Redistribution, Polarization, and Ideology

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Abstract

Why doesn't rising inequality encourage income redistribution? The standard model posits that the more concentrated are income and wealth, the more the median voter values redistribution. Yet despite the marked increase in U.S. inequality, redistribution has barely changed. I approach this puzzle from a fresh angle by considering the role and nature of polarization for the politics of redistribution. While inequality increases voting elasticity with respect of redistribution, polarization has the opposite effect, thus reducing parties' accountability towards voters. But without further structure, inequality and polarization's effects on redistribution cannot be determined. I demonstrate that for polarization to discourage redistribution, ideology must be a "normal good", i.e. its importance for the voters needs to rise with income. Using data from the American National Election Study and the Census, I verify that this is indeed the case. Armed with this result, I use the model to assess the effects of inequality and polarization on redistribution within no-inequality and no-polarization counterfactuals. Effects of "income elastic" ideology can account for the stability of redistribution policy, and shed light on the economic implications of political extremism.

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1 Introduction

Income inequality in the U.S. has increased substantially in the last 40 years. OECD data show that the pre-tax-and-transfer Gini coefficient increased by 24.63% between 1974 and 2012. The standard political economy model of redistribution (Meltzer and Richard, 1981) predicts a positive relationship between income inequality and level of redistribution. Yet, redistribution has

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remained fairly stable. The post-tax-and-transfer Gini, that incorporates the effect of redistribution, has indeed increased by 23.10% over the same period. At the same time, political parties have become increasingly different on ideological grounds. The Republican party has moved to more conservative positions on social issues, while the Democratic party has shifted towards more liberal views. (McCarty, Poole, and Rosenthal, 2006).[1]

This paper analyzes the impact of income inequality and political polarization on redistribution, both theoretically and empirically. The results account for the observed pattern of redistribution, in contrast to the standard model. Indeed, Meltzer and Richard (1981) model fails to consider ideological preferences, which play an important role in voters' decisions. A conservative poor voter might be attracted to the Democratic party because of the prospects of higher redistribution, and, at the same time, be attracted to the Republican party, because of ideological views, e.g. on abortion. Such a voter's decision depends on the importance attached to the non-economic issues, relative to redistribution.[2] The weight (or importance) of ideological preferences relative to preferences for redistribution (henceforth referred to as "ideological salience") determines the elasticity of an individual's vote to changes in the redistributive policy proposed by the politicians. Voters that deeply care about redistribution (i.e. have low ideological salience) will likely switch the party they vote for in response to a change in proposed redistribution. Conversely, voters with high ideological salience will be less responsive to such a change.[3]

The model shows that if ideological salience systematically changes with income, increases in inequality and polarization push redistribution in opposite directions. The overall change in redistribution is small, consistently with the U.S. experience. Rising income inequality and party polarization change the voter base of each party; the former by increasing both the gains (for the poor) and the losses (for the rich) from redistribution, the latter by affecting the distance between individuals' and parties' ideologies. The joint distribution of ideological salience and income (reflecting the population distribution of preferences for redistribution) determines how parties adjust redistribution in response. If ideological salience and income are positively correlated, rising inequality increases redistribution, while an increase in polarization decreases it. The opposite is true in case of negative correlation. In contrast, if ideological salience and income are uncorrelated, inequality and polarization have no effect on the level of redistribution proposed

[1] For surveys of the political science literature on polarization and its causes, see Hetherington (2009) and Fiorina and Abrams (2008).

[2] The term "ideology" is usually used to indicate a compound of beliefs and preferences about economic as well as social issues. With a slight tweak of terminology, this paper uses a narrower definition of ideology, indicating instead the individual's position on non-economic issues only, ranging from liberal to conservative.

[3] Ideological salience does not depend on the voter's position on the ideological spectrum. People with extreme positions on ideological issues might have low levels of ideological salience, and voters with moderate ideology might attach a large importance to it when it comes to voting. In fact, ideological salience is simply the marginal rate of substitution between preferences for redistribution and preferences on social issues in the voter's utility function.

by the parties.

Using data from the American National Election Study (ANES) for the years 1972-2012, I estimate the correlation between individual income and the importance that a voter attaches to ideology. I find that ideological salience rises with income. This result is robust to a variety of specifications, and determines the sign of the effects of inequality and polarization: given the positive correlation between ideological salience and income, inequality has a positive effect on redistribution, while the effect of party polarization is negative.

The results revisit the intuition of the seminal paper by Meltzer and Richard (1981). The apparent empirical failure of their model is explained by the contemporaneous increase in party polarization, which neutralizes the effect of inequality on redistribution. Notably, these results are independent of any causal relationship between inequality and polarization.

Simulation of the model allows for a decomposition of the effect of inequality and polarization on redistribution, and permits to assess whether the estimated parameters for ideological salience can account for the stability of redistribution observed in the U.S. When the parameters are calibrated to match the observed level of redistribution for the period 1980-2008, the calibrated model predicts that the effects of inequality and polarization stronger for the Republican party. The comparison of the level of redistribution prevalent under different scenarios of inequality and polarization provides a decomposition of the effects. In absence of polarization, the 2008 tax rate proposed by the Republican party would have been about 1.5% higher than in the baseline scenario (where both polarization and inequality occur,) as an effect of the increase in inequality; in absence of inequality, it would have been about 1% lower, as an effect of polarization. Most importantly, these effects almost perfectly offset each other, providing evidence that the estimated salience parameters can account for the observed stability of redistribution.

This paper contributes to the literature on the relationship between income inequality and redistribution, originated by the work of Meltzer and Richard (1981) mentioned above.[4] However, the empirical evidence on the predictions of these models is mixed (among others, Milanovic, 2000; Rodriguez, 1999a; Karabarbounis, 2011; Perotti, 1996). The lack of empirical support has been attributed to a variety of factors: political participation and contributions (Benabou, 2000; Rodriguez, 1999b), upward mobility (Benabou and Ok, 2001), altruism (Galasso, 2003; Fehr and Schmidt, 1999), agents' beliefs about race and fairness (Alesina and Glaeser, 2004; Alesina and Angeletos, 2005).[5] Alesina and Giuliano (2011) assess the empirical relevance of these explanations and find that preferences for redistribution are affected by a variety of factors. Both personal characteristics, such as age, gender, race, and socio-economic status, and

[4]The standard framework has been extended to a dynamic setting, as in Alesina and Rodrik (1994) and Persson and Tabellini (1994), finding that the higher redistribution triggered by an increase in inequality leads to negative implications for investment, and therefore for economic growth.

[5]For a survey of the literature on income inequality and redistribution, see Borck (2007) and Alesina and Giuliano (2011).

cultural/ideological components are important determinants of preferences for redistribution.[6] This paper contributes to the literature by providing an additional explanation for this lack of empirical support, identifying the need to consider, not just the existence of preferences along non-economic dimensions, but also the importance that voters attach to them.

Other works have stressed how the mere existence of preferences along additional non-economic dimensions affects economic outcomes. Besley and Coate (2008) show that issue bundling, together with the fact that citizens only have one vote to cast, may lead to political outcomes that contrast with the preferences of the majority. Along the same lines, Roemer (1998) discusses the effect of issue salience on the extent of redistribution, and claims that, as the salience of non-economic issues increases, redistribution will fall, compared to the case in which the policy is unidimensional. He focuses his analysis on the case in which issue salience is equal for all individuals. By relaxing this assumption, this paper contributes in showing that, when salience varies across income groups, the effect on redistribution can be either positive or negative, depending on which group attaches larger importance to ideology. Besides, salience interacts with inequality and polarization in affecting redistributive policy.

Changes in parties' positions on moral (or ideological) issues are the object of study in Krasa and Polborn (2014), who claim that the effect of changes in parties' ideology on public goods provision (and the implied tax rate) depends on the direction of this movement. In particular, their model predicts that a movement to the right of the political spectrum by either the Democratic or the Republican party decreases public goods provision, while a movement to the left increases it. Therefore, in their model the same effect on the tax rate can be generated by an increase in polarization, e.g. when the Republican party becomes more conservative, or by a decrease in it, for instance when the Democratic party becomes more right-wing. Differently from Krasa and Polborn, in this paper the effect of changes in party ideology purely derives from polarization, i.e. from increased divergence in party positions. Besides, the effect is independent of which party polarizes, and only depends on the sign of the correlation between income and ideological salience.

The paper is organized as follows: section 2 presents the theoretical model, section 3 illustrates the empirical strategy used in the estimation, section 4 discusses the empirical results, section 5 presents the counterfactual experiments, and section 6 concludes.

[6]They define ideology in the usual way, that includes both economic and social issues. This standard definition is different from the definition of ideology used in this paper, which only considers opinions on social issues.

2 Model

2.1 Voters

Consider an economy made of a unit mass of individuals who differ along two dimensions: income and ideology. Each individual receives some exogenous income, used exclusively for consumption. There are two groups in the population: poor (p) and rich (r). Poor constitute a fraction η of the population receiving y_p, while the remaining share $(1-\eta)$ of population is rich, receiving y_r, with $y_r > y_p > 0$.

Agents have ideological preferences on social issues, e.g. abortion, gun control, gay marriage. These social issues are orthogonal to fiscal policy. The ideological position of individual i in group $j = r, p$ on these issues is summarized by the variable a_{ij}, which takes values in the interval $[0, 1]$ and is distributed according to the cdf $F_j(a_{ij})$. Low values of a_{ij} indicate a liberal ideology, whereas high values denote conservative views.

Individuals get utility from consumption and from the ideological policy set by the party that wins the election.

The utility function of voter i in group j is:

$$U_{ij} = c_j - \frac{\xi_j}{2}(z - a_{ij})^2 \tag{1}$$

where $\xi_j > 0$ is the marginal rate of substitution between consumption and ideology for voters in group j, and represents the ideological salience for the group. z is the ideological position set by the party in power, and c_j is consumption. Consumption is equal for all individuals in group j, because they all receive the same level of income.

Beside these "rational"/sincere voters - who vote for the party that delivers them the higher utility, - there is a unit mass of "noise" voters, who vote according to the realization of a random variable X, and regardless of their utility. The only purpose of noise voters in the model is to introduce uncertainty in the electoral results, which is necessary to analyze the strategic behavior of the parties, in a framework otherwise characterized by complete information. Other equivalent mechanisms used in the literature are, for instance, the occurrence of "popularity shocks", like scandals that involve one of the parties and sway voters, or "participation shocks", like the chance of rain on election day.

2.2 Government

The government runs a balanced budget and sets the ideological policy z and a proportional tax rate τ used to finance redistribution through a lump-sum transfer. The net income of an individual (and therefore his/her consumption) is equal to:

$$c_j = (1-\tau)y_j + f = (1-\tau)y_j + \tau\bar{y} \tag{2}$$

where $f = \tau\bar{y}$ is the per capita lump-sum transfer, and $\bar{y} = \eta y_p + (1-\eta)y_r$ is the average income.

For simplicity the model abstracts from dead weight loss of taxation by assuming that income is exogenous. Poor people have pre-tax income lower than the average income, so they always gain from redistribution, and hence prefer complete redistribution ($\tau = 1$), which would give everybody net income equal to $\bar{y}$. On the contrary, rich people lose from redistribution, and so they prefer $\tau = 0$.

2.3 Parties

There are two parties competing in the elections, D and R. Parties care about the redistribution implemented, and have their own preferred level, summarized by the tax rate b_k, $k = D, R$. They also have ideological positions, z_k, which are fixed, and perfectly known by the electorate. These positions are more moderate than their ideological bliss points, a_k, which are located to the extremes of the ideological spectrum. Party D favors a more liberal ideological policy, and a higher level of redistribution than party R (Assumption 1.)

Assumption 1.

1.1 $0 = a_D < z_D < z_R < a_R = 1$

1.2 $0 < b_R < b_D < 1$

The payoff that parties get from redistribution is decreasing in the distance from their preferred policies, b_k and a_k. Each party maximizes its expected payoff from redistribution.

For reasons of credibility, a party finds it easier to change its position on redistributive issues, that also depend on the overall state of the economy, rather than on ideological issues like abortion, gun control, or environmental protection. Even when changes in ideological positions occur, they are slow moving, compared to taxation/redistribution policies. Hence, it is assumed that parties can deviate from b_k when deciding their electoral platform. However, voters expect that each party will set its ideological policy $z = z_k$ upon winning the elections.

Party D wins the elections with probability π_D, and sets a level of redistribution τ_D if such an event occurs. On the other hand, the policy set by party R upon winning the elections is τ_R.

Therefore, party D and party R's expected payoffs are:

$$\begin{aligned} W_D(\tau_D, \tau_R) &= \pi_D[-(\tau_D - b_D)^2 - (z_D - a_D)^2] + \pi_R[-(\tau_R - b_D)^2 - (z_R - a_D)^2] \\ &= \pi_D[-(\tau_D - b_D)^2 - z_D^2] + \pi_R[-(\tau_R - b_D)^2 - z_R^2] \end{aligned} \tag{3}$$

and

$$\begin{aligned} W_R(\tau_D,\tau_R) &= \pi_R[-(\tau_R-b_R)^2-(z_R-a_R)^2]+\pi_D[-(\tau_D-b_R)^2-(z_D-a_R)^2] \\ &= \pi_R[-(\tau_R-b_R)^2-(1-z_R)^2]+\pi_D[-(\tau_D-b_R)^2-(1-z_D)^2] \end{aligned} \tag{4}$$

where π_D and $\pi_R = 1-\pi_D$ are the probabilities of parties D and R, respectively, to win the elections.

Parties D and R propose their tax rate simultaneously, and then elections are held. It is assumed that parties can credibly commit to the proposed policy. So, once in office, the winning party does not deviate from the platform proposed during the electoral campaign.

The following simplified payoff function:

$$W_k = \pi_k\left[-(\tau_k-b_k)^2\right]+\pi_{-k}\left[-(\tau_{-k}-b_k)^2\right] \tag{5}$$

where $k = D, R$, delivers the same qualitative results as equations (3) and (4). The equivalence between the two versions is proved in Section G of the Appendix. I will focus on the simpler version in (5), because of its easier tractability. However, all results directly extend to the payoff functions in (3) and (4).

2.4 Winning probability

All individuals vote, and a party is elected if it receives a majority of the votes. Rational/sincere voters and noise voters account for one half of the population each. S_D and N_D are the share of sincere and noise voters, respectively, voting for party D. The party's probability of winning the elections is:

$$\pi_D = Pr\left\{\frac{S_D+N_D}{2}\geq\frac{1}{2}\right\}$$

The random variable X that determines N_D is uniformly distributed in [0,1] and independent of any platform chosen by the parties. In particular, for any realization x, a share x of noise voters vote for party D, and a share $(1-x)$ vote for party R.

Thus, party D's probability of victory π_D can be written as:

$$\pi_D = Pr\left\{\frac{S_D+x}{2}\geq\frac{1}{2}\right\} = Pr\left\{x\geq 1-S_D\right\} = S_D$$

The winning probability for party D equals its share of votes among rational voters. This, in turn, is the share of voters that obtain higher utility under party D's policies; that is, those voters for which

$$U_{ij}(\tau_D,z_D)\geq U_{ij}(\tau_R,z_R) \tag{6}$$

where i indexes the voters, and j indexes the income group, $j = p, r$.

The utility function (1) and the expression for consumption (2) imply that, under assumption 1.1, expression (6) is equivalent to:

$$a_{ij} \leq \tilde{a}_j = \bar{z} + (\tau_R - \tau_D)\frac{y_j - \bar{y}}{\xi_j \Delta z} \tag{7}$$

Therefore, voter i with income y_j votes for party D if and only if his/her ideology is to the left (i.e. more liberal) than the threshold $\tilde{a}_j$.[7] The threshold $\tilde{a}_j$ corresponds to the ideology of the swing voter of group j, i.e. the voter of type j who is indifferent between the two parties. The position of the swing voters depends on two components. The first term, $\bar{z} = (z_D + z_R)/2$, is equal to the midpoint between the parties' ideologies. If voting decisions were only made on ideological grounds (i.e. the ideological salience ξ_j tended to infinity,) the swing voter would be the voter with middle-of-the-road ideological views, $\bar{z}$. The second term introduces the economic component, arising from differences in the tax policies of the two parties, $(\tau_R - \tau_D)$. The larger this difference, the larger the distance of $\tilde{a}_j$ from $\bar{z}$. For any given value of $(\tau_R - \tau_D)$, the distance between $\tilde{a}_j$ and $\bar{z}$ is larger (i.e. the economic component is more relevant) when the gains/losses from redistribution, $(y_j - \bar{y})$, are large; when the ideological difference between the parties, $\Delta z = z_R - z_D$ is small; and when the ideological salience, ξ_j is small. More specifically, since $(y_j - \bar{y})$ is positive for the rich, and negative for the poor, if $\tau_R < \tau_D$ the swing voter for the rich is to the left of $\bar{z}$, meaning that even relatively liberal rich people vote for party R, while the swing voter for the poor is to the left of it; that is, party D attracts votes from some conservative poor voters.

The proportion of people in group j that vote for party D is $Pr\{a_{ij} \leq \tilde{a}_j\} = F_j(\tilde{a}_j)$. Hence, the overall share of rational voters voting for party D is:

$$S_D = \eta F_p(\tilde{a}_p) + (1 - \eta)F_r(\tilde{a}_r)$$

The following assumption on $F_j(a_{ij})$ is imposed:

Assumption 2. a_{ij} *follows a uniform distribution on* $[0, 1]$ *for both* $j = p, r$.

Empirical evidence that justifies this assumption is presented in Section 2.8.

When assumption 2 holds, $F_j(\tilde{a}_j) = \tilde{a}_j$, for $j = p, r$, and the probability of victory can be written as:

$$\pi_D = S_D = \eta\tilde{a}_p + (1 - \eta)\tilde{a}_r = \bar{z} + \frac{\alpha}{\Delta z}(\tau_R - \tau_D) \tag{8}$$

[7] In the case in which $z_R = z_D$, all poor voters, of any ideology, vote for the party that proposes the higher redistribution. Conversely, all rich vote for the party that delivers the lower level of redistribution. Therefore, the winning party is entirely determined by the size of the two groups, η.

where:

$$\alpha = (y_p - \bar{y})\frac{\eta}{\xi_p} + (y_r - \bar{y})\frac{(1-\eta)}{\xi_r} = \frac{-\eta(1-\eta)(\xi_r - \xi_p)(y_r - y_p)}{\xi_r \xi_p} \tag{9}$$

The variable α is a weighted average of the preferences for redistribution of the two groups $(y_j - \bar{y})$, where the weights depend on the groups' size η, and on the ideological salience ξ_j. The larger the group, the more important its preferences are for the party to take into account. Conversely, if the group's ideological salience is high relative to the other group's, its preferences for redistribution have a smaller weight in the party's decision. As such, α summarizes the preferences for redistribution of the whole society as seen from the parties' point of view: a positive value of α denotes that the poor care about redistribution more than the rich ($\xi_r > \xi_p$,) while a negative value indicates the opposite. A value of α equal to zero signifies that the rich and poor display the same degree of ideological salience, ξ_j, and their preferences are valued equally by the party.

Party D's winning probability is increasing in $\bar{z}$, the midpoint between the parties' ideologies. That is, even when the parties set the same redistribution policy ($\tau_R = \tau_D$,) - and the electoral competition reduces to a competition on ideology only, - or when all voters have the same ideological salience ($\xi_r = \xi_p$,) the voters do not perceive the parties as perfect substitutes.

Finally, party R's probability of victory is simply

$$\pi_R = 1 - \pi_D = (1 - \bar{z}) - \frac{\alpha}{\Delta z}(\tau_R - \tau_D) \tag{10}$$

2.5 Equilibrium

The FOCs for the parties are:

$$\frac{\partial W_D}{\partial \tau_D} = \frac{\partial \pi_D}{\partial \tau_D}[-(\tau_D - b_D)^2] + \pi_D[-2(\tau_D - b_D)] + \frac{\partial \pi_R}{\partial \tau_D}[-(\tau_R - b_D)^2] = 0 \tag{11}$$

$$\frac{\partial W_R}{\partial \tau_R} = \frac{\partial \pi_R}{\partial \tau_R}[-(\tau_R - b_R)^2] + \pi_R[-2(\tau_R - b_R)] + \frac{\partial \pi_D}{\partial \tau_R}[-(\tau_D - b_R)^2] = 0 \tag{12}$$

The expression above imply the following:

Proposition 1.

1.1 Under assumptions 1.1 and 2, the best response functions of parties D and R are, respectively:

$$\tau_D = b_D + \frac{1}{3\alpha}\left\{[\alpha(\tau_R - b_D) + \bar{z}\Delta z] - \sqrt{\phi_D}\right\} \tag{13}$$

$$\tau_R = b_R + \frac{1}{3\alpha}\left\{[\alpha(\tau_D - b_R) + (1-\bar{z})\Delta z] - \sqrt{\phi_R}\right\} \tag{14}$$

where

$$\phi_D = [\alpha(\tau_R - b_D) + \bar{z}\Delta z]^2 + 3\alpha^2(\tau_R - b_D)^2 \tag{15}$$

$$\phi_R = [\alpha(\tau_D - b_R) + (1 - \bar{z})\Delta z]^2 + 3\alpha^2(\tau_D - b_R)^2 \tag{16}$$

1.2 When $\xi_r > \xi_p$ ($\alpha < 0$), for each party $k = D, R$, the best response τ_k is convex in τ_{-k}, and has a minimum at party k's ideal point, b_k. Conversely, for $\xi_r < \xi_p$ ($\alpha > 0$), the best response function is concave in τ_{-k}, and has a maximum at b_k. The minimum (maximum) lies on the diagonal of the policy space, i.e. the best response to $\tau_{-k} = b_k$ is to set $\tau_k = b_k$.

