, D. (2002) Technical change, inequality and the labor market, *Journal of Economic Literature*, **40** (1), 7–72.
- ALGAN, Y., CAHUC, P., and SANGNIER, M. (2016) Trust and the Welfare State: the Twin Peaks Curve. *The Economic Journal*, **126** (593), 861–883.
- ALDERSON, A. and NIELSEN, F. (2002). Globalization and the great u-turn: Income inequality trends in 16 Oecd countries. *American Journal of Sociology*, **107** (5), 1244–1299.
- ALESINA, A., GLAESER, E. and SACERDOTE, B. (2001). Why doesn't the US have a European-style welfare system? National bureau of economic research.
- ANDERSON, E., D'OREY J.M.A., DU VENDACK, M. and ESPOSITO, L. (2017) Does government spending affect income inequality? A meta-regression analysis. *Journal of Economic Surveys* **31** (4), 961–987.
- ALVAREDO F., CHANCEL L., PIKETTY T., SAEZ E., ZUCMAN G. (eds.), 2018, *World Inequality Report 2018*, WID.world, Berlin.
- ANGRIST, J., PISCHKE, J. (2009) Mostly Harmless Econometrics: An Empiricist's Companion, Princeton University Press, Princeton, New Jersey.
- ATKINSON, A. B., PIKETTY, T., and SAEZ, E. (2011) Top incomes in the long run of history, *Journal of Economic Literature*, **49** (1), 3–71.
- BECK, T., CLARKE, G., GROFF, A., KEEFER, P. and WALSH, P. (2001). New tools in comparative political economy: The database of political institutions. *World Bank Economic Review*, **15** (1), 165–176.
- BECKER, S. O., EGGER P.H., and EHRLICH, M. (2013) Absorptive capacity and the growth and investment effects of regional transfers: A regression discontinuity design with heterogeneous treatment effects. *American Economic Journal: Economic Policy* **5** (4), 29–77.
- BERGH, A. and NILSSON, T. (2010) Do liberalization and globalization increase income inequality? *European Journal of Political Economy*, **26**(4), 488–505.
- BERGH, A. and BJØRNSKOV, C. (2011) Historical trust levels predict the current size of the welfare state. *Kyklos*, **64**(1), 1–19.
- BJØRNSKOV, C. and SVENDSEN, G. (2013) Does social trust determine the size of the welfare state? Evidence using historical identification. *Public Choice*, **157**(1), 269–286.
- BRANDOLINI A., and SMEEDING, T.M. (2009) Income inequality in richer and OECD Countries, in Salverda, W., Nolan, B., and Smeeding, T.M. (eds), *The Oxford Handbook of Economic Inequality*, Oxford University Press, Oxford.

- CAUSA, O., and HERMANSEN, M. (2017), *Income Redistribution Through Taxes and Transfers across OECD Countries*, OECD Economics Department Working Papers No. 1453, OECD Paris.
- CHAMBERLAIN, G. (1980) Analysis of covariance with qualitative data. *The Review of Economic Studies* 47 (1), 225–238.
- CRAGG, J. G. and DONALD, S. G. (1993). Testing identifiability and specification in instrumental variable models. *Econometric Theory*, **9**(2), 222–240.
- D’AGOSTINO, G. , DUNNE, P.J. and PIERONI, L. (2018). Military Expenditure, Endogeneity and Economic Growth. *Defence and Peace Economics*, **forthcoming**.
- DANIELE, G. and GEYS, B. (2015). Interpersonal trust and welfare state support. *European Journal of Political Economy*, **39**(2), 1–12.
- DINCER, O.C. and GUNALP, B. (2012). Corruption and Income Inequality in the United States. *Contemporary Economic Policy*, **30**, 283–292.
- DOERRENBERG, P. and PEICHL, A. (2014). The impact of redistributive policies on inequality in OECD countries. *Applied Economics*, **46** (17), 2066–2086.
- FORDHAM, B. O. and WALKER, T. C. (2005). Kantian liberalism, regime type, and military resource allocation: Do democracies spend less? *International Studies Quarterly*, **49** (1), 141–157.
- FREEMAN, R. (2009) Globalisation and inequality, in Salverda, W., Nolan, B., and Smeeding, T.M. (eds), *The Oxford Handbook of Economic Inequality*, Oxford University Press, Oxford, 575–598.
- GARFINKEL, I., RAINWATER, L. and SMEEDING, T. M. (2006). A re-examination of welfare states and inequality in rich nations: How in-kind transfers and indirect taxes change the story. *Journal of Policy Analysis and Management*, **25** (4), 897–919.
- GLYN, A. (2006) *Capitalism unleashed*. Oxford University Press, Oxford.
- GUPTA, S., DAVOODI, H. and ALONSO-TERME, R. (2002). Does corruption affect income inequality and poverty? *Economics of Governance*, **31** (1), 23–45.
- GONI, E., LOPEZ, J.H, and SERVEN, L. (2011). Fiscal redistribution and income inequality in Latin America. *World Development*, **39** (9), 1558–1569.
- IVERSEN, T. (2005). *Capitalism, Democracy, and Welfare*. Cambridge University Press, Cambridge.
- IVERSEN, T. and SOSKICE, D. (2006). Electoral institutions and the politics of coalitions: Why some democracies redistribute more than others. *American Political Science Review*, **100** (2), 165–181.

