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Macro Implications of Inequality-driven Political Polarization*

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Abstract

This paper builds a model of heterogenous agents, incomplete markets and idiosyncratic shocks extended with a political mechanism that allows for realistic party competition. Higher inequality leads to more disperse policy preferences, to which parties respond endogenously distancing themselves from median voter preferences. The polarization of party proposals leads to greater uncertainty before elections, as well as greater policy switches after them, with significant macroeconomic effects. Results are in line with previous empirical evidence linking inequality, polarization and macroeconomic performance. The model is solved introducing political quasi-aggregation, and can be extended to analyze different economic policies and alternative political institutions.

Resumen

Este trabajo construye un modelo de agentes heterogéneos, mercados incompletos y shocks idiosincráticos que además incluye un mecanismo político que permite incluir la competencia entre partidos políticos. Mayores niveles de desigualdad llevan a preferencias políticas más dispersas a lo que los partidos responden endógenamente distanciándose de las preferencias del votante mediano. La polarización de las propuestas de política de los partidos genera mayor incertidumbre antes de las elecciones y a cambios más significativos en políticas luego de éstas, con efectos macroeconómicos significativos. Estos resultados son consistentes con evidencia empírica previa que estudia la relación entre desigualdad, polarización y la macroeconomía. El modelo es resuelto mediante cuasi agregación política y puede ser utilizado para analizar diferentes políticas e instituciones.

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1 Introduction

Inequality has pushed its way to the forefront of public debate, and the macro literature has not lagged behind in analyzing its consequences. Greater availability of data for many countries and during longer periods of time has allowed to document a significant variation of economic inequality across time and space. Concurrently with this there has been a strong development in the last decades of quantitative models to assess the economic causes and consequences of inequality variations. In particular quantitative models of heterogeneous agents, the natural environment to study this issue, have become increasingly popular in macroeconomics. However, despite their rich heterogeneity, they have been seldom used to analyze the political implications of inequality variations, and how these in turn affect the economy.[1]

Most of the political economy literature on the consequences of inequality is based, at least indirectly, on its positive relationship with redistribution as implied by the median voter collective choice mechanism [Downs, 1957, Romer, 1975, Meltzer and Richard, 1981], where greater pre-tax inequality leads smoothly to more redistribution (something, it is worth noticing, at odds with the empirical evidence). But, as put forward by Roemer [2009], the price of getting the simplicity this model delivers, is the elimination of politics from political competition. Hence, the broader connection between economic inequality and politics, concerning issues like political polarization and conflict, and how these affect the economy, have been less explored theoretically, and it is practically absent in heterogenous agents models.

This paper studies the effects of inequality through politics, with an explicit role for political polarization and party competition. To do this it builds a model of heterogenous agents, incomplete markets and idiosyncratic shocks extended with a political mechanism that departs from the median voter theorem, following the approach introduced by Wittman [1973], and further developed by Roemer [2009]. The model generates an empirically plausible wealth distribution and contains a more realistic and historically more accurate description of the political process. Agents have well defined preferences over taxes, depending on their wealth, labor efficiency and other individual state variables. Public revenue is used by the party in power to finance transfers, which play a distributional as well as an insurance role. Political parties care about the welfare of their voters, and compete in elections to implement their desired policies. This, together with an imperfect knowledge of the mapping between policy proposals and votes, lead political parties to propose taxes that differ from the one preferred by the median and from each other. The model is then one in which taxes are stochastic, but with a probability distribution that is endogenous, reflecting the political preferences of the population.

I use the model to assess the political consequences of inequality, as well as how these affect

[1] Boppart et al. [2018] argue that exploring the political realm where inequality affects the macroeconomy, through the workings of democracy for example, is among the main reasons for the increasing emphasis on inequality by macroeconomists. However, they add, this realm is not yet well explored.

the macroeconomy. More inequality leads to more disperse preferences over policy. The gap between tax preferences of an agent (rich or poor) and the median voter increases. This result, a positive correlation between inequality and political polarization has been widely discussed and is in line with empirical evidence [McCarty et al., 2016, Aguirre, 2023]. Preferences' dispersion leads parties to propose policies that are further away from each other, generating polarization of policy platforms, with significant effects on the economy, both before the election through economic uncertainty [Aguirre, 2023], and after the election through tax-driven partisian cycles [Azzimonti and Talbert, 2014].