1.3 If $\xi_r > \xi_p$, the tax rates chosen by the parties will be greater than or equal to their ideal point; that is, $\tau_k \geq b_k$. Conversely, if $\xi_r < \xi_p$, the tax rates chosen by parties are smaller than or equal to their own preferred policy.

1.4 If $\xi_r = \xi_p$ ($\alpha = 0$), the parties will simply set a tax rate equal to their preferred policy, b_k.

Proof. See Appendix, section C. □

Parties care about the implemented policy, so their actions need to consider both the chance of implementing their own optimally chosen policy, i.e. the probability of winning the elections, as well as what policy the other party selects.

Increases in τ_k make party k win votes from the poor, and lose votes from the rich. The overall effect of this voter reallocation on its probability of winning π_k depends on the ideological salience of the voters. Voters with low ideological salience are more responsive to changes in the redistributive policy. Hence, when τ_k increases, π_k increases if the poor have lower ideological salience than the rich ($\xi_r > \xi_p$, or equivalently, $\alpha < 0$,) and decreases otherwise. This causes the tax rate chosen by the parties to be tilted towards the one preferred by the group with low ideological salience: the parties select a level of redistribution higher than their ideal level b_k (and closer to the one preferred by the poor, $\tau = 1$) if $\xi_r > \xi_p$, and a level lower than b_k (and closer to $\tau = 0$, preferred by the rich) if $\xi_r < \xi_p$.

The equilibrium of the political game is determined by the intersection of the best response functions. The following lemma rules out multiplicity of equilibria and corner solutions.

Lemma 1.

1.1 A sufficient condition for $0 < \tau_D < 1$ is:

$$\frac{1}{4} < b_D < \frac{3}{4}$$

1.2 A sufficient condition for $0 < \tau_R < 1$ *is:*

$$\frac{1}{4} < b_R < \frac{3}{4}$$

Proof. See Appendix, section D. $\square$

The combination of assumption 1.2 and the results of lemma 1 yields the following condition:

$$\frac{1}{4} < b_R < b_D < \frac{3}{4} \tag{17}$$

Proposition 2.

2.1 Under assumptions 1.1 and 2 and condition (17)*, the game has a unique, interior, and stable equilibrium (Figure 2.)*

The following inequalities hold at the equilibrium:

$$\begin{aligned} &b_R < \tau_R < b_D < \tau_D \quad , \text{ if } \xi_r > \xi_p \\ &\tau_R < b_R < \tau_D < b_D \quad , \text{ if } \xi_r < \xi_p \end{aligned} \tag{18}$$

2.2 Also, at the equilibrium:

$$\tau_k - b_k < \tau_{-k} - b_k$$

i.e. the ideal policy of party k, b_k*, is always closer to the party's selected policy* τ_k*, than to the other party's policy* τ_{-k}*.*

Proof. See Figure 2 for a graphical proof of 2.1. See Appendix, section E for a proof of 2.2.

Proposition 2 implies that $\tau_R < \tau_D$. So, in equilibrium, party D proposes a higher level of redistribution than party R. Together with equation (7) for the position of the swing voters, this implies that the poor swing voter $\tilde{a}_p$ is to the right of $\bar{z}$, that is, some conservative (relative to $\bar{z}$) poor voters vote for party D. On the other hand, the rich swing voter $\tilde{a}_r$ is to left of $\bar{z}$, i.e. some liberal rich voters vote for party R.

2.6 Comparative statics

Consider the vector β of the parameters of interest: $\beta = \Big((y_r - y_p), z_D, z_R\Big)$. The first element represents the parameter governing income inequality, whereas the other two elements govern party polarization. The effect of a change in one of the components of β on the equilibrium policy of party k, $k = D, R$, is described by:

$$\frac{d\tau_k}{d\beta} = -\frac{\partial^2 W_k/\partial\tau_k\partial\tau_{-k}}{\partial^2 W_k/\partial\tau_k^2}\cdot\frac{d\tau_{-k}}{d\beta} - \frac{\partial^2 W_k/\partial\tau_k\partial\beta}{\partial^2 W_k/\partial\tau_k^2} \tag{19}$$

The last term of (19) describes the direct effect of β on τ_k, i.e. how party k's best response function changes when β changes, for any level of τ_{-k}. Its denominator is negative, by the SOC of party k's optimization problem, so the sign of $d\tau_k/d\beta$ is the same as the sign of its numerator. The numerator can be expressed as:

$$\frac{\partial^2 W_k}{\partial\tau_k\partial\beta} = \frac{\partial^2\pi_k}{\partial\tau_k\partial\beta}[-(\tau_k - b_k)^2] + \frac{\partial\pi_k}{\partial\beta}[-2(\tau_k - b_k)] + \frac{\partial^2\pi_{-k}}{\partial\tau_k\partial\beta}[-(\tau_{-k} - b_k)^2] \tag{20}$$

The second term, $\partial\pi_k/\partial\beta$, represents the first order effect of β on the winning probability of party k. The other terms, $\partial^2\pi_k/\partial\tau_k\partial\beta$ and $\partial^2\pi_{-k}/\partial\tau_k\partial\beta$, denote how the change in β affects the responsiveness of these probabilities to changes in τ_k.

The overall effect on the equilibrium tax rates depend both on the direct effect illustrated in equation (20) and on the strategic effect, summarized by the first term in (19).

2.6.1 Income inequality

Proposition 3. *An increase in income inequality, namely an increase in $(y_r - y_p)$, increases the tax rate proposed by at least one of the parties, when $\xi_r > \xi_p$. Conversely, it decreases at least one of the tax rates when $\xi_r < \xi_p$.*

In particular, if $\xi_r > \xi_p$, an increase in income inequality increases the level of redistribution provided by party R. In this case, τ_D increases if and only if the difference between τ_D and τ_R is small, relative to the difference between τ_D and b_D.[8]

If $\xi_r < \xi_p$, rising inequality leads to a lower level of redistribution by party D. In such a case, τ_R decreases if and only if the difference between τ_D and τ_R is small, relative to the difference between τ_R and b_R.[9]

Proof. See Appendix, section F.1. □

Figure 3 shows the effect of an increase in inequality on the equilibrium.

[8] The tax rate proposed by party D increases if and only if:

$$\tau_D - \tau_R < \frac{2(1-\bar{z})\alpha(\tau_R - b_R) - \bar{z}\sqrt{\phi_R}}{(1-\bar{z})\alpha(\tau_R - b_R)}(\tau_D - b_D) \tag{21}$$

[9] The condition under which τ_R decreases is:

$$\tau_D - \tau_R < \frac{2\bar{z}\alpha(\tau_D - b_D) - (1-\bar{z})\sqrt{\phi_D}}{\bar{z}\alpha(\tau_D - b_D)}(b_R - \tau_R) \tag{22}$$

When inequality increases, both the gains (for the poor) and the losses (for the rich) from redistribution increase. Provided that $\tau_D > \tau_R$, party D gains votes in the poor group, and loses votes in the rich group. The opposite happens to party R. The effect on the respective probability of winning, namely the sign of $\partial\pi_k/\partial(y_r - y_p)$, depends on the ideological salience of the groups. In particular, if the poor care more about redistribution than the rich ($\xi_r > \xi_p$), π_D will increase, while π_R will decrease. Of course, the opposite is true if $\xi_r < \xi_p$.

Also, increased gains and losses make both groups of voters more reactive to changes in the level of redistribution. In terms of equation (20), this means that the term $\partial^2\pi_k/\partial\tau_k\partial(y_r - y_p)$ has the same sign as $\partial\pi_k/\partial\tau_k$, exacerbating the reaction of π_k to changes in τ_k. Rising income inequality increases the elasticity of this probability to changes in the tax rates.

Suppose that $\xi_r > \xi_p$. In this case, an increase in the proposed tax rate leads to an increase in the probability of victory. Together with the increased elasticity of the winning probability, this provides an incentive to increase redistribution, in order to "chase" the very mobile poor voters. Hence, the direct effect of inequality is to increase the level of redistribution proposed by both parties.

Besides this direct effect, however, one needs to consider a strategic effect. Differently from the direct effect, the strategic effect works in opposite directions for the two parties. Since in equilibrium $b_R < \tau_R < b_D < \tau_D$, an increase in τ_D also increases the distance between τ_D and the party R's preferred policy b_R, worsening what party R would get in the case in which party D wins. Hence, the desire to avoid such a bad outcome reinforces party R's incentive to increase the tax rate, in order to increase its chances of victory. Direct and strategic effect reinforce each other, and, in the new equilibrium, τ_R is higher.

For party D, instead, as party R increases the tax rate, the distance between τ_R and b_D decreases, and a victory by party R is a less unfavorable outcome than before. As a result, the strategic consideration pushes party D towards lowering τ_D and getting closer to b_D. Therefore, direct and strategic effect work in opposite directions. When the tax rates proposed are very similar, i.e. the distance between τ_D and τ_R is small, also the probability of victory π_D and π_R are similar. In this case, the direct effect dominates the strategic effect, because a decrease in τ_D significantly jeopardizes party D's chances of victory. On the other hand, as long as the parties' winning probabilities are sufficiently different, the strategic effect dominates the direct effect.

The opposite happens when $\xi_r < \xi_p$. The direct effect of rising inequality is to decrease the level of redistribution, in order to chase the votes of the rich, who are more sensitive to changes in redistribution, because of their low ideological salience. The strategic effect plays out differently for the two parties. Since $\tau_R < b_R < \tau_D < b_D$, a decrease in τ_R increases its distance from b_D, reinforcing party D's incentive to increase its winning probability by further decreasing τ_D. So, strategic and direct effect go in the same direction. Conversely, a decrease in τ_D reduces its distance from b_R, giving party R an incentive to get closer to its ideal policy b_R. Therefore, strategic and direct effect go in opposite directions for party R.

2.6.2 Party polarization

Proposition 4. *Polarization decreases the tax rate proposed by at least one of the parties, when $\xi_r > \xi_p$. Conversely, it increases at least one of the tax rates when $\xi_r < \xi_p$.*

If $\xi_r > \xi_p$, an increase in polarization decreases the level of redistribution proposed by party R. The level of redistribution set by party D decreases if and only if the difference between τ_D and τ_R is small, relative to the difference between τ_D and b_D. [10]

If $\xi_r < \xi_p$, the level of redistribution set by party D always increases. The level of redistribution set by party R increases if and only if the difference between τ_D and τ_R is small, relative to the difference between τ_R and b_R.[11]

Proof. See Appendix, section F.2. □

The effect of polarization on the equilibrium is displayed in Figure 4. In order to focus on the effects of "pure" polarization, consider the case of symmetric polarization, in which the ideological midpoint of the two parties is unchanged.

When the parties polarize, party R's movement to the right pushes some liberal rich voters away from it, because they now deem too extreme R's ideological position. This movement of voters is mitigated, but not completely offset, by the movement of party D towards the opposite end of the political spectrum. For the same reason, some conservative poor people will switch away from party D, as this latter polarizes. As a result, party R loses votes from the rich, and party D loses votes from the poor. The swing voters of both groups move towards the center, i.e. people become better sorted along ideological lines. In fact, increasing sorting of voters along ideological lines is claimed to be in place in the American electorate (Fiorina, Abrams, and Pope, 2005). The sorting effect is larger for the group with low ideological salience ξ_j, because the high salience group was well sorted by ideology even prior to polarization. Indeed, its swing voter was relatively closer to the middle-of-the-road policy, $\bar{z}$ (see equation 7.) Sharper ideological divisions between the supporters of party R and those of party D indicate that the

[10] The level of redistribution proposed by party D decreases if and only if:

$$\tau_D - \tau_R < \frac{2(1-\tilde{z})\alpha(\tau_R - b_R) - \tilde{z}\sqrt{\phi_R}}{(1-\tilde{z})\alpha(\tau_R - b_R)}(\tau_D - b_D) \tag{23}$$

where $\tilde{z}$ is equal to z_R in case of polarization triggered by party R (z_R increases), is equal to z_D in case of polarization triggered by party D (z_D decreases), and is equal to $\bar{z}$ in case of symmetric polarization (Δz increases, but $\bar{z}$ remains unchanged.)

[11] Similarly, the condition under which τ_R increases as an effect of polarization is:

$$\tau_D - \tau_R < \frac{2\tilde{z}\alpha(\tau_D - b_D) - (1-\tilde{z})\sqrt{\phi_D}}{\tilde{z}\alpha(\tau_D - b_D)}(b_R - \tau_R) \tag{24}$$

where $\tilde{z}$ is defined as above.

ideological issues have become more divisive, and lower the responsiveness of the electorate to changes in redistribution. In terms of the effect of polarization on the parties' best responses, the term $\partial^2\pi_k/\partial\tau_k\partial\Delta z$ in equation (20) has the opposite sign as $\partial\pi_k/\partial\tau_k$, dampening the elasticity of the winning probability to changes in redistributive policy. Lower elasticity to changes in redistribution reduces party accountability towards the high salience group, leaving the parties larger scope to pursue the policy they prefer, without fearing a flight of votes.

For instance, suppose that $\xi_r > \xi_p$. In such a case, both parties are setting tax rates which are higher than their preferred level. As a result, both parties have an incentive to get closer to their ideal policy, by decreasing the level of redistribution proposed, because sorting has made voters less reactive to changes in redistribution. By decreasing the proposed tax rate, parties also decrease their probability of winning the elections. However, increased ideological sorting among voters, especially among the poor, shields the parties from drastic drops in the probability of victory.

As in the case of rising inequality, the direct effect goes in the same direction for both parties, but the strategic effect plays out differently for them. For party R, as τ_D decreases, its distance from b_R decreases as well, making a victory by party D a less adverse event than before. This strengthens party R's incentive to decrease the tax rate. Direct and strategic effect go in the same direction: as a result, in the new equilibrium, τ_R is lower.

In contrast, for party D, as τ_R decreases, the distance between τ_R and b_D increases, worsening the outcome that party D would get if party R were to win the elections. As a result, the strategic effect pushes party D towards increasing the tax rate, with the purpose of gaining back some of the poor voters, thus increasing its probability of winning the elections. Therefore, direct and strategic effects go in opposite directions. Like in the case of inequality, the direct effect dominates the strategic effect when the difference between τ_D and τ_R is small; that is, when the parties have similar winning probabilities.

When $\xi_r < \xi_p$, the results are opposite. Sorting affects disproportionately more the rich than the poor, and the reduced elasticity of the winning probability with respect to redistribution gives both parties an incentive to increase the level of proposed redistribution to get closer to their ideal policies. Direct and strategic effect work in the same direction for party D, and go in opposite directions for party R. The direct effect, that prescribes increased redistribution, dominates the strategic effect when the two parties are setting similar policies.

When polarization is unilateral, to the effect of "pure" polarization described above one must add the effect deriving from a change in the middle-of-the-road policy $\bar{z}$. In line with what observed by McCarty, Poole, and Rosenthal (2006) for the U.S. case, in which most of party polarization is due to a shift to the right of the Republican party, suppose that party R polarizes. As before, by inducing voter sorting, polarization decreases the elasticity of the winning probability with respect to the proposed policy, and gives both parties an incentive to move their policy closer to their preferred one. When $\xi_r > \xi_p$, both parties have therefore an incentive to reduce the proposed tax rate. However, if the swing voters of the two groups lie between z_D and z_R, the rise in $\bar{z}$ induced by the unilateral polarization increases party D's probability of victory. As a result, party D's incentive to decrease the tax rate is stronger than in the case of symmetric polarization. Comparing the conditions under which the direct effect dominates the strategic effect, it is indeed apparent that, since $z_R > \bar{z}$,

$$\frac{2(1 - z_R)\alpha(\tau_R - b_R) - z_R\sqrt{\phi_R}}{(1 - z_R)\alpha(\tau_R - b_R)} < \frac{2(1 - \bar{z})\alpha(\tau_R - b_R) - \bar{z}\sqrt{\phi_R}}{(1 - \bar{z})\alpha(\tau_R - b_R)}$$

That is, the scope for party D's direct effect to dominate the strategic effect is larger when polarization comes from a unilateral movement of party R to the right.

2.7 Discussion

The key mechanism that governs the party reactions to increases in inequality and party polarization relies on the elasticity of the parties' winning probability to changes in the proposed redistributive policies.

In particular, income inequality increases this elasticity, forcing the parties to be more responsive to those voters that are more concerned about redistribution. Inequality, therefore, acts as a device that increases politicians' accountability towards the low salience voters.

In contrast, polarization induces voters, and especially those with low ideological salience, to sort into parties according to ideology. In doing so, it decreases the elasticity of the parties' probability of victory with respect to redistribution. In this way, parties are more free to pursue their preferred policies, and party accountability towards the low salience voters is reduced.

In this mechanism, the preferences of the group with high ideological salience play a marginal role: consistently with the findings of the classical probabilistic voting model, it is the preferences of the more responsive voters, - those that care more about redistribution, - that have the higher political clout, and are therefore rewarded in the redistributive game. Party polarization, however, by dampening this responsiveness, gives more leeway to the politicians to set policies that reflect their own preferences, rather than those of the voters.

In this sense, this model looks at an utterly different mechanism than the one hypothesized by Frank (2007) about the political dynamics in Kansas. In his book, Frank claims that the political focus on ideological issues in the last decades has led poor voters to more conservatism, and has affected the importance that these voters give to economic policy, thus inducing them to vote against their own economic interests. The model presented here generates outcomes that are consistent with Frank's observation about Kansas, but derive from a different rationale. More specifically, an increase in party polarization leads to a reduction in the level of redistribution if the rich (and not the poor!) are those who care more about ideology. If this is the case, polarization generates more sorting in the group of poor voters, but for this to happen, one does not need changes in the voters' preferences, or an increase in the ideological salience of the poor. What is more, if poor voters are more ideologically involved than the rich, namely if $\xi_r < \xi_p$, party polarization would actually increase the level of redistribution.

The model also highlights effects of polarization on redistribution that are different for sign and origin from those highlighted in Krasa and Polborn (2014), that find opposite effects on the tax rate, depending on which party becomes more extremist: if the Republican party polarizes, the tax rate will decrease, while if the Democratic party polarizes, the opposite will occur. What is more, in their model, the effect on the tax rate derives not from polarization per se, but rather from the direction of the ideological movement. A movement of the Democratic party to the right, i.e. a decrease in polarization, generates the same result as a movement of the Republican party to the right, which is in fact an increase in polarization. Symmetrically, a Republican party's movement to the left has the same effect as a Democratic party's movement in the same direction. Besides, in Krasa and Polborn the effect of symmetric polarization is potentially ambiguous. In contrast, in my model the effects of polarization do not depend on the identity of the party that polarizes, but rather on which voters are more concerned with ideology, and which ones are more concerned with redistribution. In fact, the same effects arise even in the case of symmetric polarization.

The inclusion of a second ideological dimension, and of different salience attached to it by different voters, makes this model depart from the seminal work of Meltzer and Richard (1981), that predicts a positive relationship between income inequality and redistribution. In my model, this positive relationship arises only if ideological salience is positively correlated with income; that is, if poorer voters are those more concerned with redistribution. Indeed, lower ideological salience gives the poor more political power on redistributive choices. If, instead, poorer voters attached a higher importance to ideology than rich voters, then the political clout of the poor would drastically decrease, and, in case of increased inequality, redistributive policy would be set in a way more favorable to the rich. Moreover, the consequences of an increase in inequality can be undone by an increase in polarization, a dimension that is absent in Meltzer and Richard's analysis.

2.8 Evidence about the ideological distribution in the United States

The assumption of equal ideological distribution between rich and poor, stated in Assumption 2, is consistent with evidence from the United States.

American public opinion data, indeed, show that the ideological distribution of voters does not vary with income, i.e. that $F_p(\cdot)$ is not statistically different from $F_r(\cdot)$. This evidence is presented in Figure 1 and Table 1, which are based on ANES data for the presidential election years between 1972 and 2012. Figure 1 compares the cdf of the variable $RID = [(z_R - a_{ij})^2 -$

$(z_D - a_{ij})^2] = (z_R^2 - z_D^2) - 2(z_R - z_D)a_{ij}$ for different quintiles of the income distribution. RID stands for Relative Ideological Distance, and represents the ideological position of an individual, relative to the ideology of the two parties. It is a linear transformation of the variable a_{ij}, and is the main ideological variable used in the empirical part of the paper. RID is an indicator that aggregates several ideological issues, and the methodology used for its construction is described in Section 3. The issues used for the construction of the RID variable are listed in Table 2.

Figure 1 shows that the distribution of RID appears not to be significantly different across income groups. This is confirmed by Table 1, which presents the results from a more rigorous test for the equality of ideological distributions, the Kolmogorov-Smirnov test. The test performs pairwise comparisons of the cdf of RID per income group, in each year considered. With five income groups, corresponding to the five quintiles of the income distribution, there are ten pairwise comparisons per year. The first column of Table 1 shows the number of comparisons that pass the equality test, while the second column displays the total number of comparisons. Over 75% of the pairwise comparisons pass the test, both when considering the aggregated measure RID, and when the ideological issues that comprise it are considered separately.