- KLEIBERGEN, F. and PAAP, R. (2006). Generalized reduced rank tests using the singular value decomposition. *Journal of Econometrics*, **133** (1), 97 – 126.
- KOSTER, F. (2014). Economic openness and welfare state attitudes: A multilevel study across 67 countries, *International Journal of Social Welfare*, **23** (2), 128–138.
- LUPU, N. and PONTUSSON, J. J. (2011). The structure of inequality and the politics of redistribution. *American Political Science Review*, **105** (2), 316 – 336.
- MARTNEZ-VÀZQUEZ, J. VULOVIC, V. and MORENO DODSON, B. (2012). The Impact of Tax and Expenditure Policies on Income Distribution: Evidence from a Large Panel of Countries, International Center for Public Policy Working Paper Series.
- MAURO, P. (2004). The persistence of corruption and slow economic growth. *IMF staff papers*, **51** (1), 1–18.
- MELTZER, A. H. Mauro, P. (2004). The persistence of corruption and slow economic growth. IMF staff papers, 51(1), 1-18.
- MELTZER, A. H. and RICHARD, S. F. (1981). A rational theory of the size of government. *Journal of Political Economy*, **89** (5), 914–927.
- MIGUEL, E., SATYANATH, S. and SERGENTI, S. (2004). Economic shocks and civil conflict: An instrumental variables approach. *Journal of Political Economy*, **112** (4), 725–753.
- MILESI-FERRETTI, G. M., PEROTTI, R. and ROSTAGNO, M. (2002). Electoral systems and public spending. *The Quarterly Journal of Economics*, **117** (2), 609–657.
- NIEHUES, J. (2010). *Social spending generosity and income inequality: A dynamic panel approach*. IZA Discussion Papers 5178, Institute for the Study of Labor (IZA), Bonn.
- ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT (2011). Divided we stand. Why inequality keeps rising. OECD, Paris.
- ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT (2015). In it together. Why Less Inequality Benefits All. OECD, Paris.
- PECORARO, B. (2014). Inequality in Democracies: Testing the Classic Democratic Theory of Redistribution. *Economic Letters*, **123** (3), 398–402.
- PECORARO, B. (2017). Why Don't Voters' Put the Gini Back in the Bottle'? Inequality and Economic Preferences for Redistribution. *European Economic Review*, **93**, 152–172.
- PERSSON, T., ROLAND, G. and TABELLINI, G. (2004). *How do electoral rules shape party structures, government coalitions, and economic policies?* Working Paper 10176, National Bureau of Economic Research, Washington.
- PERSSON, T., ROLAND, G. and TABELLINI, G. (2007). Electoral Rules and Government Spending in Parliamentary Democracies. *Quarterly Journal of Political Science*, **2** (2), 155–188.

- PIKETTY, T. (2014). *Capital in the twenty-first century*. Harvard University Press, Cambridge Mass.
- PONTUSSON, J. (2013). Unionization, inequality and redistribution, *British Journal of Industrial Relations*, **51** (4), 797–825.
- 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*, **93** 7-8, 974–988.
- SÁNCHEZ, A. and PÈREZ-CORRAL, A.L. (2018). Government Social Expenditure and Income Inequalities in the European Union, IZA Discussion Paper.
- SMEEDING, T. and GRODNER, A. (2000). Changing income inequality in oecd countries: Updated results from the Luxembourg income study (lis). In R. Hauser and I. Becker (eds.), *The Personal Distribution of Income in an International Perspective*, Springer, Berlin -Heidelberg, 205–224.
- SOLT, F. (2016). The Standardized World Income Inequality Database. *Social Science Quarterly*, **97** (5), 1267–1281.
- STURM, J-E. (2017). Political economy aspects of income (re-) distribution. *European Journal of Political Economy*, **50**, 52–53.
- WOOLDRIDGE, J. (2002). *Econometric Analysis of Cross Section and Panel Data*. *Scandinavian Political Studies*, MIT Press, Cambridge, Mass.
- WULFGRAMM, M. and STARKE, P. (2017). Divided by the market, divided by the state: Distribution, redistribution and welfare attitudes in 47 countries. *Scandinavian Political Studies*, **40** (1), 1–27.