Analytically the contribution of the paper is the introduction, in a quantitative model with rich heterogeneity, of a political mechanism that exploits the dispersion of political preferences and generates party competition. I build on Roemer [2009], who shows that a combination of party preferences a la Wittman [1973], where parties can commit and care about the welfare of voters, plus uncertainty regarding how policy platforms translate in the fraction of votes obtained, gives a role for party competition. Only in this case there is a trade-off to deviate from the policy preferred by the median voter. Although this strategy implies a net-lost in terms of votes, the probability of winning only falls smoothly and the party is able to improve the welfare of its electoral constituency. Policy proposals are an outcome of Nash equilibrium between the parties at every election date and depend on aggregate state variables. I propose a specification for modeling this structure in a quantitatively meaningful way and, as the political structure makes the model non-stationary, apply a political quasi-aggregation technique, following the economic quasi-aggregation introduced by Krusell and Smith [1998], that allows for a precise computation of the model.[2] The model can be easily extended to analyze the political economy of different policies as well as alternative political institutions under rich economic heterogeneity and party competition.

2 Literature Review

There is abundant work related to the political consequences of inequality, and how this in turn affects the economy, the general theme of this paper. On the political consequences of economic inequality the closest group of papers links the former and political polarization. A broad analysis is done by McCarty et al. [2016], concluding that the two have been closely related for the post-war period in the US. Aguirre [2023] finds a statistically significant relationship for a panel of 25 mostly developed countries and about four decades.[3]

Regarding the link between politics and the macroeconomy the analysis by Azzimonti and

[2]Interestingly political quasi-aggregation makes clear that the link between inequality and polarization exists regardless of any specific knowledge by agents about their position on the income or wealth distribution.

[3]McCarty et al. [2016] find that partisanship has become more stratified by income due to party polarization and economic inequality. See also Pontusson and Rueda [2008], Garand [2010], Grechyna [2016], Duca and Saving [2016] for evidence on the relationship between economic inequality and political polarization.

Talbert [2014] consider polarization as a cause of business cycles.[4] Party alternation in power induces excess policy volatility in polarized societies. This is consistent with the mechanism in this paper, where the analysis additionally incorporates economic inequality as the primary force, policy uncertainty explicitly, and endogenous policies by modeling political competition. Another branch of the literature, mostly empirical, is one in which elections generate drops in economic activity due to policy uncertainty. Canes-Wrone and Park [2012] find a negative effect of elections on investment in OECD countries, arguing that the effect is driven by political polarization, while Julio and Yook [2012] and Julio [2016] show a similar result using data on firms in developing countries. The role of inequality in driving these effects is explored in Aguirre [2023], who identifies drops in economic activity around elections but only in times of relatively high economic inequality. This unequal political business cycle (UPBC) is found both in a panel of mostly advanced economies and in time-series for the US for the post-war period, in which case the evidence also shows a spike of policy uncertainty only in periods of high inequality.[5]

On the methodological side the paper relates to heterogenous agents models, particularly the few of them that endogenize politics. In this setting agents rationally predict the effect of current policy alternatives on current and future prices as well as on future policies, while disperse preferences over policy are induced via the economic equilibrium and not considered primitives. The canonical paper by Krusell and Rios-Rull [1999] consider a median voter equilibrium in an economy without idiosyncratic or aggregate shocks.[6] Corbae et al. [2009] build on Krusell and Rios-Rull [1999], extending their analysis to idiosyncratic shocks, and analyze the consequences of risk and precautionary behaviour in the determination of tax rates, again using the median voter theorem and without aggregate shocks. Finally, Bachmann and Bai [2013] endogenizes policy through a social choice mechanism where political representation depends on wealth in a model with aggregate productivity shocks and idiosyncratic uncertainty.[7] This paper contributes to this literature mainly by departing from the median voter as the collective choice mechanism, considering instead a more realistic political process which, in turn, generates policy uncertainty, a feature that hasn't been analyzed so far in models of ex-post heterogeneity and politics.