Besides, the third and forth row of Table 1 show that these results are specific to ideological preferences, and do not extend to preferences for redistribution. The variable RRD (Relative Redistribution Distance) is the equivalent of RID for preferences for redistribution/preferences on economic issues. It is constructed using data on opinions about the role of government in guaranteeing jobs and living standards and in providing health insurance, tax progressivity and tax cuts, level of general public spending, and preferences on how to solve the tradeoff between unemployment and inflation. The list of issues used to construct the variable RRD is presented in Table 3. When considering preferences for redistribution, equality of distribution across income groups can only be claimed in about one third of the pairwise comparisons. This result confirms that socio-economic status affects preferences for redistribution, but not preferences on social issues.

3 Empirical strategy

The model described in the previous section highlights that parties' redistributive policies react to increased inequality and polarization if rich and poor voters have different ideological salience. Furthermore, the direction of the change in redistribution depends on the correlation between income and ideological salience.

The empirical part of the paper is therefore devoted to verify whether such a correlation exists, and to establish its sign by estimating the parameters of the utility function in expression (1).

Without normalizing the coefficient for income, equation (1) can be rewritten as:

$$U_{ij} = \delta\left[(1-\tau)\,y_{ij} + f\right] - \frac{\gamma_j}{2}\left(z - a_{ij}\right)^2$$

The ratio γ_j/δ corresponds to the salience parameter ξ_j. Besides, the decision of an individual to vote for the Democratic (vs. Republican) presidential candidate displayed in equation (6) can be rewritten as:

$$Pr\left(D_{ij} = 1\right) = Pr\left(U_{ij}^{D} - U_{ij}^{R} > 0\right) = Pr\left(\alpha + \beta y_{ij} + \gamma_j RID_{ij} > 0\right) \tag{25}$$

where D_{ij} is a dummy that is equal to one if individual i in income group j voted for the Democratic party, and is equal to zero if he/she voted for the Republican party, $\alpha = 2\delta\left(f_D - f_R\right)$, $\beta = 2\delta(\tau_R - \tau_D)$, and RID is the measure of Relative Ideological Distance between the individual and the candidates, defined as $RID_{ij} = \left[\left(z_R - a_{ij}\right)^2 - \left(z_D - a_{ij}\right)^2\right]$ and introduced in Section 2. A positive value of RID indicates that the individual is ideologically closer to the Democratic than the Republican party.

The objective of the estimation is the ratio γ_j/β and how it changes with income, as this ratio is proportional to the marginal rate of substituion between income and ideology, ξ_j. Since β (the coefficient for income) is common to all income groups, the focus can be restricted to the parameters γ_j. If they are statistically different across income groups, and they monotonically change with income, it is possible to pin down the direction of the effects of inequality and polarization on redistribution. In particular, if γ_j is increasing in the income groups j, then an increase in inequality leads to an increase in redistribution, while an increase in polarization leads to a reduction in it (at least for the Republican party, and possibly for the Democratic party as well.) If γ_j decreases with income, then the signs of the effects of polarization and inequality are flipped.

The parameters in (25) are estimated using data from the American National Election Study (ANES) for the presidential election years from 1972 through 2012. The ANES is a survey of the American electorate, conducted during national election years since 1948. The units of observation are eligible voters, and the information collected includes, among other things, demographic characteristics, socio-economic status, religious beliefs, voting behavior, political attitudes, and questions on public opinion on current issues. The structure of the surveys is a repeated cross-section, with a small panel component in only a few of the years.

The empirical counterpart of equation (25) is

$$Pr\left(Dem_i = 1\right) = Pr\left(\alpha + \beta income_i + \sum_{j=1}^{5} \gamma_j incomegroup_i^j \times RID_i + \phi X_i + \epsilon_i > 0\right) \tag{26}$$

where Dem is a dummy variable that takes value 1 if the individual voted for the Democratic (as opposed to Republican) presidential candidate,[12] $income$ is individual income in 2011 thousands of U.S. dollars, $incomegroup^j$ is a dummy that takes value 1 if the individual belongs to the quintile j of the income distribution, RID is the measure of ideology, and X is a set of control variables, including age, education, gender, religion, degree of religiosity, race, employment status, marital status, degree of trust in government, home ownership, union membership, as well as State and year fixed effects.

The variable Dem is only observed if the individual voted. To address possible issues of selection into voting, expression (26) is estimated using a probit with selection. The selection equation is modeled as:

$$Pr\left(Vote_i = 1\right) = Pr\left(\delta extremism_i + \eta MV_i + \lambda Z_i + u_i > 0\right)$$

where $Vote$ is a dummy that takes value equal to one if the individual went to the polls and zero otherwise, Z is the vector of regressors included in the main equation, and $extremism$ and MV are the selection variables. $extremism$ is the degree of political extremism of the individual (on either side of the political spectrum). It likely affects the probability with which an individual goes to the polls, because more extremist people have stronger political preferences and are therefore more likely to vote. However, since political extremism is considered on either side of the political spectrum, it does not have any effect on the probability of voting for any specific party. MV is the absolute value of the margin of victory of the presidential candidate in the State of residency of the voter, taken from the U.S. Election Atlas. Its inclusion captures the perception of whether the elections are going to be close. The perception of upcoming close elections likely increases the probability that an individual exercises his/her voting rights, because of the higher probability to be pivotal in the election outcome.

3.1 Measurement of Relative Ideological Distance (RID)

Since 1972, ANES respondents are asked to express their opinion on a number of issues by placing themselves on a scale that can be ordered along the liberal-conservative dimension, and ranges from 1 through 7, where 1 indicates very liberal and 7 indicates very conservative. Besides, respondents are also asked to place, along the same scale, parties and candidates. The issues range from the role of the government in the economy, to social security and health insurance, to international relations, civil rights, and environment.

This feature of the survey allows to directly construct, for each issue, measures of the distance

[12] Although party polarization is a phenomenon especially pronounced at the Congress level, data show that the voting choices for the Senate increasingly match the state's presidential vote (Hetherington, 2009; Jacobson, 2003). Therefore, increased polarization at the Congressional level is somewhat reflected at the Presidential level, too.

between the voters' and the candidates/parties' (perceived) positions which the RID variable is based upon. Since individuals may have different perceptions of candidates' positions on a given issue, the candidates' stances are approximated by the average position attributed to them by the electorate. The RID variable is obtained as the first principal component of the RIDs for the single issues, in a given year. The issues selected for the analysis at hand represent preferences on social policy that can be thought as orthogonal to preferences for redistribution, e.g. abortion, environmental regulation, and foreign policy. A list of the issues selected for each year is presented in Table 2, while Table 4 displays their summary statistics. The RID variable has mean and standard deviation equal to zero and one, respectively, by construction. In all the issues considered, the Democratic party is perceived as more liberal than the Republican party. Also, the average respondent's opinions lie in-between the parties' positions. That is, the average voter is moderate, relative to the parties.

3.2 Measurement of Income

A shortcoming of the ANES is that it does not provide a continuous measure of income, since it only identifies income brackets to which the individuals belong. However, the estimation of expression (26) calls for a continuous income measure. In order to overcome this drawback of the survey, I combine the ANES data with income data from the Census CPS to get a continuous measure of income.

Although even in the CPS income is recorded in classes, the income classes identified by the Census have two advantages over those of the ANES survey. First, CPS data are representative of the U.S. population. Hence, the derived income distribution can be regarded as the "true" U.S. income distribution. Secondly, the CPS brackets are smaller than the ANES ones. Thus, the finer grid permits to extract more information.

For each ANES respondent, I therefore derive a continuous measure of income following a three-step procedure. The first step consists in fitting a lognormal distribution to the CPS income classes, in order to recover the underlying parameters of the U.S. income distribution in each of the years considered, under this distributional assumption.[13] Having obtained the distribution of income for the whole U.S. population, I then derive the distribution within each ANES income bracket as conditional distributions. Finally, the last step of the procedure is to get income values for each ANES respondent by drawing from the appropriate conditional distribution.

Figure 6 provides an assessment of the fit of this procedure. It displays and compares the theoretical distribution derived from the CPS data, and the resulting empirical distribution obtained

[13] For a discussion of the appropriateness of the lognormal distribution, see Pinkovskiy and Sala-i Martin (2009). The lognormal fitting is performed by means of an interval regression of the income brackets (transformed in logs) on a constant. The resulting estimate represents the mean of the distribution of log-income. The estimate for the standard deviation of log-income is the root-mean squared error of the regression. The parameters of the lognormal distribution are obtained as transformations of the parameters of the underlying normal distribution.

by drawing income for the ANES respondents from the conditional distributions. Simulated income nicely overlaps with the underlying theoretical lognormal distribution.

3.3 Estimation

To take into account that one of the regressors is simulated and not observed, the model is estimated using Simulated Maximum Likelihood by means of a procedure that mimics the one used in case of multiple imputation.[14] Income is simulated M times for all individuals. The model is separately estimated for each simulation m, and the results from the M estimations are then pooled together using Rubin (1987)'s combination rules.

4 Results

Table 5 shows the main results of the estimation. Columns $D = 1$ display the coefficients for the main equation, while columns $V = 1$ contain the results for the selection equation. As evidenced by the selection equation, richer and more extremist individuals are more likely to go to the polls. Also, the perception of close elections in the State (a small margin of victory) makes people more likely to cast their vote. As expected, the RID variable has no effect on the decision of whether to vote or not, highlighting that left/right ideology does not affect the decision of whether to vote or not, but only the decision of whom to vote for.

In the main equation $D = 1$, the coefficient for income is negative as expected, implying that higher income individuals are more likely to vote for the Republican party. The RID variable is positive for all income groups; that is, individuals that are ideologically closer to the Democratic than to the Republican party are more likely to vote for the former party. The coefficients for RID are about two orders of magnitude larger than the coefficient for income, denoting how ideology plays a dominant role in determining voting behavior.

Also, more interestingly, the coefficient for RID increases with income: rich voters attach a higher weight to ideology than poor voters. The F-test for the RID coefficients rejects the hypothesis that the coefficients do not vary across groups. The findings are robust to the inclusion of control variables and State and year fixed effects, confirming the positive correlation between income and ideological salience. The results determine the sign of the comparative statics for income inequality and party polarization. In particular, since rich voters attach higher salience to ideology, an increase in income inequality increases redistribution, while an increase

[14]The procedure for multiple imputation (Rubin, 1987) consists of three steps: imputation, completed-data analysis, and pooling step. The imputation step is independent of the analysis and pooling steps, since the latter do not require any information about the missing-data aspect of the problem. In the application of multiple imputation techniques to the context at hand, the imputation step is not performed, since it is replaced by the simulation described above. The independence property guarantees that the technique can be validly applied to the current setting.

in polarization reduces it.

Table 6 presents the results of the same analysis, performed by year. The results are qualitatively similar, but somewhat less stark than the previous ones. The coefficient for income and RID are significant for years at the beginning and at the end of the period considered. In these years, the coefficient for RID are statistically different across income groups. In the other years, although the impact of income and ideology on voting decisions is less sharp, the RID coefficients are always significant for the top income classes, confirming that richer voters are more concerned with ideology than poor ones, and that this is a stable feature of American politics.

An exception to this pattern are the two Clinton elections in the 1990s. In the first election, the coefficients for RID are negative for all income classes, while in the second they have the expected sign, but the monotonicity with income is reversed. A possible explanation of the first result is that 1992 presidential elections were realignment elections: many States that had been reliably Republican switched ever since to the Democratic party, e.g. California. The negative coefficient for RID signifies that many conservatives voted for the Democratic party in those elections, and the non-significance of the income coefficient can be attributed to the fact that Clinton's support came from all classes of society.

4.1 Robustness checks

Table 7 uses a different specification to estimate the correlation between income and ideological salience. Instead of allowing the RID coefficient to vary across income groups, Table 6 presents the results of the inclusion of an interaction term between income and RID. Also in this case, the RID coefficient is significant, and two orders of magnitude larger than the coefficient for income. What is more, the interaction term is positive and significant, confirming the positive correlation between income and ideological salience. As in the specification presented in Table 5, the results are robust to the inclusion of control variables and fixed effects.

Table 8 presents an additional robustness check. The multiple income simulations are substituted with the midpoint income of the bracket to which the individual belongs. All results are carried over from the main specification, and the coefficients are quantitatively similar to those of Table 5.

Finally, Table 9 presents the results from a leave-one-out estimation. The RID variable is redefined to exclude one of the issues at a time. The table shows that the results are robust to leaving one of the issues out, with the only exceptions of the issues on defense spending and aid to the Blacks. In particular, opinions on defense spending play the most prominent role: it is the only dimension that, when left out, makes the point estimates of the RID coefficients similar for all income groups. It is an indication that the correlation with income may largely originates from the salience attached to defense issues. However, questions on defense spending and aid to Blacks are those most consistently asked in all ANES waves. Excluding them, therefore, results is a large loss of information available to estimate the effect of ideology on voting behavior.

5 Counterfactual experiments

The results from the empirical part of the paper imply that, given the positive correlation between income and ideological salience, increases in inequality lead to higher redistribution, whereas increases of polarization have the opposite effect.

By comparing the level of redistribution arising under different scenarios, it is possible to quantify the effects of inequality and polarization on redistribution, and to assess whether the estimated ideological salience can account for the stability of redistribution observed in the data. I carry out this assessment by calibrating the model in Section 2 and focusing on the following scenarios: 1. Both polarization and inequality occur (baseline); 2. No-inequality; 3. No-polarization.

The level of redistribution is determined by the tax rates in equations (13) and (14):

$$\tau_D = b_D + \frac{1}{3\alpha}\left\{[\alpha(\tau_R - b_D) + \bar{z}\Delta z] - \sqrt{\phi_D}\right\}$$

$$\tau_R = b_R + \frac{1}{3\alpha}\left\{[\alpha(\tau_D - b_R) + (1-\bar{z})\Delta z] - \sqrt{\phi_R}\right\}$$

where ϕ_D and ϕ_R are defined as in equations (15) and (16). Thus, the parameters to calibrate are the ideal policy of the two parties (b_D and b_R,) their ideological positions (z_R and z_D, that determine Δz and $\bar{z}$,) and the parameter α, which, in turn, depends on voters' income (y_r and y_p,) size of the income groups (η,) and groups' ideological salience (ξ_r and ξ_p.)

5.1 Calibration

The ideal policies of the two parties, b_D and b_R, are unobservables. They are calibrated for the model to match the average implicit tax rates set by the parties when in office. The implicit tax rate is the tax rate implied by the comparison between pre- and post-tax-and-transfer income distribution.

The Congressional Budget Office (CBO) provides data on median and Gini coefficient for market income and disposable income for the period 1979-2011.[15]

[15]CBO defines market income as consisting of "labor income, business income, capital gains (profits realized from the sale of assets), capital income excluding capital gains, income received in retirement for past services, and other sources of income." It defines disposable income as "market income plus government transfers minus federal taxes." Government transfers are "cash payments and in-kind benefits from social insurance and other government assistance programs. Those transfers include payments and benefits from federal, state, and local governments." Federal taxes "include individual income taxes, payroll (or social insurance) taxes, corporate income taxes, and excise taxes" (Congressional Budget Office, 2014).

Under the assumption that income follows a log-normal distribution, median income and Gini coefficients have a parametric interpretation. In particular,

$$Gini = 2\Phi\left(\frac{\sigma}{\sqrt{2}}\right) - 1$$

$$y_{med} = e^{\mu}$$

where μ and σ are, respectively, the mean and variance of log-income, and Φ is the standard normal CDF. Thus, it is possible to recover the parameters and the moments of distribution of market and disposable income from median and Gini coefficient.[16]

For the simple taxation scheme hypothesized in the theoretical model in Section 2, the relationship between market and disposable income is the following:

$$Y_D = f + (1-\tau)Y_M = \tau\bar{Y}_M + (1-\tau)Y_M \tag{27}$$

where Y_D and Y_M are disposable and market income, respectively, and the transfer f is equal to a share τ of the average market income $\bar{Y}_M$ for all individuals. Hence, since f is a constant,

$$var(Y_D) = (1-\tau)^2 var(Y_M)$$

and the implicit tax rate derived from the distributions of market and disposable income is:

$$\tau = 1 - \sqrt{\frac{var(Y_D)}{var(Y_M)}} \tag{28}$$

Table 10 shows the median income and the Gini coefficient for market and disposable income, the implicit tax rates and the party in office in the years considered. The tax rates implied by difference between the distributions of market and disposable income are very high: the average implicit tax rate when the Democratic party is in office is 54.53%, while for the Republican party it is 52.51%. However, they must be taken with a grain of salt, since they are derived under the simple tax scheme in equation (27), and under the assumption that market income Y_M and transfer f are independent. They represent an upper bound to the tax rates chosen by the parties.[17]

Consistently with the calibration of b_D and b_R, the income distribution used in the counterfactual experiments derives from the median and Gini coefficient for market income.

[16] Suppose that $X \sim N(\mu, \sigma^2)$, and consider the random variable $Y = e^X$. Then, $E[Y] = e^{\mu+\sigma^2/2}$ and $var[Y] = (e^{\sigma^2} - 1)e^{2\mu+\sigma^2}$.

[17] Appendix H proves that, if $cov(f, Y_M) < 0$ (as it is usually the case in a progressive tax system,) the implicit tax rate is less or equal than the tax rate in (28).

The parameter for ideological salience derive from the estimates for the equation $D = 1$ in the rightmost specification of Table 5. In terms of those coefficients, the ideological salience of group j is:

$$\xi_j = 2\frac{\gamma_j}{\beta}(\tau_R - \tau_D)$$

The original two groups of voters of the model, p and r, have been extended in the estimation to five groups, representing the quintiles of the income distribution. Hence, one needs to modify the parameter α in equation (9) accordingly. In the counterfactuals, the parameter is therefore calculated as:

$$\alpha = \sum_{j=1}^{5} \frac{\eta_j}{\xi_j}(y_j - \bar{y}) = 0.20 \cdot \sum_{j=1}^{5} \frac{(y_j - \bar{y})}{\xi_j}$$

where the size of each quintile, η_j, is equal to 20% of the population for all groups, and y_j is a level of income representative of the income group j, and set to the median income within each quintile of the income distribution, namely the income levels associated with the 0.10, 0.30, 0.50, 0.70, and 0.90 quantiles.[18]

The ideological positions of the two parties, z_R and z_D, are the party averages of the first dimension of the DW-NOMINATE score for the House of Representatives in the two consecutive Congresses that span a presidential term.[19]

Table 11 contains the values used in the calibration of the parameters other than b_D and b_R. Table 12 shows the calibration for b_D and b_R and assesses the fit of the model.

5.2 Results

Figure 7 compares the level of taxation chosen by the parties under the different scenarios. The no-polarization scenario is defined as the scenario in which the level of party polarization is equal to the level of 1979. In the no-inequality scenario, the income distribution is the same as in 1979 in all years.

Both the effects of inequality and polarization are stronger for the Republican party. In the no-polarization scenario, the tax rate set by the Republican party in 2008 is about 1.5% higher than in the baseline scenario, due to the effect of inequality. On the other hand, in the no-inequality scenario, the level of taxation chosen by the party in 2008 is about 1% lower than

[18] For elections held at time s, the income distribution considered is the one for period $(s-1)$.

[19] DW-NOMINATE scores (Poole and Rosenthal, 1997) are two-dimensional measures of ideological positions given to every member of Congress on the basis of their record of roll call votes. The first dimension of the score can be interpreted as positions along the liberal-conservative dimension. The second dimension represents racial issues, and loses importance starting from the 1980s. The first dimension alone explains over 85% of legislators' roll call votes (McCarty, Poole, and Rosenthal, 2006). DW-NOMINATE scores range between -1 and +1. For consistency with the theoretical model presented in Section 2, they have been rescaled to lie in the [0,1] interval. For elections held at time s, the party positions used are the average for the period $(s+1, s+4)$. This reflects the fact that elections are held at the end of year s, and that the government takes office at the beginning of the following year, $s+1$.

in the baseline, as an effect of polarization. Overall, the effects of inequality and polarization almost perfectly cancel out, and can therefore account for stability of redistribution.

The effect for the Democratic party is one order of magnitude smaller than for the Republican party. Also, both inequality and polarization reduce the level of redistribution chosen by the Democratic party. A negative effect of inequality on the tax rate set by the Democratic party is explained by the contrasting direct and strategic effects for this party, highlighted in the model. The effect of polarization is almost zero, as well as the overall effect.

The larger effect for the Republican party is consistent with the predictions of the model. Indeed, when ideological salience is positively correlated with income, the model predicts unambiguous effects for the Republican party, but potentially ambiguous ones for the Democratic party, that experiences a tradeoff between direct and strategic effects of increases in inequality and polarization.

Figure 8 presents the result of the same comparison, when increases in inequality are defined in terms of Gini coefficient. The results are similar to the previous ones in quality and magnitude. Also in this case both polarization and inequality have a stronger effect on the Republican party's behavior.

6 Conclusions

The observed pattern of redistribution in the U.S. in the last decades may seem puzzling if observed under the lenses of the standard political economy models of redistribution, that predict a positive relationship between inequality and redistribution. These models, however, do not consider the ideological reasons that affect voting behavior, and the dynamics of party polarization. This paper takes these two factors into account, and studies the effect of inequality and polarization on redistribution.

The paper provides both a theoretical framework and empirical evidence to analyze redistribution as the outcome of a political game. The key element is that the salience attached by voters to ideological issues is correlated with income. The sign of the effects on redistribution depends on the the sign of this correlation, and are driven by the parties' accountability towards the voters that are more responsive to changes in the proposed redistributive policy.

The empirical part of the paper estimates the correlation between income and ideological salience, and finds that richer voters attach a larger importance to social issues. These results imply that increases in inequality increase redistribution, while increases in polarization reduce it.