As already stated, the political structure is based on the model of political competition presented

[4] See also Azzimonti [2018] for evidence on the effect of partisan conflict on investment. Müller et al. [2016] consider public debt as the outcome over which partisan preferences affect the macroeconomy.

[5] Using micro data Aguirre [2023] also shows a (relative) drop in the consumption-income ratio of wealth-poor agents in times of elections, supporting precautionary motives as a cause for the drop in private consumption during election years.

[6] The equilibrium concept they adopt is analyzed in Krusell et al. [1997]. They compare it to other papers studying voting and economic growth.

[7] Hassler et al. [2003] analyze endogenous redistribution in a dynamic model with rich economic heterogeneity and majority voting. Since they look for analytical solutions economic inequality is restricted and not calibrated to the data as it is the case in quantitative models. See also Hassler et al. [2005], Song et al. [2012] and Müller et al. [2016] for different extensions of the model in Hassler et al. [2003].

by Roemer [2009], where he also analyses extensions such as endogenous parties, multidimensional policies and party factions. Different versions of the model has been applied to varied policy issues by Roemer [1999], Cremer et al. [2008] and Chatterjee and Eyigungor [2023], among others. It has not been implemented before in a quantitative model of heterogeneous agents with idiosyncratic risk.

Often used as an alternative to Downs [1957] are the so-called probabilistic voting models. Their distinctive feature is uncertainty about the mapping from policy to aggregate voting behavior, smoothing-out the relationship between policies and winning probabilities. The model adopted in this paper can be classified as a particular case of the probabilistic-voting model since uncertainty is necessary but not sufficient to obtain policy divergence. It further departs from Downs [1957] in modifying the assumption of purely office-motivated politicians. This assumption is relaxed as well by the citizen-candidate model by Osborne and Slivinski [1996] and Besley and Coate [1997], where the commitment assumption is also dropped. In this case policies are stochastic, with a probability distribution that depends on voters' policy preferences, as it is the case in this paper. However there are no parties, in the sense that the selected candidate determines policies according solely to his preferences. In this paper parties care about the utility of a group of voters, and trades-off the maximization of it with the probability of winning elections.

3 The Model

First I describe the economic environment taking as given the way policy is implemented. Once I define the economic equilibrium I turn to the description of the political mechanism that endogenize policy. Finally I describe how the model is solved by political quasi-aggregation.

Economic Environment

The economy is inhabited by a continuum of infinitely lived agents of measure 1, who discount the future at a rate β. Each period they consume c units of the good, decide how much hours to work ℓ, and accumulate assets a subject to a borrowing limit $a \geq 0$. Agents differ in labor efficiency, denoted by $\epsilon \in E$, which follows a Markov process with transition probability $\pi_\epsilon(\epsilon'|\epsilon)$. They also differ in the return their obtain for their assets on top of the equilibrium interest rate r. This excess-return is denoted by $\upsilon \in V$, which also follows a Markov process, with the corresponding transition probability $\pi_\upsilon(\upsilon'|\upsilon)$. Define as $\Phi(a, \epsilon, \upsilon)$ the distribution over individual state variables.

Assets' income consists on the return on assets $(r + \upsilon)a$, and labor income $w\epsilon\ell$, where w is the equilibrium wage. Assets' returns and labor income are taxed at rate τ, and agents receive a lump-sum transfer T by the government.

Political institutions are as follows. Governments' term in office lasts S periods, $s = 1, ..., S$. They start their first period implementing the tax rate they had proposed at the election they won.

That rate is kept constant during their tenure and one period before the expiration of its mandate, $s = S - 1$, the next government, which will take power after S, is elected.

Agent's problem for periods $s = 1, .., S - 2$ (when there is neither and election nor a switch in government) is the following

$$\begin{aligned} V_s(a, \epsilon, \upsilon; \Phi, \tau) &= \max_{c,\ell,a' \geq 0} u(c, \ell) + \beta E\left[V_{s+1}(a', \epsilon', \upsilon'; \Phi', \tau)|e, \upsilon\right] \\ \text{s.t. } c + a' &= w(\Phi, \tau)\ell\epsilon(1 - \tau) + (1 + (1 - \tau)(r(\Phi, \tau) + \upsilon))a + T(\Phi, \tau) \\ \Phi' &= H_s(\Phi, \tau) \end{aligned}$$

where H_s is the law of motion for the distribution. Note that the aggregate state variable τ doesn't change form s to $s + 1$ when $s < S - 2$.