The comparison of counterfactual scenarios provides a decomposition of these effects. The effect of inequality is stronger than the effect of polarization, and they both affect prevalently the Republican party. In absence of polarization, the 2008 tax rate proposed by the Republican party would have been about 1.5% higher than in the baseline scenario; in absence of inequality, it would have been about 1% lower. The effects for the Democratic party are one order of magnitude smaller. Most, importantly, these effects almost perfectly offset each other, providing evidence that the estimated values of ideological salience, combined with exogenous changes in inequality and polarization, can account for the stability of redistribution observed in the U.S. since the 1970s.

In this paper, I take parties' ideological positions as given, to make the model tractable. Multidimensional political games are often characterized by multiple equilibria. However, endogenous choice of ideology is an important feature of actual policymaking, and future work will explore parties' incentives to polarize.

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Appendix

A Tables

Table 1: Two-sample Kolmogorov-Smirnov test for equality of distributions

	$CDF_i = CDF_j$	Comparisons	Percentage
RID	83	110	75.5
Single social issues	494	650	76
RRD	36	110	32.7
Single redistribution issues	124	320	38.8

Table 2: ANES social issues

	1972	1976	1980	1984	1988	1992	1996	2000	2004	2008	2012
International relations											
Withdrawal from Vietnam war	✓										
Cooperation with USSR			✓	✓	✓						
Involvement in Central America				✓							
Intervention by diplomacy/ military									✓		
Defense spending			✓	✓	✓	✓	✓	✓	✓	✓	✓
Environment											
Pollution ban	✓										
Jobs/environment tradeoff							✓	✓	✓	✓	✓
Environmental regulation							✓	✓			
Lower emissions										✓	
Civil rights											
School busing	✓	✓									
Aid to blacks	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Urban unrest	✓	✓									
Student unrest	✓										
Equal role/aid for women	✓	✓	✓	✓	✓		✓	✓	✓	✓	
Rights of accused	✓	✓									
Abortion (in general, for nonfatal health risks, for "wrong" gender)			✓			✓	✓	✓	✓	✓	✓
Citizenship to illegal immigrants										✓	
Other internal issues											
Liberalization of marijuana	✓	✓									
Crime reduction							✓				
Gun control								✓	✓		

Table 3: ANES economic issues

	1972	1976	1980	1984	1988	1992	1996	2000	2004	2008	2012
Guaranteed jobs and living standards	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Taxation of richer people	✓	✓									
Government vs. private health insurance	✓	✓			✓		✓			✓	✓
Fighting inflation	✓										
Government spending			✓	✓	✓	✓	✓	✓	✓	✓	✓
Inflation/unemployment tradeoff			✓								
Tax cuts			✓				✓				

Table 4: Summary statistics - Social issues

	Individual		Republican Candidate		Democratic Candidate	
	(1)		(2)		(3)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Vietnam war	3.64223	1.940192	4.612613	1.623257	1.787469	1.382997
Cooperation with USSR	3.941511	1.831251	4.558571	1.615564	3.195336	1.502179
Involvement in Central America	3.340212	1.767404	5.155611	1.622183	3.52669	1.467659
Diplomacy/military intervention	3.862725	1.754831	5.944177	1.285296	2.93994	1.481481
Defense spending	4.144912	1.614011	5.061797	1.548527	3.594823	1.539377
Pollution ban	2.147611	1.906316	3.02863	1.850392	2.527011	1.561112
Jobs/environment tradeoff	3.374474	1.749468	4.813788	1.616863	3.036234	1.615245
Environmental law	3.287027	1.770763	4.648963	1.543198	2.905965	1.461666
Lower emissions	2.729443	2.014375	3.427318	1.88079	2.559524	1.85757
School busing	6.154757	1.673464	4.578207	2.047051	3.642621	1.925803
Aid to Blacks	4.544061	1.846061	4.908183	1.581707	3.090003	1.599284
Urban unrest	3.185786	1.984341	3.936691	1.616797	2.886069	1.518954
Student unrest	4.869797	1.863423	4.943237	1.383235	3.291005	1.714751
Role of women	2.616911	1.964127	3.48023	1.736054	2.646037	1.530868
Aid to women	3.820513	1.690937	4.606414	1.455952	3.14303	1.524461
Rights of accused person	4.228269	2.121244	4.014982	1.768154	3.319051	1.673017
Abortion	3.263584	2.334624	4.638935	2.10393	2.903082	2.175342
Abortion for non-fatal risks	4.141618	2.312638	5.361559	1.969396	3.382038	2.238204
Abortion for wrong gender	6.317445	1.552912	6.314496	1.358989	5.420179	2.111581
Citizenship to illegal immigrants	3.562281	2.26408	4.306098	2.116327	2.977244	1.760894
Marijuana liberalization	5.171676	2.176077	5.14905	1.581284	3.952669	1.926007
Crime reduction	4.461302	1.986828	5.100533	1.389458	3.701266	1.694344
Gun control	2.577295	1.590811	3.833662	1.584104	2.908984	1.586452
RID	6.15e-10	.9995363				
N	26059		24811		24651	

Table 5: Probit model with selection

	(1) D=1	V=1	(2) D=1	V=1	(3) D=1	V=1	(4) D=1	V=1
Income	-0.00260***	0.00425***	-0.00280***	0.00407***	-0.00165***	0.00138**	-0.00171***	0.00147***
	(0.000443)	(0.000637)	(0.000470)	(0.000656)	(0.000453)	(0.000550)	(0.000471)	(0.000564)
Bottom 20% × RID	0.376***	-0.0462	0.385***	-0.0505*	0.298***	0.0102	0.316***	0.00322
	(0.0369)	(0.0307)	(0.0374)	(0.0303)	(0.0533)	(0.0371)	(0.0530)	(0.0374)
Second 20% × RID	0.436***	-0.00950	0.446***	-0.0105	0.383***	-0.00866	0.382***	-0.0113
	(0.0396)	(0.0357)	(0.0410)	(0.0359)	(0.0494)	(0.0467)	(0.0518)	(0.0474)
Third 20% × RID	0.456***	-0.0300	0.474***	-0.0373	0.404***	-0.0144	0.420***	-0.0269
	(0.0318)	(0.0291)	(0.0322)	(0.0291)	(0.0401)	(0.0392)	(0.0409)	(0.0391)
Forth 20% × RID	0.546***	-0.00979	0.556***	-0.0178	0.461***	-0.00277	0.472***	-0.0160
	(0.0294)	(0.0265)	(0.0302)	(0.0266)	(0.0372)	(0.0342)	(0.0375)	(0.0338)
Top 20% × RID	0.511***	0.0779*	0.519***	0.0729*	0.505***	0.0800	0.516***	0.0682
	(0.0360)	(0.0408)	(0.0374)	(0.0411)	(0.0421)	(0.0488)	(0.0420)	(0.0500)
Extremism		0.329***		0.342***		0.285***		0.300***
		(0.0139)		(0.0140)		(0.0181)		(0.0181)
Margin of victory		-0.721***		-0.540***		-0.615***		-0.619***
		(0.142)		(0.189)		(0.160)		(0.238)
Constant	0.268***	-0.269***	-0.136	-0.271**	0.0665	-1.699***	-0.278	-1.569***
	(0.0520)	(0.0619)	(0.157)	(0.138)	(0.166)	(0.129)	(0.230)	(0.212)
Controls	No	No	No	No	Yes	Yes	Yes	Yes
State FE	No	No	Yes	Yes	No	No	Yes	Yes
Year FE	No	No	Yes	Yes	No	No	Yes	Yes
Observations	16120		16120		11455		11455	
ρ	-0.521		-0.468		-0.411		-0.340	
se(ρ)	0.0778		0.0837		0.0947		0.0997	
F-test for RID	3.956		3.743		2.600		2.570	
p-value	0.00332		0.00483		0.0345		0.0363	
Simulations	271		277		300		300	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Probit model with selection - By year

	1972	1976	1980	1984	1988	1992	1996	2000	2004	2008	2012
Income	-0.00201	-0.00372**	-0.00249*	-0.00360***	-0.00433***	-0.00168	-0.00167	0.0000764	-0.00175	-0.00264*	-0.00152
	(0.00128)	(0.00157)	(0.00137)	(0.00113)	(0.00157)	(0.00111)	(0.00118)	(0.00113)	(0.00110)	(0.00146)	(0.000961)
Bottom 20% × RID	0.532***	-0.0175	0.485**	0.161	0.591***	-0.0611	0.0911	0.130	0.439	0.535***	0.533***
	(0.188)	(0.199)	(0.213)	(0.170)	(0.115)	(0.108)	(0.214)	(0.265)	(0.308)	(0.198)	(0.144)
Second 20% × RID	0.423***	0.0935	0.240	0.237**	0.680***	-0.229	0.536**	0.172	0.640*	0.567***	1.055***
	(0.161)	(0.158)	(0.155)	(0.0978)	(0.184)	(0.140)	(0.217)	(0.231)	(0.361)	(0.183)	(0.199)
Third 20% × RID	0.490***	0.276*	0.102	0.390***	0.401***	-0.270**	0.446**	0.0776	0.755***	0.553***	1.294***
	(0.107)	(0.142)	(0.151)	(0.144)	(0.128)	(0.112)	(0.185)	(0.179)	(0.192)	(0.120)	(0.223)
Forth 20% × RID	0.799***	0.105	0.423***	0.478***	0.417***	-0.247**	0.404***	0.263*	1.371***	0.516***	1.576***
	(0.117)	(0.125)	(0.129)	(0.125)	(0.137)	(0.0980)	(0.131)	(0.139)	(0.299)	(0.111)	(0.184)
Top 20% × RID	0.868***	0.224**	0.346***	0.602***	0.654***	-0.461***	0.302**	0.489***	1.668***	0.871***	1.408***
	(0.147)	(0.114)	(0.109)	(0.150)	(0.146)	(0.116)	(0.145)	(0.175)	(0.292)	(0.215)	(0.186)
F-test for RID	2.133	0.527	1.070	1.871	0.631	1.337	0.561	0.864	4.977	0.835	6.110
p-value for F	0.0744	0.716	0.370	0.113	0.640	0.254	0.691	0.485	0.000542	0.503	0.0000695

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Probit model with selection - RID-income interaction

	(1)		(2)		(3)		(4)	
	D=1	V=1	D=1	V=1	D=1	V=1	D=1	V=1
Income	-0.00282***	0.00439***	-0.00303***	0.00421***	-0.00184***	0.00151***	-0.00191***	0.00158***
	(0.000443)	(0.000599)	(0.000474)	(0.000604)	(0.000496)	(0.000556)	(0.000515)	(0.000567)
RID	0.400***	-0.0649*	0.413***	-0.0701*	0.339***	-0.0389	0.350***	-0.0472
	(0.0307)	(0.0387)	(0.0317)	(0.0381)	(0.0353)	(0.0293)	(0.0360)	(0.0298)
Income × RID	0.00113***	0.00101	0.00111***	0.00100	0.00126***	0.000846*	0.00125***	0.000816*
	(0.000405)	(0.000670)	(0.000420)	(0.000659)	(0.000451)	(0.000434)	(0.000455)	(0.000452)
Extremism		0.329***		0.342***		0.285***		0.301***
		(0.0139)		(0.0140)		(0.0181)		(0.0181)
Margin of victory		-0.725***		-0.541***		-0.617***		-0.618***
		(0.141)		(0.189)		(0.158)		(0.238)
Constant	0.287***	-0.276***	-0.120	-0.276**	0.0813	-1.698***	-0.265	-1.569***
	(0.0481)	(0.0598)	(0.153)	(0.136)	(0.164)	(0.128)	(0.228)	(0.211)
Controls	No	No	No	No	Yes	Yes	Yes	Yes
State FE	No	No	Yes	Yes	No	No	Yes	Yes
Year FE	No	No	Yes	Yes	No	No	Yes	Yes
Observations	16120		16120		11455		11455	
ρ	-0.537		-0.485		-0.424		-0.354	
se(ρ)	0.0698		0.0764		0.0921		0.0981	
Simulations	268		271		299		300	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Probit model with selection - Midpoint income

	(1) D=1	V=1	(2) D=1	V=1	(3) D=1	V=1	(4) D=1	V=1
Income	-0.00456***	0.00624***	-0.00498***	0.00608***	-0.00296***	0.00235***	-0.00308***	0.00249***
	(0.000317)	(0.000368)	(0.000318)	(0.000381)	(0.000442)	(0.000497)	(0.000462)	(0.000503)
Bottom 20% × RID	0.365***	-0.0407	0.377***	-0.0442*	0.290***	0.00816	0.310***	0.000870
	(0.0317)	(0.0255)	(0.0323)	(0.0248)	(0.0455)	(0.0292)	(0.0452)	(0.0292)
Second 20% × RID	0.433***	-0.00881	0.440***	-0.00847	0.397***	-0.00617	0.392***	-0.00789
	(0.0335)	(0.0289)	(0.0353)	(0.0290)	(0.0414)	(0.0375)	(0.0439)	(0.0377)
Third 20% × RID	0.449***	-0.0248	0.469***	-0.0324	0.398***	-0.00413	0.414***	-0.0180
	(0.0265)	(0.0231)	(0.0270)	(0.0228)	(0.0315)	(0.0306)	(0.0322)	(0.0303)
Forth 20% × RID	0.550***	-0.0142	0.560***	-0.0202	0.473***	-0.0127	0.486***	-0.0246
	(0.0230)	(0.0210)	(0.0236)	(0.0212)	(0.0280)	(0.0244)	(0.0280)	(0.0241)
Top 20% × RID	0.514***	0.0802**	0.520***	0.0757**	0.495***	0.0869**	0.502***	0.0735*
	(0.0290)	(0.0345)	(0.0304)	(0.0348)	(0.0301)	(0.0398)	(0.0302)	(0.0403)
Extremism		0.330***		0.342***		0.285***		0.300***
		(0.0122)		(0.0123)		(0.0149)		(0.0149)
Margin of victory		-0.720***		-0.530***		-0.610***		-0.619***
		(0.110)		(0.139)		(0.115)		(0.182)
Constant	0.399***	-0.376***	0.00147	-0.377***	0.110	-1.733***	-0.214	-1.610***
	(0.0329)	(0.0466)	(0.119)	(0.105)	(0.120)	(0.100)	(0.163)	(0.165)
Controls	No	No	No	No	Yes	Yes	Yes	Yes
State FE	No	No	Yes	Yes	No	No	Yes	Yes
Year FE	No	No	Yes	Yes	No	No	Yes	Yes
Observations	16120		16120		11455		11455	
ρ	-0.558		-0.508		-0.408		-0.340	
se(ρ)	0.0485		0.0536		0.0655		0.0748	
F-test for RID	7.062		6.494		4.269		4.134	
p-value	0.0000117		0.0000335		0.00192		0.00244	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Probit model with selection - Leave-one-out RID

	(1) Income	(2) Bottom 20% × RID	(3) Second 20% × RID	(4) Third 20% × RID	(5) Forth 20% × RID	(6) Top 20% × RID	(7) F-test for RID	(8) p-value
No Vietnam war	-0.00172***	0.304***	0.366***	0.408***	0.460***	0.510***	2.774	0.0258
	(0.000472)	(0.0522)	(0.0511)	(0.0404)	(0.0371)	(0.0424)		
No marijuana liberalization	-0.00172***	0.310***	0.375***	0.427***	0.485***	0.523***	3.139	0.0139
	(0.000472)	(0.0525)	(0.0511)	(0.0412)	(0.0376)	(0.0415)		
No school busing	-0.00172***	0.319***	0.370***	0.415***	0.474***	0.498***	2.356	0.0517
	(0.000470)	(0.0531)	(0.0510)	(0.0410)	(0.0370)	(0.0426)		
No pollution ban	-0.00170***	0.315***	0.380***	0.419***	0.473***	0.512***	2.544	0.0379
	(0.000471)	(0.0528)	(0.0519)	(0.0410)	(0.0375)	(0.0421)		
No equal role for women	-0.00168***	0.309***	0.385***	0.431***	0.489***	0.516***	2.985	0.0180
	(0.000468)	(0.0511)	(0.0518)	(0.0420)	(0.0377)	(0.0423)		
No rights of accused	-0.00173***	0.316***	0.387***	0.412***	0.467***	0.518***	2.557	0.0371
	(0.000472)	(0.0529)	(0.0521)	(0.0405)	(0.0375)	(0.0418)		
No urban unrest	-0.00171***	0.316***	0.375***	0.409***	0.463***	0.507***	2.368	0.0507
	(0.000468)	(0.0529)	(0.0512)	(0.0407)	(0.0372)	(0.0417)		
No students' unrest	-0.00172***	0.320***	0.380***	0.419***	0.470***	0.513***	2.448	0.0445
	(0.000472)	(0.0530)	(0.0515)	(0.0409)	(0.0374)	(0.0419)		
No aid to Blacks	-0.00187***	0.382***	0.428***	0.457***	0.465***	0.505***	0.931	0.445
	(0.000484)	(0.0495)	(0.0553)	(0.0400)	(0.0358)	(0.0431)		
No defense spending	-0.00204***	0.0203***	0.0211***	0.0271***	0.0258***	0.0272***	0.528	0.715
	(0.000488)	(0.00448)	(0.00521)	(0.00409)	(0.00344)	(0.00437)		
No abortion	-0.00152***	0.0506***	0.0730***	0.0941***	0.119***	0.139***	7.037	0.0000126
	(0.000413)	(0.0113)	(0.0130)	(0.0121)	(0.0109)	(0.0162)		
No cooperation with USSR	-0.00174***	0.296***	0.393***	0.427***	0.429***	0.497***	2.184	0.0685
	(0.000473)	(0.0512)	(0.0526)	(0.0415)	(0.0373)	(0.0435)		
No aid to women	-0.00168***	0.357***	0.428***	0.452***	0.491***	0.540***	1.996	0.0926
	(0.000467)	(0.0532)	(0.0557)	(0.0415)	(0.0374)	(0.0423)		
No Central America	-0.00170***	0.346***	0.423***	0.448***	0.490***	0.540***	2.255	0.0610
	(0.000469)	(0.0525)	(0.0539)	(0.0412)	(0.0378)	(0.0424)		
No crime reduction	-0.00170***	0.329***	0.387***	0.439***	0.481***	0.533***	2.710	0.0287
	(0.000469)	(0.0526)	(0.0514)	(0.0404)	(0.0373)	(0.0423)		
No jobs/environment tradeoff	-0.00165***	0.314***	0.349***	0.422***	0.464***	0.507***	2.766	0.0261
	(0.000457)	(0.0504)	(0.0519)	(0.0397)	(0.0374)	(0.0420)		
No environmental regulation	-0.00162***	0.347***	0.387***	0.450***	0.500***	0.530***	2.547	0.0377
	(0.000463)	(0.0521)	(0.0508)	(0.0402)	(0.0371)	(0.0419)		
No gun control	-0.00171***	0.310***	0.379***	0.418***	0.471***	0.514***	2.678	0.0303
	(0.000472)	(0.0529)	(0.0515)	(0.0410)	(0.0375)	(0.0421)		
No diplomacy vs. military	-0.00171***	0.314***	0.384***	0.421***	0.468***	0.510***	2.411	0.0472
	(0.000472)	(0.0530)	(0.0519)	(0.0409)	(0.0374)	(0.0419)		
No abortion nonfatal risks	-0.00169***	0.325***	0.398***	0.430***	0.479***	0.528***	2.530	0.0388
	(0.000463)	(0.0539)	(0.0518)	(0.0411)	(0.0386)	(0.0425)		
No abortion gender	-0.00170***	0.316***	0.396***	0.425***	0.471***	0.524***	2.599	0.0346
	(0.000461)	(0.0538)	(0.0520)	(0.0409)	(0.0385)	(0.0420)		
No lower emissions	-0.00171***	0.315***	0.382***	0.419***	0.473***	0.517***	2.643	0.0321
	(0.000471)	(0.0529)	(0.0518)	(0.0410)	(0.0376)	(0.0420)		
No illegal immigrants	-0.00171***	0.320***	0.388***	0.425***	0.476***	0.523***	2.599	0.0346
	(0.000469)	(0.0533)	(0.0519)	(0.0409)	(0.0378)	(0.0421)		

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Implicit tax rate

Year	Median market income	Median disposable income	Gini market income	Gini disposable income	Implicit tax rate	Party in office
1979	54,500	48,000	0.48	0.36	52.71	D
1980	53,400	46,500	0.48	0.36	53.24	D
1981	53,300	46,000	0.49	0.37	53.91	R
1982	51,700	46,000	0.5	0.38	52.77	R
1983	50,900	45,400	0.51	0.4	50.54	R
1984	54,000	47,500	0.51	0.4	51.22	R
1985	54,300	47,600	0.51	0.41	48.85	R
1986	55,500	48,900	0.54	0.43	52.3	R
1987	55,100	48,900	0.52	0.41	51.15	R
1988	55,800	49,100	0.53	0.42	51.95	R
1989	56,500	49,900	0.53	0.42	51.77	R
1990	56,800	50,300	0.52	0.41	51.25	R
1991	55,100	50,000	0.52	0.4	52.53	R
1992	54,900	50,400	0.53	0.41	52.37	R
1993	55,300	50,900	0.53	0.4	54.62	D
1994	56,100	51,400	0.53	0.4	54.82	D
1995	57,900	53,200	0.53	0.4	54.7	D
1996	58,700	54,100	0.54	0.41	54.99	D
1997	60,100	55,000	0.55	0.42	55.76	D
1998	62,500	57,300	0.55	0.43	53.33	D
1999	65,000	59,100	0.56	0.44	54.21	D
2000	64,700	59,500	0.57	0.45	54.21	D
2001	64,300	61,400	0.55	0.42	53.84	R
2002	62,300	60,500	0.55	0.42	53.06	R
2003	62,000	61,300	0.56	0.43	52.74	R
2004	64,200	63,700	0.57	0.44	53.14	R
2005	65,500	64,900	0.58	0.45	53.8	R
2006	66,200	65,700	0.59	0.46	54.37	R
2007	68,500	67,900	0.59	0.46	54.42	R
2008	65,700	68,000	0.58	0.44	54.22	R
2009	62,100	67,500	0.58	0.43	54.37	D
2010	62,000	67,400	0.59	0.43	57.33	D
2011	61,300	67,200	0.59	0.44	54.67	D

Income in 2011 U.S. dollars.