Now consider the consumer's problem in period S, which is the last period of the government in power. Recall that at this stage the next government has been elected already, and agents know for sure the tax rate it will implement in its first period in office. Call this tax rate τ^e. Then the problem reads

$$\begin{aligned} V_S(a, \epsilon, \upsilon; \Phi, \tau, \tau^e) &= \max_{c,\ell,a' \geq 0} u(c, \ell) + \beta E\left[V_1(a', \epsilon', \upsilon'; \Phi', \tau^e)|e, \upsilon\right] \\ \text{s.t. } c + a' &= w(\Phi, \tau)\ell\epsilon(1 - \tau) + (1 + (1 + (1 - \tau)(r(\Phi, \tau) + \upsilon))a + T(\Phi, \tau) \\ \Phi' &= H_S(\Phi, \tau, \tau^e) \end{aligned}$$

where, again, H_S is the law of motion for the distribution. Now τ^e is a new state variable and the tax rate at which the next period value function is evaluated.

Finally to solve their problem in period $s = S - 1$ agents need to form expectations about the outcome of the election, i.e. about τ^e. The probability distribution of this variable is endogenous and comes from a political mechanism. For now let's assume it depends on aggregate state variables (Φ, τ) and denote it by $\pi(\tau^e|\Phi, \tau)$, postponing its description until after the definition of the economic equilibrium. Given this transition probability the problem for period $s = S - 1$, just before the election, is

$$\begin{aligned} V_{S-1}(a, \epsilon, \upsilon; \Phi, \tau) &= \max_{c,\ell,a' \geq 0} u(c, \ell) + \beta \sum_{\tau^e} \pi(\tau^e|\Phi, \tau) E\left[V_S(a', \epsilon', \upsilon'; \Phi', \tau, \tau^e)|e, \upsilon\right] \\ \text{s.t. } c + a' &= w(\Phi, \tau)\ell\epsilon(1 - \tau) + (1 + (1 - \tau)(r(\Phi, \tau) + \upsilon))a + T(\Phi, \tau) \\ \Phi' &= H_{S-1}(\Phi, \tau) \end{aligned}$$

where, as in the previous cases, H_{S-1} is the law of motion for the distribution.

The last elements in the economic side are a representative firm with a CRS production function $F(K, L)$, where K is capital (that depreciates at rate δ) and L labor efficiency units employed by the representative firm, and a balanced budget for the government, where it is assumed that total revenues are used to finance transfers, with a fraction ψ going to waste (or financing a public good not valued by consumers).

We can now define the recursive competitive equilibrium (RCE).

Given $\pi(\tau^e|\Phi,\tau)$, a RCE is a set of functions V_s, a'_s, ℓ_s, c_s, r, w, T and H_s, for $s = 1..., S$, such that

1. Given $w(\Phi,\tau)$ and $r(\Phi,\tau)$, $V_s(a,\epsilon,\upsilon;\Phi,\tau)$, $a'_s(a,\epsilon,\upsilon;\Phi,\tau)$, $\ell_s(a,\epsilon,\upsilon;\Phi,\tau)$ and $c_s(a,\epsilon,\upsilon;\Phi,\tau)$, when $s < S$, and $V_S(a,\epsilon,\upsilon;\Phi,\tau,\tau^e)$, $a'_S(a,\epsilon,\upsilon;\Phi,\tau,\tau^e)$, $\ell_S(a,\epsilon,\upsilon;\Phi,\tau,\tau^e)$ and $c_S(a,\epsilon,\upsilon;\Phi,\tau,\tau^e)$, solve agents' problem.

2. Given $w(\Phi,\tau)$ and $r(\Phi,\tau)$, $K(\Phi)$ and $L(\Phi,\tau)$ satisfy

$$\begin{aligned} r(\Phi,\tau) &= F_K(K(\Phi),L(\Phi,\tau)) - \delta \\ w(\Phi,\tau) &= F_L(K(\Phi),L(\Phi,\tau)) \end{aligned}$$

3. Government Budget Constraint

$$T(\Phi,\tau) = (1-\psi)\tau\left[w(\Phi,\tau)L(\Phi,\tau) + r(\Phi,\tau)K(\Phi)\right]$$

4. Market Clearing

$$\begin{aligned} K(\Phi) &= \int a \, \mathrm{d}\Phi \\ L(\Phi,\tau) &= \int \ell_s(a,\epsilon,\upsilon;\Phi,\tau)\epsilon \, \mathrm{d}\Phi \\ 0 &= \int a\upsilon \, \mathrm{d}\Phi \\ \int c_s(a,\epsilon,\upsilon;\Phi,\tau) \, \mathrm{d}\Phi + \int a'_s(a,\epsilon,\upsilon;\Phi,\tau) \, \mathrm{d}\Phi &= F(K(\Phi),L(\Phi,\tau)) + (1-\delta)K(\Phi,\tau) \quad \forall s \end{aligned}$$

5. The aggregate law of motion $H_s(\Phi,\tau)$ is generated by transition probabilities $\pi_\epsilon(\epsilon'|\epsilon)$ and $\pi_\upsilon(\upsilon'|\upsilon)$, and the policy $a'_s(a,\epsilon,\upsilon;\Phi,\tau)$.

Note that the third condition in 4 implies that excess returns are transfers between agents.

Political Mechanism

Now we describe how $\pi(\tau^e|\Phi,\tau)$ is obtained as an equilibrium. I adapt the framework studied by Roemer [2009], which combines party preferences a la Wittman [1973], where parties care about the welfare of voters, with uncertainty regarding how policy platforms translate into elections' winning probabilities.

There are two parties in the economy, denoted by $P = R, L$. If one of them is elected, it implements a tax rate τ^P when gaining power. This tax rate has to be announced before the

election and there is full commitment, so the elected government sets that tax rate once in power. Next I describe the way parties decide τ^P and the corresponding winning probabilities for each party.

An agent with individual state (a, ϵ, υ) when the aggregate state is (Φ, τ) votes for R if

$$V_S(a, \epsilon, \upsilon; \Phi, \tau, \tau^R) > V_S(a, \epsilon, \upsilon; \Phi, \tau, \tau^L). \tag{1}$$

Therefore agents compare post-election's value functions, which depend on individual as well as aggregate state variables, and their law of motions or stochastic processes as the case may be. These functions are RCE's objects since agents need them to take expectations in $S-1$ about the possible taxes the new government may implement.[8] Defining $I^R(a, \epsilon, \upsilon; \Phi, \tau, \tau^R, \tau^L) = 1$ whenever (1) is true, and 0 otherwise, the fraction of votes obtained by R can be written as

$$\theta^R(\Phi, \tau, \tau^R, \tau^L) = \int I^R(a, \epsilon, \upsilon; \Phi, \tau, \tau^R, \tau^L) d\Phi \tag{2}$$

which is now a function of aggregate state variables and policy proposals.

The fraction of votes translates imperfectly into the probability of winning the election.[9] This doesn't happen in the median voter model. In that case any deviation by one party from the tax rate preferred by the median generates a discrete drop in the probability of winning from 0.5 to 0, ruling out any equilibrium with different policy proposals. Here I assume that the probability of the R-party winning the election is a strictly increasing function Γ of the fraction of votes θ^R obtained:

$$\Pi(\Phi, \tau, \tau^R, \tau^L) = \Gamma(\theta^R(\Phi, \tau, \tau^R, \tau^L))$$

In particular I use the following exponential function,

$$\Pi(\Phi, \tau, \tau^R, \tau^L) = \frac{1}{1 + \exp\left\{-\lambda(\theta^R(\Phi, \tau, \tau^R, \tau^L) - 0.5)\right\}}.$$

which facilitates the calibration of the model as it depends only on one parameter $\lambda \geq 0$ and doesn't rule out an equilibrium with proposals converging to the median voter preferences.

Figure 1 depicts the relationship between the fraction of votes obtained by the party and the probability of winning the election, for different values of λ.[10] When λ is small an increase in the fraction of votes has just a small positive effect on the probability of winning. Policy proposals in

[8] As shown below only a sub-set of taxes may be chosen in equilibrium so, for the RCE it would be enough for them to evaluate those tax rates only. However agents need to evaluate taxes that are not chosen in equilibrium as well to be able to decide their vote.