Table 11: Calibration for counterfactual experiments

	1980	1984	1988	1992	1996	2000	2004	2008
Common to all scenarios								
η_1	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
η_2	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
η_3	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
η_4	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
η_5	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
γ_1	0.3160	0.3160	0.3160	0.3160	0.3160	0.3160	0.3160	0.3160
γ_2	0.3817	0.3817	0.3817	0.3817	0.3817	0.3817	0.3817	0.3817
γ_3	0.4196	0.4196	0.4196	0.4196	0.4196	0.4196	0.4196	0.4196
γ_4	0.4723	0.4723	0.4723	0.4723	0.4723	0.4723	0.4723	0.4723
γ_5	0.5156	0.5156	0.5156	0.5156	0.5156	0.5156	0.5156	0.5156
β	-0.0017	-0.0017	-0.0017	-0.0017	-0.0017	-0.0017	-0.0017	-0.0017
Income* (with increase in inequality)								
y_1	16.983	14.567	15.318	15.318	15.632	16.037	15.296	15.388
y_2	33.821	30.506	32.634	32.634	33.883	36.661	34.969	37.182
y_3	54.500	50.900	55.100	55.100	57.900	65.000	62.000	68.500
y_4	87.822	84.928	93.033	93.033	98.940	115.245	109.926	126.197
y_5	174.896	177.855	198.193	198.193	214.461	263.460	251.300	304.920
$\bar{y}$	82.442	81.973	90.741	90.741	97.582	117.998	112.552	135.049
Income* (no increase in inequality = same distribution as 1976)								
y_1	16.983	16.983	16.983	16.983	16.983	16.983	16.983	16.983
y_2	33.821	33.821	33.821	33.821	33.821	33.821	33.821	33.821
y_3	54.500	54.500	54.500	54.500	54.500	54.500	54.500	54.500
y_4	87.822	87.822	87.822	87.822	87.822	87.822	87.822	87.822
y_5	174.896	174.896	174.896	174.896	174.896	174.896	174.896	174.896
$\bar{y}$	82.442	82.442	82.442	82.442	82.442	82.442	82.442	82.442
Income* (no increase in inequality = same Gini as 1976)								
y_1	16.983	15.861	17.170	17.170	18.042	20.255	19.320	21.346
y_2	33.821	31.587	34.193	34.193	35.931	40.337	38.475	42.509
y_3	54.500	50.900	55.100	55.100	57.900	65.000	62.000	68.500
y_4	87.822	82.021	88.789	88.789	93.301	104.742	99.908	110.382
y_5	174.896	163.343	176.822	176.822	185.807	208.592	198.964	219.824
$\bar{y}$	82.442	76.996	83.350	83.350	87.585	98.325	93.787	103.620
Party ideology** (with increase in polarization)								
z_D	0.348	0.348	0.348	0.335	0.323	0.322	0.324	0.320
z_R	0.628	0.653	0.673	0.721	0.752	0.781	0.808	0.853
Party ideology** (no increase in polarization								
z_D	0.348	0.348	0.348	0.348	0.348	0.348	0.348	0.348
z_R	0.628	0.628	0.628	0.628	0.628	0.628	0.628	0.628

*Income in thousand 2011 US dollars

**DW-NOMINATE scores rescaled to [0,1]

Table 12: Calibration of b_D and b_R and goodness of fit

Year	CBO tax rate	Party in office	b_D	b_R	Model τ_D*	Model τ_R*
1980	52.11	R	54.35	51.64	54.55	52.23
1984	51.06	R	54.35	51.64	54.55	52.26
1988	51.98	R	54.35	51.64	54.55	52.35
1992	54.78	D	54.35	51.64	54.53	52.21
1996	54.38	D	54.35	51.64	54.53	52.22
2000	53.19	R	54.35	51.64	54.52	52.53
2004	54.2	R	54.35	51.64	54.52	52.43
2008	55.45	D	54.35	51.64	54.49	52.87

* Scenario with inequality and polarization

B Figures

Figure 1: Distribution of RID by income group-year

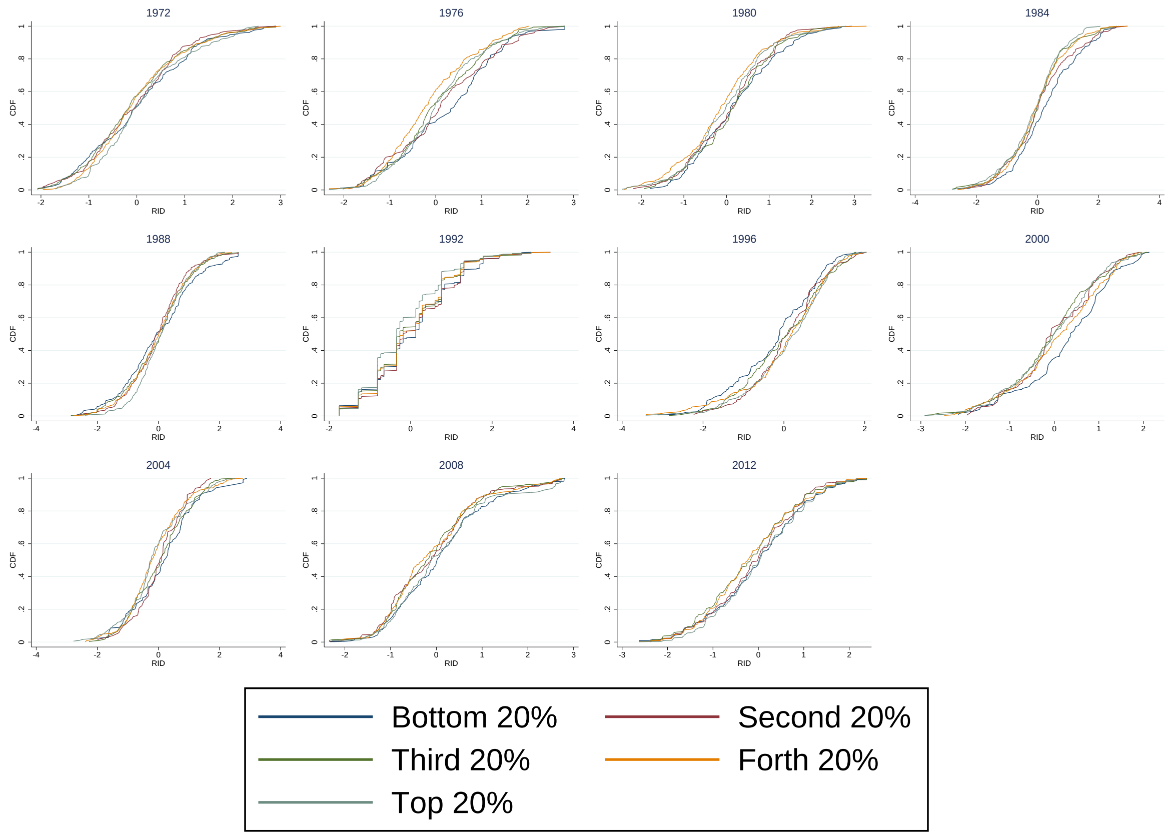


Figure 2: Equilibrium for the case $\xi_r > \xi_p$ (left) and $\xi_r < \xi_p$ (right).

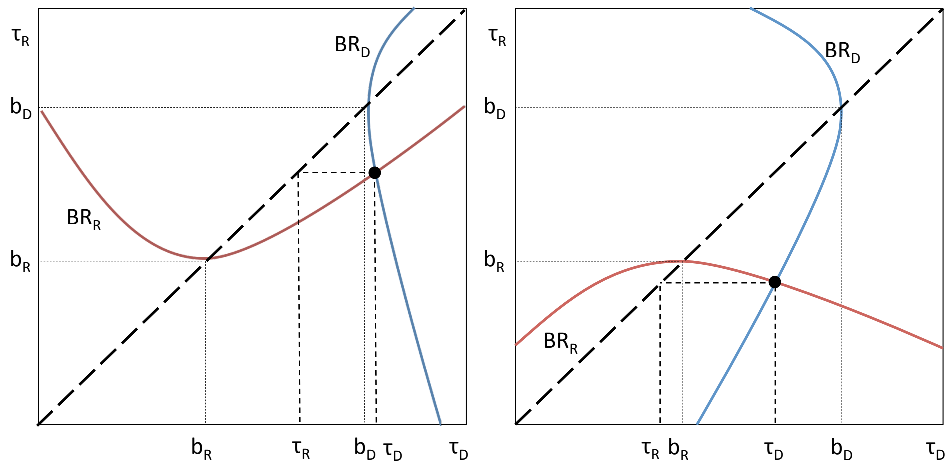


Figure 3: Effect on equilibria of an increase in inequality.
$\xi_r > \xi_p$ case (left) and $\xi_r < \xi_p$ case (right).

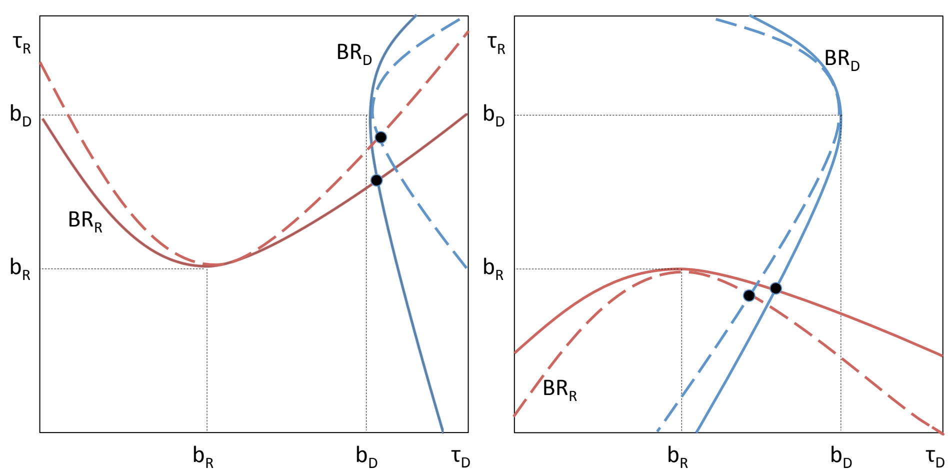


Figure 4: Effect on equilibria of an increase in polarization.
$\xi_r > \xi_p$ case (left) and $\xi_r < \xi_p$ case (right).

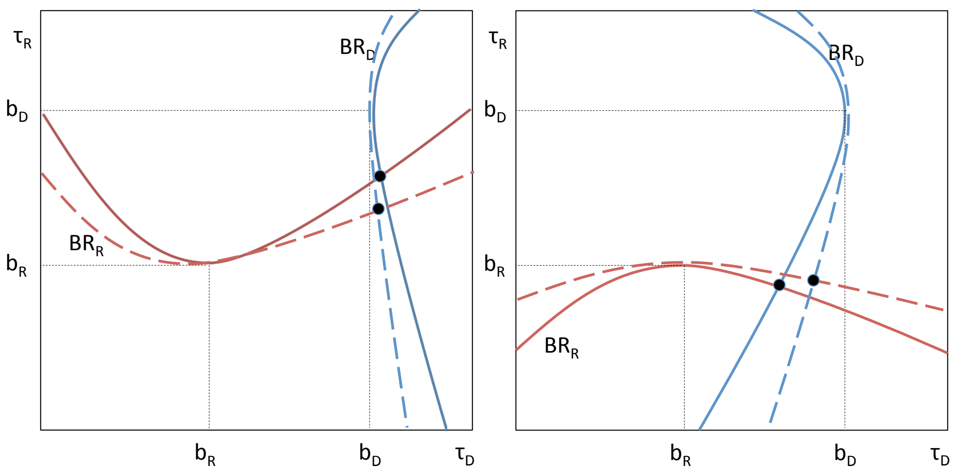
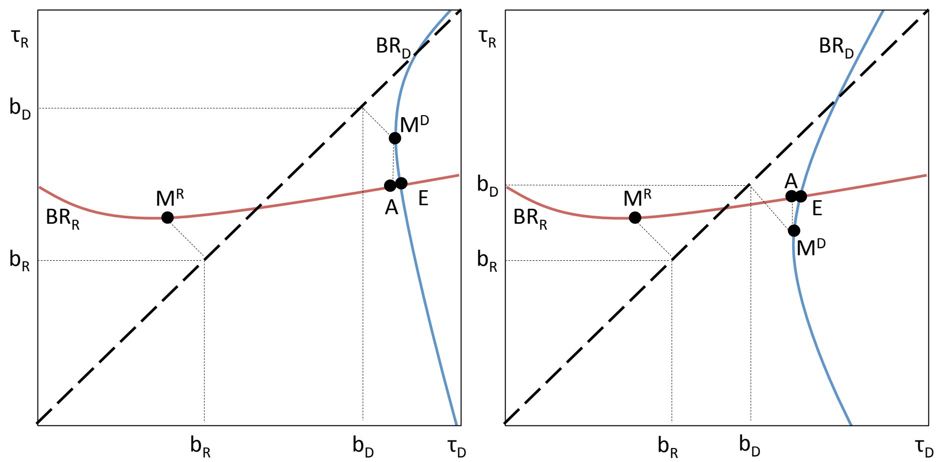


Figure 5: Equilibrium for the case $\xi_r > \xi_p$ (top) and $\xi_r < \xi_p$ (bottom) - Extended model.

(a) Equilibrium for the case $\xi_r > \xi_p$. Stable (left) and unstable (right) equilibrium.



(b) Equilibrium for the case $\xi_r < \xi_p$. Stable (left) and unstable (right) equilibrium.

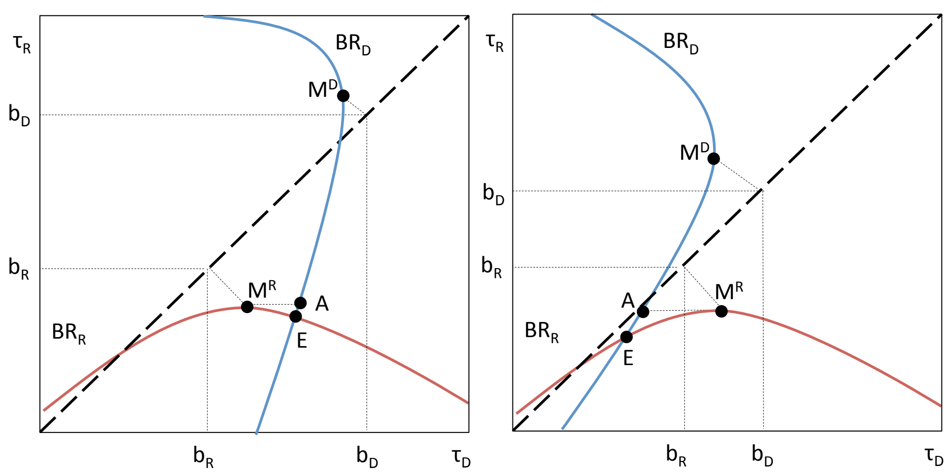


Figure 6: Comparison between theoretical and empirical income distribution by year

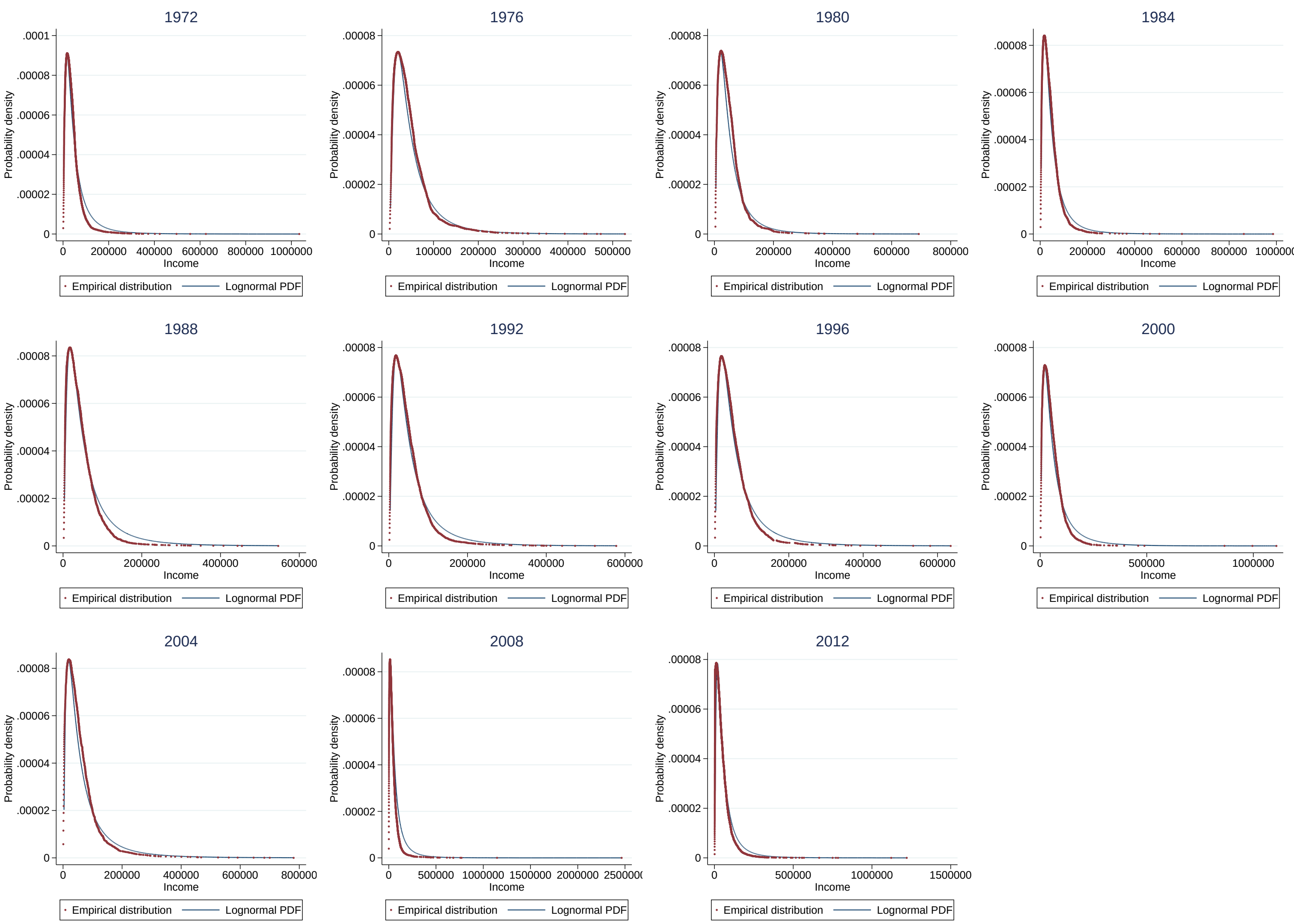


Figure 7: Counterfactuals
Absence of inequality = same income distribution as in 1979