[9] Electoral uncertainty is common in models of probabilistic voting. For instance candidates may differ in dimensions unrelated to policies and the different valuations of such features by voters may be only partially known [Lindbeck and Weibull, 1987]. Alternatively the set of voters may be only a fraction of total citizens, and that fraction may be stochastic [Roemer, 2009].

[10] In analytical work the most common specification would be $\Gamma(\Phi, \tau, \tau^R, \tau^L) = P(\theta^R(\Phi, \tau, \tau^R, \tau^L) + \epsilon > 0.5)$, where ϵ is typically uniformly distributed. The quantitative nature of the exercise allows for a more realistic specification.

this case are not very significant defining the outcome of the elections and then they would rather be aimed to make party's voters better off, probably those gaining the most from policies. Hence polarization of preferences have large effects on policies when λ is low. As λ rises the slope of the function increases around θ^P=0.5, making the odds of winning the election more responsive to policies. In the limit, when $\lambda \to \infty$, the probability is zero whenever the fraction of votes is less than 0.5. It jumps to 0.5 when that value is achieved and then jumps to 1 for any value greater than 0.5. If this is the case then parties never want to deviate form the median, irrespective from the specification of their objective functions.[11] In this case the median voter result is obtained.

It is left to specify the parties' objective functions. To allow for the possibility of policy proposals that deviate from the preferences of the median voter it is assumed that parties not only care for being in office but for the welfare of their voters as well. Most of the literature assumes that parties maximize the expected average utility of their voters, with the expectation taken with respect to the probability of winning or losing the election. In the quantitative context of this paper that feature would lead parties to focus almost exclusively on richest agents who have much higher utility than poorer agents. To avoid this I consider, as a way of normalization, the relative gains a voter obtains with respect to the policy proposed by the other party as the welfare measure parties care of. Then, defining the consumption equivalent gains from voting for party R as

$$g_R(a,\epsilon,\upsilon;\Phi,\tau,\tau^R,\tau^L) = \left(\frac{V_S(a,\epsilon,\upsilon;\Phi,\tau,\tau^R)}{V_S(a,\epsilon,\upsilon;\Phi,\tau,\tau^L)}\right)^{\frac{1}{1-\sigma}} - 1,$$

party's R objective function is

$$W(\Phi,\tau,\tau^R,\tau^L) = \Pi(\Phi,\tau,\tau^R,\tau^L)\frac{\int g_R(a,\epsilon,\upsilon;\Phi,\tau,\tau^R,\tau^L)I^R(a,\epsilon,\upsilon;\Phi,\tau,\tau^R,\tau^L)d\Phi}{\theta^R(\Phi,\tau,\tau^R,\tau^L)}. \quad (3)$$

By maximizing the expected gains of those that vote for them, policy proposals don't maximize election probabilities. While a tax close to the median achieves this, the one that maximizes average gains is closer to the preferences of the mean $R-$voter. The chosen tax trade-offs these two effects.[12]

Finally, the problem for party R is to choose τ^R to maximize $W(\Phi,\tau,\tau^R,\tau^L)$, taking τ^L as given. Since everything is symmetric for party L, it faces a similar problem. Defining

$$\begin{aligned} \tau^{R*} &= argmax_{\tau^R}\{W(\Phi,\tau,\tau^R,\tau^{L*})\} \\ \tau^{L*} &= argmax_{\tau^L}\{W(\Phi,\tau,\tau^{R*},\tau^L)\} \end{aligned} \quad (4)$$

the probability distribution for taxes $\pi(\tau^e|\Phi,\tau)$ is the outcome of a Nash-equilibrium between

[11] This is true if the proposal doesn't affect directly the utility of voters when losing the election, a common and realistic assumption

[12] It is still the case that if λ is large enough the median voter result obtains since only the effect on the probability will be taken into account by the party when proposing policies.

parties R and L, and it is given by

$$\pi(\tau^e|\Phi,\tau) = \begin{cases} \Pi(\Phi,\tau,\tau^{R*},\tau^{L*}) & \text{if} \quad \tau^e = \tau^{R*} \\ 1-\Pi(\Phi,\tau,\tau^{R*},\tau^{L*}) & \text{if} \quad \tau^e = \tau^{L*} \\ 0 & \text{ow} \end{cases} \tag{5}$$

We can now define the recursive political equilibrium (RPE).