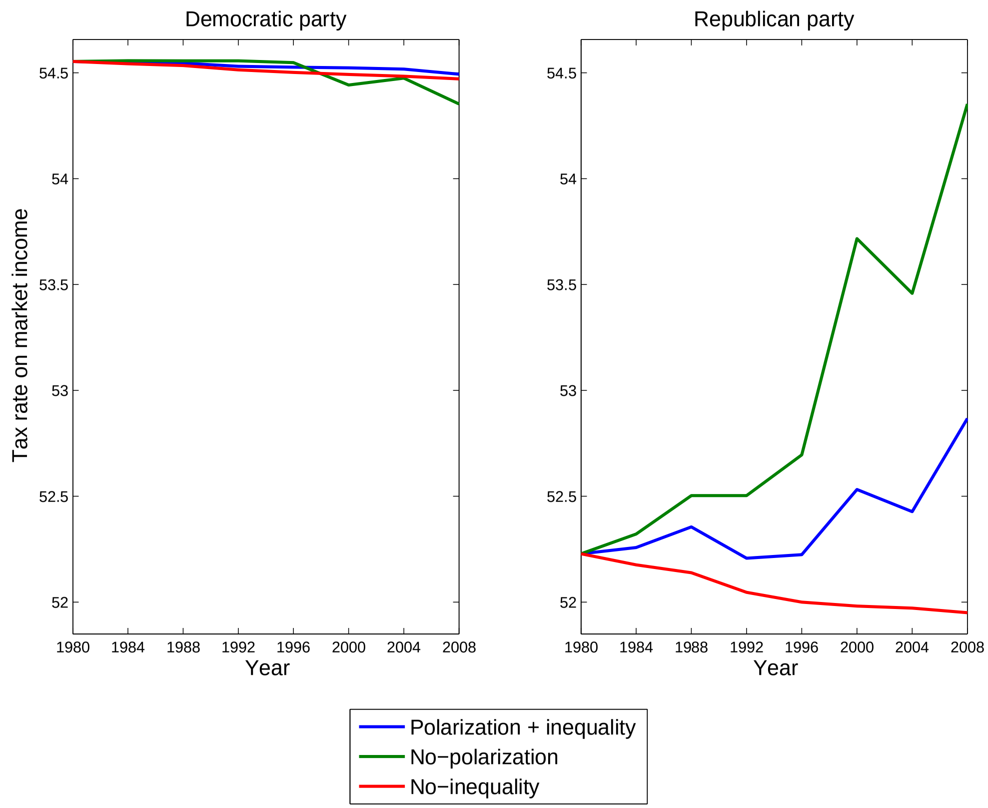
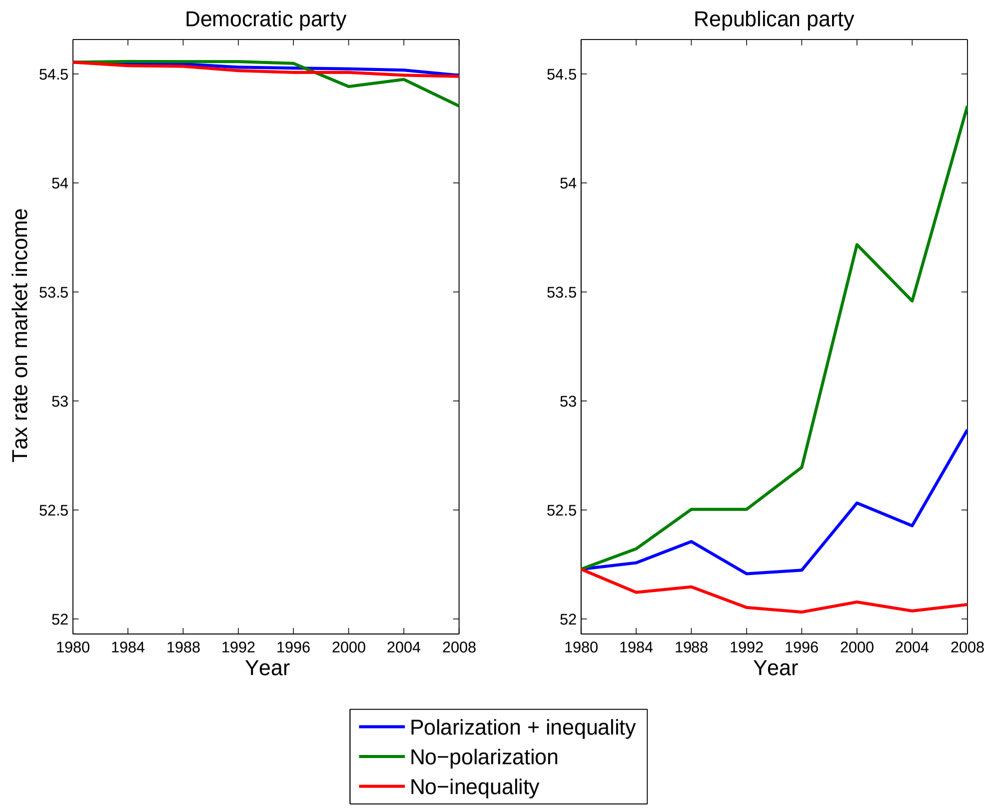


Figure 8: Counterfactuals
Absence of inequality = same Gini coefficient as in 1979



C Proof of Proposition 1

C.1 Proof of Proposition 1.1

The FOCs for parties D and R in equations (11) and (12) can be rewritten, for the generic party k, $k = D, R$, as:

$$\frac{\partial W_k}{\partial \tau_k} = \frac{\partial \pi_k}{\partial \tau_k}[-(\tau_k - b_k)^2] + \pi_k[-2(\tau_k - b_k)] + \frac{\partial \pi_{-k}}{\partial \tau_k}[-(\tau_{-k} - b_k)^2] = 0 \tag{29}$$

where $-k$ indexes the variables pertaining to the opposing party.

Also the probability of winning in equations (8) and (10) can be expressed as:

$$\pi_k = \hat{z}_k + \frac{\alpha}{\Delta z}(\tau_{-k} - \tau_k) \tag{30}$$

where

$$\hat{z}_k = \begin{cases} \bar{z} & \text{, if } k = D \\ \\ 1 - \bar{z} & \text{, if } k = R \end{cases} \tag{31}$$

Substituting the expressions for π_k and π_{-k} and the relative derivatives from equation (30), equation (29) becomes:

$$\frac{\alpha}{\Delta z}\left[(\tau_k - b_k)^2 - (\tau_{-k} - b_k)^2\right] - 2\left[\hat{z}_k + \frac{\alpha}{\Delta z}(\tau_{-k} - \tau_k)\right](\tau_k - b_k) = 0$$

Using $(\tau_{-k} - \tau_k) = [(\tau_{-k} - b_k) - (\tau_k - b_k)]$, and rearranging the terms, one obtains:

$$3\alpha(\tau_k - b_k)^2 - 2\left[\alpha(\tau_{-k} - b_k) + \hat{z}_k \Delta z\right](\tau_k - b_k) - \alpha(\tau_{-k} - b_k)^2 = 0$$

which is a second degree equation in $(\tau_k - b_k)$, whose discriminant

$$\begin{aligned}\Delta &= 4\left[[-\alpha(\tau_{-k} - b_k) - \hat{z}_k \Delta z]^2 + 3\alpha^2(\tau_{-k} - b_k)^2\right] \\ &= 4\left[[\alpha(\tau_{-k} - b_k) + \hat{z}_k \Delta z]^2 + 3\alpha^2(\tau_{-k} - b_k)^2\right] = 4\phi_k\end{aligned}$$

is positive. Therefore, there are two real solutions:

$$\tau_k - b_k = \frac{1}{3\alpha}\left\{[\alpha(\tau_{-k} - b_k) + \hat{z}_k \Delta z] \pm \sqrt{\phi_k}\right\} \tag{32}$$

where:

$$\phi_k = [\alpha(\tau_{-k} - b_k) + \hat{z}_k \Delta z]^2 + 3\alpha^2(\tau_{-k} - b_k)^2 \tag{33}$$

The SOC for the problem is:

$$\begin{aligned}\frac{\partial^2 W_k}{\partial \tau_k^2} &= \frac{\partial^2 \pi_k}{\partial \tau_k^2}\left[-(\tau_k - b_k)^2\right] + 2\frac{\partial \pi_k}{\partial \tau_k}[-2(\tau_k - b_k)] - 2\pi_k + \frac{\partial^2 \pi_{-k}}{\partial \tau_k^2}\left[-(\tau_{-k} - b_k)^2\right] \\ &= -4\frac{\partial \pi_k}{\partial \tau_k}(\tau_k - b_k) - 2\pi_k < 0\end{aligned} \tag{34}$$

Substituting the corresponding expressions for π_k and its derivatives from expression (30), equation (34) becomes:

$$4\frac{\alpha}{\Delta z}(\tau_k - b_k) - 2\left[\hat{z}_k + \frac{\alpha}{\Delta z}(\tau_{-k} - \tau_k)\right] < 0$$

Again, using $(\tau_{-k} - \tau_k) = [(\tau_{-k} - b_k) - (\tau_k - b_k)]$, and rearranging the terms, one obtains:

$$3\frac{\alpha}{\Delta z}(\tau_k - b_k) - \frac{\alpha}{\Delta z}(\tau_{-k} - b_k) - \hat{z}_k < 0$$

Substituting the (+) solution of (32), the above expression becomes:

$$3\frac{\alpha}{\Delta z}\left(\left[b_k + \frac{1}{3\alpha}\left\{[\alpha(\tau_{-k} - b_k) + \hat{z}_k \Delta z] + \sqrt{\phi_k}\right\}\right] - b_k\right) - \frac{\alpha}{\Delta z}(\tau_{-k} - b_k) - \hat{z}_k < 0$$

which, simplified, corresponds to:

$$\frac{1}{\Delta z}\sqrt{\phi_k} < 0$$

Under assumption 1.1, the above inequality is never satisfied. Therefore, the $(-)$ solution is the maximum of the function, and represents the best response function:

$$\tau_k = b_k + \frac{1}{3\alpha}\left\{[\alpha(\tau_{-k} - b_k) + \hat{z}_k \Delta z] - \sqrt{\phi_k}\right\} \tag{35}$$

which corresponds to equations (13) and (14).[20]

[20] In the more general case in which the objective function is
$W_D = -\pi_D\left[(\tau_D - b_D)^2 + (z_D - a_D)^2\right] - (1 - \pi_D)\left[(\tau_R - b_D)^2 + (z_R - a_D)^2\right]$
the best response is:
$\tau_D = b_D + \frac{1}{3\alpha}\left\{[\alpha(\tau_R - b_D) + \bar{z}\Delta z] - \sqrt{[\alpha(\tau_R - b_D) + \bar{z}\Delta z]^2 + 3\alpha\left[\alpha(\tau_R - b_D)^2 + 2\alpha\Delta z(\bar{z} - a_D)\right]}\right\}$
Notice that as long as $(z_D - a_D)^2 - (z_R - a_D)^2 = -2\Delta z(\bar{z} - a_D) < 0$, then $(\bar{z} - a_D) > 0$. Hence, the term in braces is negative.
In the special case in which $a_D = z_D$, the last term in the square root reduces to:
$2\alpha\Delta z(\bar{z} - a_D) = \alpha\Delta z^2$.

C.2 Proof of Proposition 1.2

Taking the derivative of the FOC (29) with respect to τ_{-k}, one obtains:

$$\frac{\partial^2 W_k}{\partial \tau_k \partial \tau_{-k}} = \frac{\partial^2 \pi_k}{\partial \tau_k \partial \tau_{-k}}[-(\tau_k - b_k)^2] + \frac{\partial \pi_k}{\partial \tau_{-k}}[-2(\tau_k - b_k)] + \frac{\partial^2 \pi_{-k}}{\partial \tau_k \partial \tau_{-k}}[-(\tau_{-k} - b_k)^2] + \frac{\partial \pi_{-k}}{\partial \tau_k}[-2(\tau_{-k} - b_k)] \tag{36}$$

Substituting the corresponding expressions for π_k and its derivatives from (30), equation (36) reduces to:

$$\frac{\partial^2 W_k}{\partial \tau_k \partial \tau_{-k}} = -2\frac{\alpha}{\Delta z}[(\tau_{-k} - b_k) + (\tau_k - b_k)] \tag{37}$$

By the implicit function theorem, the slope of the best response function is given by $-\frac{\partial^2 W_k / \partial \tau_k \partial t_{-k}}{\partial^2 W_k / \partial \tau_k^2}$. Therefore, the minima/maxima of the best response function for party k are found by setting expression (37) equal to zero. The maxima/minima satisfy:

$$\tau_{-k} = 2b_k - \tau_k \tag{38}$$

Substituting the above expression in the FOC (29), one obtains the following two solutions:

$$\tau_k = b_k \tag{39}$$
$$\tau_k = b_k + \frac{\hat{z}_k \Delta z}{2\alpha}$$

However, only the first of the two solutions satisfies the SOC (34) for the party problem. Therefore, equations (38) and (39) together imply that the maximum/minimum is the point that satisfies:

$$\tau_{-k} = \tau_k = b_k$$

i.e. the maximum (minimum) of the best response function lies along the diagonal of the policy space, in correspondence to the party's own bliss point, b_k.

This solution is a maximum of the best response for $\partial^3 W_k / \partial \tau_k \partial \tau_{-k}^2 < 0$, and a minimum for $\partial^3 W_k / \partial \tau_k \partial \tau_{-k}^2 > 0$. Since $\Delta z > 0$ by assumption 1.1, and

$$\frac{\partial^3 W_k}{\partial \tau_k \partial \tau_{-k}^2} = -2\frac{\alpha}{\Delta z} \tag{40}$$

Thus, if $\xi_r > \xi_p$, the best response function for party k is convex in τ_{-k}, and has a minimum at $\tau_k = \tau_{-k} = b_k$. On the other hand, if $\xi_r < \xi_p$, the function is concave in τ_{-k}, and has a maximum at $\tau_k = \tau_{-k} = b_k$.

If $\xi_r = \xi_p$, from expression (9) for α, it follows that $\alpha = 0$. In such a case, the probability of victory (30) reduces to $\pi_k = \hat{z}_k$, and the FOC (29) reduces to:

$$-2\hat{z}_k(\tau_k - b_k) = 0$$

which is only satisfied for $\tau_k = b_k$. Under assumption 1.1, $0 < \hat{z}_k < 1$. Therefore, this solution satisfies the SOC (34).

Summarizing the above results:

$$\tau_k \begin{cases} \leq b_k & , \quad \text{if } \alpha > 0 \quad (\xi_p > \xi_r) \\ = b_k & , \quad \text{if } \alpha = 0 \quad (\xi_p = \xi_r) \\ \geq b_k & , \quad \text{if } \alpha < 0 \quad (\xi_p < \xi_r) \end{cases} \tag{41}$$

D Proof of Lemma 1

The optimal tax rate τ_k must belong to the interval $[0, 1]$. Thus, equations (13) and (14) must satisfy:

$$\tau_k = b_k + \frac{1}{3\alpha}\left\{[\alpha(\tau_{-k} - b_k) + \hat{z}_k\Delta z] - \sqrt{\phi_k}\right\} \geq 0 \tag{42}$$

D.1 $\xi_r > \xi_p$ $(\alpha < 0)$

When this is the case, $\tau_k \geq b_k$, as apparent from expression (41). As a consequence, condition (42) is always satisfied.

Equations (13) and (14) must also satisfy:

$$\tau_k = b_k + \frac{1}{3\alpha}\left\{[\alpha(\tau_{-k} - b_k) + \hat{z}_k\Delta z] - \sqrt{\phi_k}\right\} \leq 1 \tag{43}$$

It can be expressed as:

$$-\frac{1}{3\alpha}\sqrt{\phi_k} \leq 1 - b_k - \frac{1}{3\alpha}\left[\alpha(\tau_{-k} - b_k) + \hat{z}_k\Delta z\right]$$

or, equivalently,

$$-\frac{1}{3\alpha}\sqrt{\phi_k} \leq 1 - \frac{2}{3}b_k - \frac{1}{3}\tau_{-k} + \frac{1}{3\alpha}\hat{z}_k\Delta z$$

Both sides of the inequality are positive, provided that $\alpha < 0$ and $\tau_{-k} \leq 1$, and that assumptions 1.1 and 1.2 hold. So, taking the square of both sides does not affect the direction of the inequality.

$$\frac{1}{9\alpha^2}\phi_k \leq \left\{1 - b_k - \frac{1}{3\alpha}\left[\alpha(\tau_{-k} - b_k) + \hat{z}_k\Delta z\right]\right\}^2 \tag{44}$$

Substituting expression (33) for ϕ_k and manipulating the inequality, one obtains:

$$\tau_{-k}^2 - 4\tau_{-k}b_k \leq 3 - 4b_k - 2\tau_{-k} - 2(1-b_k)\frac{\hat{z}_k \Delta z}{\alpha}$$

which can be written as:

$$(1-\tau_{-k})\left[2 + (1+\tau_{-k}) - 4b_k\right] - 2(1-b_k)\frac{\hat{z}_k \Delta z}{\alpha} \geq 0$$

The second term at the LHS of the above expression is positive. Hence, a sufficient condition for $\tau_k \leq 1$ is that the first term at the LHS is positive or equal to zero. This is the case when:

$$2 + (1+\tau_{-k}) - 4b_k \geq 0 \implies b_k \leq \frac{3+\tau_{-k}}{4}$$

which is most restrictive when $\tau_{-k} = 0$. Thus,

$$b_k < \frac{3}{4}$$

is a *sufficient* condition for $\tau_k < 1$.

D.2 $\xi_r < \xi_p \quad (\alpha > 0)$

Condition (42) can be rewritten as:

$$b_k + \frac{1}{3\alpha}\left[\alpha(\tau_{-k} - b_k) + \hat{z}_k \Delta z\right] \geq \frac{1}{3\alpha}\sqrt{\phi_k}$$

or, equivalently

$$\frac{2}{3}b_k + \frac{1}{3}\tau_{-k} + \frac{1}{3\alpha}\hat{z}_k \Delta z \geq \frac{1}{3\alpha}\sqrt{\phi_k}$$

Both sides of the inequality are positive, since $\alpha > 0$ and $\tau_{-k} \geq 0$, and provided that assumptions 1.1 and 1.2 hold. So, taking the square of both sides of the inequality yields:

$$\left\{b_k + \frac{1}{3\alpha}\left[\alpha(\tau_{-k} - b_k) + \hat{z}_k \Delta z\right]\right\}^2 \geq \frac{1}{9\alpha^2}\phi_k \tag{45}$$

Substituting expression (33) for ϕ_k, and manipulating the inequality, one obtains:

$$\tau_{-k}(4b_k - \tau_{-k}) + 2\frac{\hat{z}_k \Delta z}{\alpha}b_k \geq 0$$

The second term at the LHS of the inequality is positive. Therefore, a sufficient condition for $\tau_k \geq 0$ is that the first term at the LHS is positive or zero. This is the case when:

$$4b_k - \tau_{-k} \geq 0 \implies b_k \geq \frac{\tau_{-k}}{4}$$

which is most restrictive when $\tau_{-k} = 1$. Hence,

$$b_k > \frac{1}{4}$$

is a *sufficient* condition for $\tau_k > 0$.

Conversely, condition (43) is always satisfied, because in this case $\tau_k \leq b_k$, as apparent from (41).

E Proof of Proposition 2

As showed in Section C.2, the slope of the best response function of party k, $k = D, R$ has the same sign as equation (37):[21]

$$\frac{\partial^2 W_k}{\partial \tau_k \partial \tau_{-k}} = -2\frac{\alpha}{\Delta z}[(\tau_{-k} - b_k) + (\tau_k - b_k)]$$

Figure 2 shows that if the best response functions satisfy all the conditions previously stated, they only cross in one point of the policy space. Also, at the equilibrium, $\tau_D > \tau_R$.

At the equilibrium point, when $\xi_r > \xi_p$ ($\xi_r < \xi_p$), party D's best response function is decreasing (increasing) in τ_R, while party R's best response function is increasing (decreasing) in τ_D.

Therefore, if $k = D$, equation (37) is negative for $\xi_r > \xi_p$, and positive for $\xi_r < \xi_p$. This implies that:

$$(\tau_R - b_D) + (\tau_D - b_D) < 0 \implies (\tau_R - b_D) < -(\tau_D - b_D) \tag{46}$$

Expression (18) implies that the LHS of expression (46) above is always negative, whereas the RHS is negative when $\xi_r > \xi_p$, and positive for $\xi_r < \xi_p$. For condition (46) to hold in the $\xi_r > \xi_p$ case, then, one needs:

$$|\tau_D - b_D| < |\tau_R - b_D| \tag{47}$$

When $\xi_r < \xi_p$, condition (46) is always satisfied. Besides, expression (18) shows that condition (47) holds in this case, too.

[21] By the implicit function theorem, the slope of the best response function is equal to $-\frac{\partial^2 W_k/\partial \tau_k \partial \tau_{-k}}{\partial^2 W_k/\partial \tau_k^2}$, but the denominator of this fraction is always negative, because of the SOC (34).

If $k = R$, equation (37) is positive for $\xi_r > \xi_p$, and negative for $\xi_r < \xi_p$, implying:

$$(\tau_D - b_R) + (\tau_R - b_R) > 0 \implies (\tau_D - b_R) < -(\tau_R - b_R) \tag{48}$$

The LHS of (48) is always positive, because of expression (18). The RHS is negative when $\xi_r > \xi_p$, and positive for $\xi_r < \xi_p$. Similarly to the case discussed above,

$$|\tau_R - b_R| < |\tau_D - b_R|$$

F Comparative statics

Rewriting the best response (35) for party k and its opponent as implicit functions, and labeling them F and G, the equilibrium is defined by the following system of equations:

$$\begin{cases} F\left(\tau_k, \tau_{-k}, \beta\right) = b_k + \frac{1}{3\alpha}\left\{[\alpha(\tau_{-k} - b_k) + \hat{z}_k \Delta z] - \sqrt{\phi_k}\right\} - \tau_k = 0 \\ \\ G\left(\tau_k, \tau_{-k}, \beta\right) = b_{-k} + \frac{1}{3\alpha}\left\{[\alpha(\tau_k - b_{-k}) + (1 - \hat{z}_k)\Delta z] - \sqrt{\phi_{-k}}\right\} - \tau_{-k} = 0 \end{cases}$$

where $\beta = (b_D, b_R, \bar{z}, \Delta z, \alpha)$ is a vector of parameters of the model.

The total differential of the two functions shows the effect of changes in the parameters contained in β on the equilibrium tax rates. Taking the total differential and using $\partial F/\partial \tau_k = \partial G/\partial \tau_{-k} = -1$, the system of perturbed best responses can be written in matrix form:

$$\begin{bmatrix} -1 & \frac{\partial F}{\partial \tau_{-k}} \\ \\ \frac{\partial G}{\partial \tau_k} & -1 \end{bmatrix} \times \begin{bmatrix} d\tau_k \\ \\ d\tau_{-k} \end{bmatrix} = \begin{bmatrix} -\frac{\partial F}{\partial \beta} \\ \\ -\frac{\partial G}{\partial \beta} \end{bmatrix} \times d\beta$$

This system has solution:

$$\frac{d\tau_k}{d\beta} = \frac{\begin{vmatrix} -\frac{\partial F}{\partial \beta} d\beta & \frac{\partial F}{\partial \tau_{-k}} \\ \\ -\frac{\partial G}{\partial \beta} d\beta & -1 \end{vmatrix}}{\begin{vmatrix} -1 & \frac{\partial F}{\partial \tau_{-k}} \\ \\ \frac{\partial G}{\partial \tau_k} & -1 \end{vmatrix}} = \frac{\frac{\partial F}{\partial \beta} + \frac{\partial F}{\partial \tau_{-k}} \frac{\partial G}{\partial \beta}}{1 - \frac{\partial F}{\partial \tau_{-k}} \frac{\partial G}{\partial \tau_k}} \tag{49}$$

One needs to find expressions for all the terms in (49). The term $\partial F/\partial \tau_{-k}$ is equal to:

$$\frac{\partial F}{\partial \tau_{-k}} = \frac{1}{3\alpha}\left[\alpha - \frac{\frac{\partial \phi_k}{\partial \tau_{-k}}}{2\sqrt{\phi_k}}\right]$$

Using expression (33) for ϕ_k to find $\partial\phi_k/\partial\tau_{-k}$, the expression above can be written as:

$$\frac{\partial F}{\partial \tau_{-k}} = -\frac{1}{3\alpha\sqrt{\phi_k}}\left\{3\alpha^2(\tau_{-k}-b_k)+\alpha\left[\alpha(\tau_{-k}-b_k)+\hat{z}_k\Delta z-\sqrt{\phi_k}\right]\right\}$$

$$= -\frac{\alpha}{\sqrt{\phi_k}}\left\{(\tau_{-k}-b_k)+\frac{1}{3\alpha}\left[\alpha(\tau_{-k}-b_k)+\hat{z}_k\Delta z-\sqrt{\phi_k}\right]\right\}$$

Using best response function (35) to substitute for the second term in braces, the expression above can be rewritten as:

$$\frac{\partial F}{\partial \tau_{-k}} = -\frac{\alpha}{\sqrt{\phi_k}}\left[(\tau_{-k}-b_k)+(\tau_k-b_k)\right] \tag{50}$$

Similarly, for the other party,

$$\frac{\partial G}{\partial \tau_k} = \frac{1}{3\alpha}\left[\alpha-\frac{\frac{\partial\phi_{-k}}{\partial\tau_k}}{2\sqrt{\phi_{-k}}}\right] = -\frac{\alpha}{\sqrt{\phi_{-k}}}\left[(\tau_k-b_{-k})+(\tau_{-k}-b_{-k})\right] \tag{51}$$

From Proposition 2.2, it follows that $\partial F/\partial\tau_{-k}$ and $\partial G/\partial\tau_k$ always have opposite signs. Therefore, the denominator of (49) is always positive, and the sign of the effect of β on the equilibrium tax rates only depends on the sign of the numerator.

F.1 Proof of Proposition 3

The effect of an increase in inequality on τ_k has the same sign as:

$$\frac{\partial F}{\partial(y_r-y_p)}+\frac{\partial F}{\partial\tau_{-k}}\frac{\partial G}{\partial(y_r-y_p)} \tag{52}$$

The first term represents the direct effect of an increase in inequality on τ_k, while the second term represents the strategic effect, that takes into account the other party's reaction.

The derivative of F with respect to (y_r-y_p) is:

$$\frac{\partial F}{\partial(y_r-y_p)} = \frac{\partial F}{\partial\alpha}\frac{\partial\alpha}{\partial(y_r-y_p)} = \frac{1}{3\alpha^2\sqrt{\phi_k}}\left[-\frac{\alpha}{2}\frac{\partial\phi_k}{\partial\alpha}-\hat{z}_k\Delta z\sqrt{\phi_k}-\phi_k\right]\frac{\partial\alpha}{\partial(y_r-y_p)}$$

Substituting ϕ_k and $\partial\phi_k/\partial\alpha$ using (33) and manipulating the expression yields:

$$\frac{\partial F}{\partial(y_r-y_p)} = \frac{\hat{z}_k\Delta z}{\alpha\sqrt{\phi_k}}\left\{\frac{1}{3\alpha}\left[\alpha(\tau_{-k}-b_k)+\hat{z}_k\Delta z-\sqrt{\phi_k}\right]\right\}\frac{\partial\alpha}{\partial(y_r-y_p)}$$

Using (35) to substitute for the expression in braces, $\partial F/\partial(y_r - y_p)$ becomes:

$$\frac{\partial F}{\partial(y_r - y_p)} = \frac{\hat{z}_k \Delta z}{\alpha\sqrt{\phi_k}}(\tau_k - b_k)\frac{\partial \alpha}{\partial(y_r - y_p)} \tag{53}$$

Symmetrically, $\partial G/\partial(y_r - y_p)$ is

$$\frac{\partial G}{\partial(y_r - y_p)} = \frac{(1-\hat{z}_k)\Delta z}{\alpha\sqrt{\phi_{-k}}}(\tau_{-k} - b_{-k})\frac{\partial \alpha}{\partial(y_r - y_p)} \tag{54}$$

F.1.1 $\xi_r > \xi_p \quad (\alpha < 0)$

In this case, $\partial\alpha/\partial(y_r - y_p) < 0$. So, it follows from Proposition 2 that (53) and (54) are positive.

If $k = D$, $\partial F/\partial\tau_{-k}$ is negative. Therefore, the first term of (52) is positive, while the second one is negative. It follows that an increase in inequality *increases* τ_D only if the direct effect is stronger than the strategic effect; that is, when

$$\begin{gathered}\frac{\partial F}{\partial(y_r - y_p)} + \frac{\partial F}{\partial\tau_{-k}}\frac{\partial G}{\partial(y_r - y_p)} > 0 \implies \\ \frac{\partial G}{\partial(y_r - y_p)} < -\frac{\partial F/\partial(y_r - y_p)}{\partial F/\partial\tau_{-k}} \implies \frac{\partial G}{\partial\alpha} > -\frac{\partial F/\partial\alpha}{\partial F/\partial\tau_{-k}}\end{gathered} \tag{55}$$

Substituting expression (50) for $\partial F/\partial\tau_{-k}$ and the direct effects (53) and (54), the above expression becomes:

$$\frac{(1-\hat{z}_k)\Delta z}{\alpha\sqrt{\phi_{-k}}}(\tau_{-k} - b_{-k}) > \frac{\hat{z}_k\Delta z}{\alpha^2}\frac{(\tau_k - b_k)}{[(\tau_{-k} - b_k) + (\tau_k - b_k)]}$$

Manipulating the inequality, one obtains:

$$\frac{\alpha(1-\hat{z}_k)(\tau_{-k} - b_{-k})(\tau_{-k} - b_k)}{(\tau_k - b_k)} < \hat{z}_k\sqrt{\phi_{-k}} - \alpha(1-\hat{z}_k)(\tau_{-k} - b_{-k})$$

Expressing $(\tau_{-k} - b_k) = [(\tau_{-k} - \tau_k) + (\tau_k - b_k)]$ and manipulating the expression yields:

$$\frac{\alpha(1-\hat{z}_k)(\tau_{-k} - b_{-k})(\tau_{-k} - \tau_k)}{(\tau_k - b_k)} < \hat{z}_k\sqrt{\phi_k} - 2\alpha(1-\hat{z}_k)(\tau_{-k} - b_{-k})$$

which implies

$$\tau_k - \tau_{-k} < \frac{2\alpha(1-\hat{z}_k)(\tau_{-k} - b_{-k}) - \hat{z}_k\sqrt{\phi_{-k}}}{\alpha(1-\hat{z}_k)(\tau_{-k} - b_{-k})}(\tau_k - b_k) \tag{56}$$

which, in turn, corresponds to expression (21).

For $k = R$, $\partial F/\partial\tau_{-k}$ is positive. In this case, both terms of expression (52) are positive, and τ_R always *increases.*

F.1.2 $\xi_r < \xi_p \quad (\alpha > 0)$

If this is the case, $\partial\alpha/\partial(y_r - y_p) > 0$, so expressions $\partial F/\partial(y_r - y_p)$ and $\partial G/\partial(y_r - y_p)$ in (53) and (54) are always negative.

For $k = D$, $\partial F/\partial\tau_{-k}$ is positive. Therefore, the effect of inequality (52) is always negative, and τ_D will always *decrease*.

For $k = R$, $\partial F/\partial\tau_{-k}$ is negative, hence the τ_R increases if (55) holds. As a result, τ_R *decreases* when condition (56) does *not* hold or, equivalently, when condition (22) is satisfied.

F.2 Proof of Proposition 4

Denote $\omega = (z_R, z_D, \Delta z)$ the vector of parameters governing party polarization. In particular, polarization is defined by an increase in Δz or z_R (a movement to the right by party R,) or by a decrease in z_D (a movement to the left of party D.)

The effect on τ_k of increased polarization depends on the sign of:

$$\frac{\partial F}{\partial\omega} + \frac{\partial F}{\partial\tau_{-k}}\frac{\partial G}{\partial\omega}$$

The first term represents the direct effect of an increase in polarization, while the second term represents the strategic effect.

The derivative of F with respect to one of the components of ω is:

$$\frac{\partial F}{\partial\omega} = \frac{1}{3\alpha}\left\{\left[\Delta z\frac{\partial\hat{z}_k}{\partial\omega} + \hat{z}_k\frac{\partial\Delta z}{\partial\omega}\right] - \frac{\partial\phi_k/\partial\omega}{2\sqrt{\phi_k}}\right\} = \frac{1}{3\alpha}\left\{\Gamma - \frac{\partial\phi_k/\partial\omega}{2\sqrt{\phi_k}}\right\}$$

where:

$$\Gamma = \Delta z\frac{\partial\hat{z}_k}{\partial\omega} + \hat{z}_k\frac{\partial\Delta z}{\partial\omega} \tag{57}$$

Substituting $\partial\phi_k/\partial\omega$ using expression (33), $\partial F/\partial\omega$ can be rewritten as:

$$\frac{\partial F}{\partial\omega} = -\frac{\Gamma}{\sqrt{\phi_k}}\left\{\frac{1}{3\alpha}\left[\alpha(\tau_{-k} - b_k) + \hat{z}_k\Delta z - \sqrt{\phi_k}\right]\right\}$$

Using (35) to substitute the expression in braces, $\partial F/\partial\omega$ becomes:

$$\frac{\partial F}{\partial\omega} = -\frac{\Gamma}{\sqrt{\phi_k}}(\tau_k - b_k) \tag{58}$$

Similarly, the derivative of G with respect to ω is:

$$\frac{\partial G}{\partial\omega} = -\frac{\Lambda}{\sqrt{\phi_{-k}}}(\tau_{-k} - b_{-k}) \tag{59}$$

where:

$$\begin{aligned}\Lambda &= \Delta z \frac{\partial(1-\hat{z}_k)}{\partial \omega} + (1-\hat{z}_k)\frac{\partial \Delta z}{\partial \omega} \\ &= \frac{\partial \Delta z}{\partial \omega} - \Gamma\end{aligned} \tag{60}$$

Symmetric polarization

When the parties symmetrically polarize, Δz increases, but the midpoint $\bar{z}$ (and therefore $\hat{z}_k$) remains the same. The level of redistribution τ_k *increases* only if:

$$\frac{\partial F}{\partial \omega} + \frac{\partial F}{\partial \tau_{-k}} \frac{\partial G}{\partial \omega} > 0 \tag{61}$$

In case of symmetric polarization Γ and Λ in (57) and (60) are, respectively:

$$\Gamma = \begin{cases} \bar{z} > 0 & \text{if} \quad k = D \\ 1-\bar{z} > 0 & \text{if} \quad k = R \end{cases} \tag{62}$$

$$\Lambda = \begin{cases} 1-\bar{z} > 0 & \text{if} \quad k = D \\ \bar{z} > 0 & \text{if} \quad k = R \end{cases} \tag{63}$$

where the values for $k = D, R$ are found by substituting the corresponding values for $\hat{z}_k$ from (31).

F.2.1 $\xi_r > \xi_p \quad (\alpha < 0)$

Since Γ and Λ are positive, Proposition 2 implies that both $\partial F/\partial \omega$ and $\partial G/\partial \omega$ are negative when $\xi_r > \xi_p$.

The sign of $\partial F/\partial \tau_{-k}$ depends on the identity of party k. If $k = D$, $\partial F/\partial \tau_{-k}$ is negative.

Therefore, the first and second term of (61) have opposite signs, and the tax rate τ_k increases only if:

$$\frac{\partial G}{\partial \omega} < -\frac{\partial F/\partial \omega}{\partial F/\partial \tau_{-k}} \tag{64}$$

Substituting the corresponding expression for $\partial F/\partial \tau_{-k}$, (50), and the direct effects of polarization (58), and (59), the above condition can be expressed as:

$$\frac{\Lambda}{\sqrt{\phi_{-k}}}(\tau_{-k} - b_{-k}) > \frac{\Gamma(\tau_k - b_k)}{\alpha[(\tau_{-k} - b_k) + (\tau_k - b_k)]}$$

Manipulating the inequality, one obtains:

$$\frac{\alpha\Lambda(\tau_{-k}-b_{-k})(\tau_{-k}-b_k)}{(\tau_k-b_k)} > \Gamma\sqrt{\phi_{-k}} - \alpha\Lambda(\tau_{-k}-b_{-k})$$

Expressing $(\tau_{-k}-b_k) = [(\tau_{-k}-\tau_k)+(\tau_k-b_k)]$ and manipulating the expression yields:

$$\frac{\alpha\Lambda(\tau_{-k}-b_{-k})(\tau_{-k}-\tau_k)}{(\tau_k-b_k)} > \Gamma\sqrt{\phi_{-k}} - 2\alpha\Lambda(\tau_{-k}-b_{-k})$$

which implies

$$\tau_{-k}-\tau_k < \frac{\Gamma\sqrt{\phi_{-k}} - 2\alpha\Lambda(\tau_{-k}-b_{-k})}{\alpha\Lambda(\tau_{-k}-b_{-k})}(\tau_k-b_k)$$

that is:

$$\tau_k-\tau_{-k} > \frac{2\alpha\Lambda(\tau_{-k}-b_{-k}) - \Gamma\sqrt{\phi_{-k}}}{\alpha\Lambda(\tau_{-k}-b_{-k})}(\tau_k-b_k) \tag{65}$$

Hence, party D's redistribution *decreases* when the above condition is *not* satisfied. Substituting Γ and Λ using (62) and (63), party D's tax rate decreases when:

$$\tau_D-\tau_R < \frac{2\alpha(1-\bar{z})(\tau_R-b_R) - \bar{z}\sqrt{\phi_R}}{\alpha(1-\bar{z})(\tau_R-b_R)}(\tau_D-b_D)$$

which is condition (23).

Notice that the ratio at the RHS of (23) is positive and larger than one. Hence, the condition implies that symmetric polarization increases party D's tax rate only if the difference between τ_D and τ_R is large enough, relative to the difference between τ_D and b_D.

In contrast, if $k = R$, $\partial F/\partial\tau_{-k}$ is positive. Therefore, condition (61) is never satisfied, and τ_R always *decreases* following an increase in Δz.

F.2.2 $\xi_r < \xi_p$ $(\alpha > 0)$

In this case, both $\partial F/\partial\omega$ and $\partial G/\partial\omega$ are positive by Proposition 2.

Also, if $k = D$, $\partial F/\partial\tau_{-k}$ is positive. Hence, condition (61) is always satisfied, and τ_D always *increases* as a result of polarization.

If $k = R$, $\frac{\partial F}{\partial\tau_{-k}}$ is negative. Therefore, party R's tax rate *increases* when condition (64) is satisfied; that is, when inequality (65) holds.

Substituting Γ and Λ, and the corresponding values for $\hat{z}_k$, the condition (65) can be rewritten as:

$$\tau_R-\tau_D > \frac{2\alpha\bar{z}(\tau_D-b_D) - (1-\bar{z})\sqrt{\phi_D}}{\alpha\bar{z}(\tau_D-b_D)}(\tau_R-b_R)$$

which is equivalent to condition (24).

Notice that, also in this case, the ratio at the RHS of the above condition is positive and larger than one.

Polarization of party R

When party R polarizes, Γ and Λ in (57) and (60) are, respectively:

$$\Gamma = \hat{z}_k - \frac{\Delta z}{2}\frac{\partial \Delta z}{\partial z_k} = \begin{cases} z_R > 0 & \text{if} \quad k = D \\ 1 - z_R > 0 & \text{if} \quad k = R \end{cases} \tag{66}$$

$$\Lambda = 1 - \Gamma = \begin{cases} 1 - z_R > 0 & \text{if} \quad k = D \\ z_R > 0 & \text{if} \quad k = R \end{cases} \tag{67}$$

The signs of Γ and Λ are the same as in the case of symmetric polarization. Therefore, $\partial F/\partial \omega$ and $\partial G/\partial \omega$ have the same sign as before, and all the previous considerations apply.

F.2.3 $\xi_r > \xi_p$ $(\alpha < 0)$

In this case, if $k = D$, the party's tax rate *decreases* if condition (65) does *not* apply. Substituting Γ and Λ from (66) and (67), party D's tax rate decreases when:

$$\tau_D - \tau_R < \frac{2\alpha(1 - z_R)(\tau_R - b_R) - z_R\sqrt{\phi_R}}{\alpha(1 - z_R)(\tau_R - b_R)}(\tau_D - b_D)$$

which is condition (23).

If $k = R$, the tax rate τ_k *decreases*, because condition (61) is never satisfied.

F.2.4 $\xi_r < \xi_p$ $(\alpha > 0)$

If $k = D$, condition (61) is always satisfied. Therefore, party D's tax rate *increases* because of increased polarization.

If $k = R$, party R's tax rate *increases* if condition (65) holds; that is, when:

$$\tau_R - \tau_D > \frac{2\alpha z_R(\tau_D - b_D) - (1 - z_R)\sqrt{\phi_D}}{\alpha z_R(\tau_D - b_D)}(\tau_R - b_R)$$

which is equivalent to condition (24).

Polarization of party D

In case of polarization triggered by party D, Γ and Λ in (57) and (60) are, respectively:

$$\Gamma = -\hat{z}_k - \frac{\Delta z}{2}\frac{\partial \Delta z}{\partial z_k} = \begin{cases} -z_D < 0 & \text{if} \quad k = D \\ -(1 - z_D) < 0 & \text{if} \quad k = R \end{cases} \tag{68}$$

$$\Lambda = -1 - \Gamma \qquad = \begin{cases} -(1 - z_D) < 0 & \text{if} \quad k = D \\ -z_D > 0 & \text{if} \quad k = R \end{cases} \tag{69}$$

Since polarization of party D means that z_D has decreased, moving towards the left, polarization *decreases* the tax rate τ_k if (61) is satisfied.

F.2.5 $\quad \xi_r > \xi_p \quad (\alpha < 0)$

Since Γ and Λ are negative, Proposition 2 implies that both $\partial F/\partial \omega$ and $\partial G/\partial \omega$ are positive when $\xi_r > \xi_p$.

If $k = D$, τ_k decreases when condition (64) is satisfied, which implies[22]

$$\tau_k - \tau_{-k} > \frac{2\alpha\Lambda(\tau_{-k} - b_{-k}) - \Gamma\sqrt{\phi_{-k}}}{\alpha\Lambda(\tau_{-k} - b_{-k})}(\tau_k - b_k) \tag{70}$$

Substituting Γ and Λ from (68) and (69), party D's tax rate decreases when:

$$\tau_D - \tau_R < \frac{-2\alpha(1 - z_D)(\tau_R - b_R) + z_D\sqrt{\phi_R}}{-\alpha(1 - z_D)(\tau_R - b_R)}(\tau_D - b_D)$$

which is equivalent to condition (23).

If $k = R$, (61) is always satisfied, and the tax rate proposed by party R *decreases* as a result of polarization.

F.2.6 $\quad \xi_r < \xi_p \quad (\alpha > 0)$

When this is the case, $\partial F/\partial \omega$ and $\partial G/\partial \omega$ are negative.

If $k = D$, (64) is never satisfied, and τ_k *increases* as an effect of polarization.

On the other hand, if $k = R$, the tax rate τ_k decreases if (64) is satisfied; that is, when condition (70) holds. Thus, it *increases* when:

$$\tau_k - \tau_{-k} < \frac{2\alpha\Lambda(\tau_{-k} - b_{-k}) - \Gamma\sqrt{\phi_{-k}}}{\alpha\Lambda(\tau_{-k} - b_{-k})}(\tau_k - b_k)$$

[22] The direction of the inequality is reversed, compared to (65), because of the sign of Γ and Λ.

Substituting Γ and Λ from (68) and (69), party D's tax rate *decreases* when:

$$\tau_R - \tau_D < \frac{-2\alpha z_D(\tau_D - b_D) + z_D\sqrt{\phi_D}}{-\alpha z_D(\tau_D - b_D)}(\tau_R - b_R)$$

which is equivalent to condition (24).

G Extended model

G.1 Best response functions

Party k's objective function is:

$$W_k = \pi_k \left[-(\tau_k - b_k)^2 - \psi_k (z_k - a_k)^2\right] + (1-\pi_k)\left[-(\tau_{-k} - b_k)^2 - \psi_k (z_{-k} - a_k)^2\right]$$

where $\psi_k > 0$ is a penalty parameter representing party k's intensity of ideological preferences.