A RPE is a RCE and, in addition, $\pi(\tau^e|\Phi,\tau)$ is defined by (4) and (5).

Political Quasi-Aggregation

Aggregate variables are governed by shocks to taxes and hence the equilibrium is non-stationary. It is well known that under these conditions, where wealth distribution becomes a state variable, the exact computation of the model is not feasible. On the economic side agents' knowledge of the entire distribution of assets, and not only of its first moment, is needed to forecast next period aggregate capital, the equilibrium interest rate and fiscal transfers.[13] I follow the quasi-aggregation method proposed by Krusell and Smith [1998] reducing the dimensionality to a finite set of moments of the distribution, which are used by agents to forecast next period capital and transfers. Let's call this economic quasi-aggregation.

On the political side of the model agents need to know the wealth distribution because it influences the probability distribution of next period taxes. Expression (5) shows that only exists three functions that completely define $\pi(\tau^e|\Phi,\tau)$. These are $\tau^{R*}(\Phi,\tau)$, $\tau^{L*}(\Phi,\tau)$ and $\Pi(\Phi,\tau)$. I implement a political quasi-aggregation in this case, assuming that only a finite set of moments are used by agents to forecast them. Notice that political quasi-aggregation concerns the predictions made by agents about the optimization of political parties, in particular the aggregation in (2) and (3). Parties solve their problem using full-information, but their proposals need to be predicted by agents using partial information.[14] Once this happens economic quasi-aggregation implies that the entire distribution doesn't influence (1). This means that behind the results obtained computing this model agents don't use any information about their exact position on the wealth distribution to push for more or less redistribution.[15]

4 Calibration

The first group of parameters to be calibrated are those that govern individual stochastic processes for labor efficiency and excess returns. To calibrate these I match the fraction of wealth and

[13] The interest rate and transfers are not uniquely determined by aggregate capital due to return' heterogeneity.

[14] The problem of the parties in (3) and the resulting Nash equilibrium described in (4) are solved during simulations for every election period and the realized distribution.

[15] Hence the mechanism is consistent with agents' misperception of actual inequality and their position on the distribution.

income accrued to each percentile of the corresponding distribution. Figure 2 depicts the results and Table 3 contains the exact numbers. The data is from WID for the year 2020. In the case of labor efficiency I use a discrete grid with 5 possible realizations and restrict the elements of the transition matrix $\pi_\epsilon(\epsilon'|\epsilon)$, allowing only the diagonal and the elements adjacent to it to be non-zero. Table 1 shows the grid, the transition matrix and the corresponding stationary distribution γ_ϵ^* that is obtained after matching the distributional moments. Differences in efficiency are large, with a small group of less than 1% of the population with levels that are more than 60 times larger than the average (normalized to 1). On the other extreme, the group with the lowest efficiency level comprises around 25% of the population, with only 20% of the average level of efficiency in the economy. From the transition matrix we can see that the probability of switching to other realization is always close to 50% and that the probability of entering the highest efficiency group is extremely low.

Previous work has shown that heterogeneous returns are key to match the disperse wealth distribution observed in the data. Here I set to 3 the elements on the grid for υ and don't impose any restriction to the transition matrix $\pi_\upsilon(\upsilon'|\upsilon)$. The parametrization that is obtained after matching the distributions are shown in Table 2. Each of the three groups represents roughly one third of the population. The state with zero excess return is relatively persistent, while the other two, with excess returns of around 1% and 1.5%, show less persistence and a even lower probability of switching to the zero excess return realization.

Since the motivation for this paper is to explore the macro effects of inequality I also compute the equilibrium for a benchmark economy depicting low inequality for comparisons. For this benchmark I set the efficiency and excess-return parameters to match income and wealth distribution in the US for the year 1978, which is when, according to the data recorded by WID, the lowest fraction of wealth was accumulated by the top 10 and 1% of the population in the post war period.