The above equation can be rewritten as:

$$W_k = \pi_k \left[(\tau_{-k} - b_k)^2 - (\tau_k - b_k)^2 + \psi_k A_k\right] - (\tau_{-k} - b_k)^2 - \psi_k (z_{-k} - a_k)^2 \tag{71}$$

where $A_k = (z_{-k} - a_k)^2 - (z_k - a_k)^2 = 2(z_{-k} - z_k)(\bar{z} - a_k)$. Since $a_D = 0$ and $a_R = 1$, the variable A_k is equal to $A_D = 2\bar{z}\Delta z$ for party D, and $A_R = 2(1-\bar{z})\Delta z$ for party R. Therefore, using expression (31), for the generic party k, A_k can be rewritten as:

$$A_k = 2\hat{z}_k \Delta z$$

Hence, equation (72) becomes:

$$W_k = \pi_k \left[(\tau_{-k} - b_k)^2 - (\tau_k - b_k)^2 + 2\psi_k \hat{z}_k \Delta z\right] - (\tau_{-k} - b_k)^2 - \psi_k (z_{-k} - a_k)^2 \tag{72}$$

The FOC for the maximization of payoff function (72) is:

$$\frac{\partial W_k}{\partial \tau_k} = \frac{\partial \pi_k}{\partial \tau_k}[(\tau_{-k} - b_k)^2 - (\tau_k - b_k)^2 + 2\psi_k \hat{z}_k \Delta z] + \pi_k[-2(\tau_k - b_k)] = 0 \tag{73}$$

Substituting the expressions for π_k and π_{-k} and the relative derivatives from equation (30), and using $(\tau_{-k} - \tau_k) = [(\tau_{-k} - b_k) - (\tau_k - b_k)]$, equation (73) becomes:

$$3\alpha(\tau_k - b_k)^2 - 2\left[\alpha(\tau_{-k} - b_k) + \hat{z}_k \Delta z\right](\tau_k - b_k) - \alpha\left[(\tau_{-k} - b_k)^2 + 2\psi_k \hat{z}_k \Delta z\right] = 0$$

which is a second degree equation in $(\tau_k - b_k)$, with positive discriminant

$$\Delta = 4\left\{[-\alpha(\tau_{-k} - b_k) - \hat{z}_k\Delta z]^2 + 3\alpha^2\left[(\tau_{-k} - b_k)^2 + 2\psi_k\hat{z}_k\Delta z\right]\right\}$$

$$= 4\left\{[\alpha(\tau_{-k} - b_k) + \hat{z}_k\Delta z]^2 + 3\alpha^2\left[(\tau_{-k} - b_k)^2 + 2\psi_k\hat{z}_k\Delta z\right]\right\} = 4\phi_k$$

The SOC of the problem is:

$$\begin{aligned}\frac{\partial^2 W_k}{\partial\tau_k^2} &= \frac{\partial^2\pi_k}{\partial\tau_k^2}[(\tau_{-k} - b_k)^2 - (\tau_k - b_k)^2 + 2\psi_k\hat{z}_k\Delta z] + 2\frac{\partial\pi_k}{\partial\tau_k}[-2(\tau_k - b_k)] - 2\pi_k \\ &= -4\frac{\partial\pi_k}{\partial\tau_k}(\tau_k - b_k) - 2\pi_k < 0\end{aligned} \tag{74}$$

It is the same expression as in (34), implying that, of the two conjugate solutions to the FOC, the one with the $(-)$ sign satisfies both the FOC and the SOC. Therefore, the best response function of party k is the same as in expression (35), with the only difference that, in this case, ϕ_k is defined as:

$$\phi_k = [\alpha(\tau_{-k} - b_k) + \hat{z}_k\Delta z]^2 + 3\alpha^2\left[(\tau_{-k} - b_k)^2 + 2\psi_k\hat{z}_k\Delta z\right] \tag{75}$$

In order to study the shape of the best response function, one must take its derivative with respect to the tax rate of the opposing party, τ_{-k}.

$$\frac{\partial^2 W_k}{\partial\tau_k\partial\tau_{-k}} = \frac{\partial^2\pi_k}{\partial\tau_k\partial\tau_{-k}}[(\tau_{-k}-b_k)^2-(\tau_k-b_k)^2+2\psi_k\hat{z}_k\Delta z]+\frac{\partial\pi_k}{\partial\tau_{-k}}[-2(\tau_k-b_k)]+\frac{\partial\pi_{-k}}{\partial\tau_k}[-2(\tau_{-k}-b_k)] \tag{76}$$

Substituting the corresponding expressions for π_k and its derivatives from (30), equation (76) reduces to:

$$\frac{\partial^2 W_k}{\partial\tau_k\partial\tau_{-k}} = -2\frac{\alpha}{\Delta z}[(\tau_{-k} - b_k) + (\tau_k - b_k)]$$

which is the same expression as in (37). Therefore, also in this case, the maxima/minima satisfy (38); that is,

$$\tau_{-k} = 2b_k - \tau_k$$

Substituting it in the FOC (73), and using expression (30) for π_k and its derivatives, one obtains the following two solutions:

$$\tau_k = b_k + \frac{1}{4\alpha}\left[\hat{z}_k\Delta z - \sqrt{\beta_k}\right] \tag{77}$$

$$\tau_k = b_k + \frac{1}{4\alpha}\left[\hat{z}_k \Delta z + \sqrt{\beta_k}\right]$$

where $\beta_k = \hat{z}_k^2 \Delta z^2 + 8\alpha^2 \psi_k \hat{z}_k \Delta z$.

Only the first of the two solutions satisfies the SOC (74). Therefore, that represents the value of the maximum/minimum of the function. Substituting expression (77) back in (38), one obtains that the maximum/minimum is found for

$$\tau_{-k} = b_k - \frac{1}{4\alpha}\left[\hat{z}_k \Delta z - \sqrt{\beta_k}\right] \tag{78}$$

Since the slope of the best response functions $\partial^2 W_k / \partial \tau_k \partial \tau_{-k}$ is the same as in the baseline model, also their concavity/convexity $\partial^3 W_k / \partial \tau_k \partial \tau_{-k}^2$ is the same as in expression (40). Thus, as in the baseline model, the best response function for party k is convex in τ_{-k} (and (77) is a minimum) for $\xi_r > \xi_p$. Conversely, the best response in concave (and (77) is a maximum) for $\xi_r < \xi_p$.

In contrast with the baseline model, the maximum/minimum of the best response function does not lie along the diagonal of the policy space. In particular, when $\xi_r > \xi_p$ ($\alpha < 0$,) τ_k is *strictly* greater than b_k, for any value of τ_{-k}, whereas it is *strictly* less than b_k for any value of τ_{-k} when $\xi_r < \xi_p$ ($\alpha > 0$.) I.e. expression (41) becomes:

$$\tau_k \begin{cases} < b_k & , \quad \text{if } \alpha > 0 \quad (\xi_p > \xi_r) \\ = b_k & , \quad \text{if } \alpha = 0 \quad (\xi_p = \xi_r) \\ > b_k & , \quad \text{if } \alpha < 0 \quad (\xi_p < \xi_r) \end{cases} \tag{79}$$

G.2 Corner solutions and possible multiple equilibria

The exclusion of corner solutions for the parties tax rates also excludes the possibility of multiple equilibria. Expressions (42) and (43) state the conditions under which the tax rate τ_k lie in the $[0, 1]$ interval.

For $\xi_r > \xi_p$, condition (42) is always satisfied because of (79). On the other hand, condition (43) can be rewritten as in (44):

$$\frac{1}{9\alpha^2}\phi_k \leq \left\{1 - b_k - \frac{1}{3\alpha}\left[\alpha(\tau_{-k} - b_k) + \hat{z}_k \Delta z\right]\right\}^2$$

Substituting expression (75) for ϕ_k and manipulating the inequality, one obtains:

$$(1 - \tau_{-k})\left[2 + (1 + \tau_{-k}) - 4b_k\right] - 2\psi_k \hat{z}_k \Delta z - 2(1 - b_k)\frac{\hat{z}_k \Delta z}{\alpha} \geq 0$$

Sufficient conditions for $\tau_k \leq 1$ are expressed by the system:

$$\begin{cases} (1-\tau_{-k})\left[2+(1+\tau_{-k})-4b_k\right] \geq 0 & (80) \\ \\ -2\psi_k \hat{z}_k \Delta z - 2(1-b_k)\dfrac{\hat{z}_k \Delta z}{\alpha} \geq 0 & (81) \end{cases}$$

Expression (80) implies:

$$b_k \leq \frac{3+\tau_{-k}}{4}$$

which is most restrictive for $\tau_{-k}=0$. Equation (81) implies:

$$\psi_k \leq -\frac{(1-b_k)}{\alpha}$$

which is positive, since $\alpha < 0$ and $b_k < 1$. Hence, $b_k \leq 3/4$ is a sufficient condition for $\tau_k \leq 1$, so long as the penalty parameter ψ_k is not too big; that is, so long as parties do not attach a very large weight to ideology.

For $\xi_r < \xi_p$, condition (42) for $\tau_k \geq 0$ can be rewritten as in expression (45):

$$\left\{b_k + \frac{1}{3\alpha}\left[\alpha(\tau_{-k}-b_k)+\hat{z}_k\Delta z\right]\right\}^2 \geq \frac{1}{9\alpha^2}\phi_k$$

Substituting expression (75) for ϕ_k and manipulating the inequality, one obtains:

$$\tau_{-k}(4b_k-\tau_{-k}) - 2\psi_k\hat{z}_k\Delta z + 2\frac{\hat{z}_k\Delta z}{\alpha}b_k \geq 0$$

Sufficient conditions for $\tau_k \leq 1$ are expressed by the system:

$$\begin{cases} \tau_{-k}\left(4b_k-\tau_{-k}\right) \geq 0 & (82) \\ \\ -2\psi_k \hat{z}_k \Delta z + 2\dfrac{\hat{z}_k \Delta z}{\alpha}b_k \geq 0 & (83) \end{cases}$$

Expression (82) implies:

$$b_k \leq \frac{\tau_{-k}}{4}$$

which is most restrictive for $\tau_{-k}=1$. Equation (83) implies:

$$\psi_k \leq \frac{b_k}{\alpha}$$

The RHS of the inequality is positive, since both α and b_k are positive. Again, $b_k \geq 1/4$ is a sufficient condition for $\tau_k \geq 0$, so long as the penalty parameter ψ_k is not too big.

Besides, condition (43) is always satisfied, because of (79).

G.3 Equilibrium

Figure 5 shows the best response functions and the equilibria in the extended model. The only difference from the baseline model is that the minimum/maximum of the best response function does not lie along the main diagonal of the policy space. As a result, stability of the equilibrium and the properties derived in Proposition 2 are not automatically achieved.

In order to assure stability (and the properties of Proposition 2), one needs to impose additional conditions. Suppose $\xi_r > \xi_p$, as in the top panel of Figure 5, and consider point A. It is the projection of the minimum of the best response of party D, point M^D, on the best response function of R. The equilibrium is stable only if $\tau_R(M^D) > \tau_R(A)$. When $\xi_r < \xi_p$ (bottom panel of Figure 5,) the equilibrium is stable if $\tau_D(M^R) < \tau_D(A)$.

As a convention, denote by k the party to which point A belongs, and by $-k$ the party which point M belongs to. Hence, for $\xi_r > \xi_p$ party k is party R, while for for $\xi_r < \xi_p$ it is party D.

Point A has coordinates:

$$\tau_{-k}(A) = \tau_{-k}(M^{-k}) = b_{-k} + \frac{1}{4\alpha}\left[(1-\hat{z}_k)\Delta z - \sqrt{\beta_{-k}}\right]$$

$$\tau_k(A) = \tau_k\big|_{\tau_{-k}=\tau_{-k}(M^{-k})}$$

Substituting $\tau_{-k}(A)$ in the expression for τ_k in (35) yields:

$$\tau_k(A) = b_k + \frac{1}{3}(b_{-k} - b_k) + \frac{(1-\hat{z}_k)\Delta z - \sqrt{\beta_{-k}}}{12\alpha} + \frac{\hat{z}_k \Delta z - \sqrt{\tilde{\phi}_k}}{3\alpha}$$

where $\tilde{\phi}_k$ is ϕ_k, evaluated at $\tau_{-k} = \tau_{-k}(M^{-k})$.

The value of $\tau_k(M^{-k})$ is given by expression (78).

For $\xi_r > \xi_p$, the equilibrium is stable if $\tau_k(M^{-k}) > \tau_k(A)$; that is:

$$b_{-k} - \frac{1}{4\alpha}\left[(1-\hat{z}_k)\Delta z - \sqrt{\beta_{-k}}\right] > b_k + \frac{1}{3}(b_{-k} - b_k) + \frac{(1-\hat{z}_k)\Delta z - \sqrt{\beta_{-k}}}{12\alpha} + \frac{\hat{z}_k \Delta z - \sqrt{\tilde{\phi}_k}}{3\alpha}$$

Manipulating the equation and recalling that party k is party R and $\alpha < 0$ when $\xi_r > \xi_p$, one obtains:

$$b_D - b_R > \frac{\Delta z - \left(\sqrt{\beta_D} + \sqrt{\tilde{\phi}_R}\right)}{2\alpha}$$

that is, the equilibrium is stable if the bliss points of the two parties are different enough.

Similarly, when $\xi_r < \xi_p$, the equilibrium is stable if $\tau_D(M^R) < \tau_D(A)$; that is if $\tau_k(M^{-k}) <$

$\tau_k(A)$. The condition under which this is satisfied is:

$$b_{-k} - \frac{1}{4\alpha}\left[(1-\hat{z}_k)\Delta z - \sqrt{\beta_{-k}}\right] < b_k + \frac{1}{3}(b_{-k} - b_k) + \frac{(1-\hat{z}_k)\Delta z - \sqrt{\beta_{-k}}}{12\alpha} + \frac{\hat{z}_k \Delta z - \sqrt{\tilde{\phi_k}}}{3\alpha}$$

which can be expressed as:

$$b_D - b_R > -\frac{\Delta z - \left(\sqrt{\beta_R} + \sqrt{\tilde{\phi_D}}\right)}{2\alpha}$$

G.4 Comparative statics

The expressions for $\partial F/\partial \tau_{-k}$ and $\partial G/\partial \tau_k$ in Section F are not qualitatively affected. Also in the extended model, they are equal to equations (50) and (51).

G.4.1 Income inequality

The expressions for $\partial F/\partial(y_r - y_p)$ and $\partial G/\partial(y_r - y_p)$ are the same as in equations (53) and (54). Differently from the baseline model, however, the position of the maximum/minimum of the best response changes, and moves in the same direction as the rest of the best response function.

G.4.2 Party polarization

The expressions for $\partial F/\partial \omega$ and $\partial G/\partial \omega$ are different than (58) and (59) in the baseline model. The general expression for $\partial F/\partial \omega$ is still:

$$\frac{\partial F}{\partial \omega} = \frac{1}{3\alpha}\left\{\Gamma - \frac{\partial \phi_k/\partial \omega}{2\sqrt{\phi_k}}\right\}$$

where Γ is defined as in (57). However, the expression for $\partial \phi_k/\partial \omega$ becomes:

$$\frac{\partial \phi_k}{\partial \omega} = 2\left[\alpha(\tau_{-k} - b_k) + \hat{z}_k \Delta z\right]\left[\frac{\partial \hat{z}_k}{\partial \omega}\Delta z + \hat{z}_k \frac{\partial \Delta z}{\partial \omega}\right] + 6\alpha^2 \psi_k \left[\frac{\partial \hat{z}_k}{\partial \omega}\Delta z + \hat{z}_k \frac{\partial \Delta z}{\partial \omega}\right]$$

Using the definition for Γ, the above expression can be rewritten as:

$$\frac{\partial \phi_k}{\partial \omega} = 2\Gamma\left[\alpha(\tau_{-k} - b_k) + \hat{z}_k \Delta z + 3\alpha^2 \psi_k\right]$$

It follows that $\partial F/\partial \omega$ and $\partial G/\partial \omega$ are, respectively:

$$\frac{\partial F}{\partial \omega} = -\frac{\Gamma}{\sqrt{\phi_k}}\left[(\tau_k - b_k) - \alpha \psi_k\right] \tag{84}$$

$$\frac{\partial G}{\partial \omega} = -\frac{\Lambda}{\sqrt{\phi_{-k}}}\left[(\tau_{-k} - b_{-k}) - \alpha\psi_{-k}\right]$$

Symmetric polarization In such a case, $\Gamma = \hat{z}_k > 0$. Expression $\partial F/\partial \Delta z$ is positive when:

$$\frac{\partial F}{\partial \Delta z} = -\frac{\hat{z}_k}{\sqrt{\phi_k}}\left[(\tau_k - b_k) - \alpha\psi_k\right] > 0$$

which is satisfied for:

$$\tau_k < b_k + \alpha\psi_k \tag{85}$$

For $\xi_r > \xi_p$, the LHS of the expression above is smaller than b_k. However, it is always the case that $\tau_k > b_k$ when $\xi_r > \xi_p$. Hence, expression (85) is never satisfied, and $\partial F/\partial \Delta z$ is always negative, as in the baseline model. The same reasoning applies to $\partial G/\partial \omega$. In contrast, when $\xi_r < \xi_p$ the LHS of (85) is greater than b_k, while the best response function has $\tau_k < b_k$. Thus, the expression is always satisfied, and $\partial F/\partial \Delta z$ is positive, as in the baseline model.

Polarization of party R In this case, $\Gamma = \hat{z}_k - (\Delta z/2)(\partial \Delta z/\partial z_k) > 0$. Expression (84) is positive when:

$$\frac{\partial F}{\partial z_R} = -\frac{\hat{z}_k - (\Delta z/2)(\partial \Delta z/\partial z_k)}{\sqrt{\phi_k}}\left[(\tau_k - b_k) - \alpha\psi_k\right] > 0$$

which, again, is satisfied for

$$\tau_k < b_k + \alpha\psi_k$$

Hence, the same considerations exposed for the case of symmetric polarization apply, and all the properties of the baseline model apply to this case, too.

Polarization of party D Finally, in this case, $\Gamma = -\hat{z}_k - (\Delta z/2)(\partial \Delta z/\partial z_k) < 0$. Therefore, expression (84) is positive when:

$$\frac{\partial F}{\partial z_D} = -\frac{-\hat{z}_k - (\Delta z/2)(\partial \Delta z/\partial z_k)}{\sqrt{\phi_k}}\left[(\tau_k - b_k) - \alpha\psi_k\right] > 0$$

which is satisfied for

$$\tau_k > b_k + \alpha\psi_k$$

This expression is never satisfied. However, since polarization of party D implies a decrease in z_D, when party D polarizes the sign of the expression is the same as in the cases of symmetric polarization and of polarization by party R. Thus, all the properties of the baseline model apply to this case.

H Counterfactuals - Bounds

Disposable income is defined as:

$$Y_D = f + (1-\tau)Y_M$$

Its variance is therefore:

$$var(Y_D) = var(f) + (1-\tau)^2 var(Y_M) + 2(1-\tau)cov(f, Y_M)$$

The above expression can be rewritten as an equation in $(1-\tau)$.

$$(1-\tau)^2 var(Y_M) + 2(1-\tau)cov(f, Y_M) + var(f) - var(Y_D) = 0$$

Solving the equation gives two solutions:

$$(1-\tau) = \frac{-cov(f, Y_M)}{var(Y_M)} \pm \sqrt{\frac{cov(f, Y_M)^2}{var(Y_M)^2} - \frac{[var(f) - var(Y_D)]}{var(Y_M)}}$$

The $(-)$ solution is impossible, because it would imply $(1-\tau) < 0$. Hence, the $(+)$ solution is the only possible one, and it implies that τ is equal to:

$$\tau^* = 1 + \frac{cov(f, Y_M)}{var(Y_M)} - \sqrt{\frac{cov(f, Y_M)^2}{var(Y_M)^2} - \frac{[var(f) - var(Y_D)]}{var(Y_M)}}$$

It can be rewritten as:

$$\tau^* = 1 + \frac{cov(f, Y_M)}{var(Y_M)} - \sqrt{\frac{cov(f, Y_M)^2}{var(Y_M)var(f)} \cdot \frac{var(f)}{var(Y_M)} - \frac{[var(f) - var(Y_D)]}{var(Y_M)}}$$

$$= 1 + \frac{cov(f, Y_M)}{var(Y_M)} - \sqrt{\frac{var(f)}{var(Y_M)} \left[\frac{cov(f, Y_M)^2}{var(Y_M)var(f)} - 1\right] + \frac{var(Y_D)}{var(Y_M)}}$$

The term $cov(f, Y_M)^2/var(Y_M)var(f)$ is less or equal to one, by Cauchy-Schwarz inequality. Hence, the expression in squared brackets is negative or zero. It follows that the expression under squared root is less or equal to $var(Y_D)/var(Y_M)$.

Also, if $cov(f, Y_M) < 0$, the term $1 + cov(f, Y_M)/var(Y_M) < 1$.

$$\tau^* = 1 + \frac{cov(f, Y_M)}{var(Y_M)} - \sqrt{\frac{var(f)}{var(Y_M)} \left[\frac{cov(f, Y_M)^2}{var(Y_M)var(f)} - 1\right] + \frac{var(Y_D)}{var(Y_M)}}$$

Therefore, $\tau^* \leq \tau^{**} = 1 - \sqrt{var(Y_D)/var(Y_M)}$, where τ^{**} is the tax rate in (28), derived under the assumption that f is a constant, equal for all individuals. Thus, τ^{**} is an *upper bound* for the tax rate set by the parties.