The second set of parameters are related to fiscal policy and the political system. I set fiscal policy parameters to obtain the observed effective tax rates (etr) in the US. Using data from the CBO I compute the fraction of disposable income that is paid in taxes minus the fraction received as transfers, for each quintile of the market income distribution.[16] Federal tax payments, mean-tested transfers as well as social insurance payments are considered in the measurement of etrs. The left panel of Figure 4 shows the constructed etrs for 2019, the last year of data availability. The etr goes from -74.2% in the lowest income quintile to 29.3% in the highest quintile. I match these two numbers. In order to generate these as average etrs the parameter of fiscal inefficiency should be $\psi = 0.08$, while other parameters need to be set such that an average tax rate of 32.8% is obtained as an outcome of the political process.[17] The same graph in Figure 4 also shows the average efts for the rest of the quintiles obtained by simulating the model. The one for the second quintile is

[16]The data is from "The distribution of Household Income 2019," downloaded from the CBO web page at https://www.cbo.gov/publication/58353.

[17]These other parameters are those influencing preferences for redistribution among voters.

very similar to its data counterpart, but the model underestimates the net amount paid by the third and forth quintiles.[18]

Data on *etr*s can also be used to calibrate λ, which governs the cost in terms of winning probabilities incurred by parties when deviating from median preferences, for a given aggregate state. This parameter greatly influences the volatility of tax rates in the model, which can be also computed using data. Table 4 shows the main statistics of *etr*s in the US using yearly data from 1979 to 2019, the period for which data is available. The first row shows average values for each quintile of market income, while the second one shows the corresponding standard deviation. The first observation is that these rates vary significantly in the data. This is true even for the *etr* paid by the highest quintile, which is arguably mostly independent from economic conditions, since transfers to this group are relatively low.[19] This pattern is in line with Borella et al. [2023], who find very frequent changes in taxes in the US since 1969 which, according to a quantitative analysis, have had dissimilar economic consequences.[20] Because it better captures policy changes I use the volatility of the *etr* paid by the richest quintile, which is 2.6%, as the target to calibrate λ.

It is worth exploring how these rates vary depending on the political party in power. Although I don't use this to calibrate the model, partisan differences in *etr*s are at the core of its main mechanism. The last two rows of Table 4 show the average *etr*s, for each income quintile, for periods when a democrat or a republican president was in power, respectively. There is a significant difference between the two in all of the quintiles, with democratic governments showing higher levels of redistribution than republican governments. Interestingly, this is true in the case of the richest quintile, evidencing a direct partisan effect. In the right panel of Figure 4 I show the time series of the *etr* paid by the richest quintile, with a blue circle marking a year with a democrat government and a red cross a year with a republican government. The partisan effects can be clearly seen. Republican governments start with relatively high *etr*s and finish with relatively low *etr*, with the opposite being true in the case of Democrat governments.

Finally I calibrate the parameters related to preferences and technology. In the first case I use a GHH utility function with a coefficient of relative risk aversion of 2, disutility from labor of 12.5 and a Frisch elasticity of labor supply equal to 0.3, respectively. The discount factor is such that the interest rate is on average 4%. In the case of technology I use a 5% depreciation rate and an elasticity of capital of 0.3. A period is one year and $S = 4$.

[18] The model, similarly than in previous work, assumes a unique tax rate and a transfer amount for every agent in the economy. Differences in *etr* only come from differences in income so the model cannot match the actual progressivity of the fiscal system. This can be introduced in the model, but it would complicate its computation as progressivity should be an outcome of the political process as well. By approximating the tax-transfer system by effective tax functions as in Heathcote et al. [2017], introducing pregressivity would require a two-dimensional policy space for parties and voters.

[19] Excluding transfers the average *etr* is 32.9% in this group, and its standard deviation 2.5%.

[20] For an empirical relationship between fiscal measures and ideology see Perotti and Kontopoulos [2002] and Müller et al. [2016].

5 Results

Policy Preferences

The first results relate to policy preferences and how these are affected by inequality. To explore this let's define τ^* as an individual's preferred tax rate, which is given by

$$\tau^*(a, \epsilon, \upsilon; K, \tau) = argmax_{\tau^e}\{V_S(a, \epsilon, \upsilon; K, \tau, \tau^e)\},$$

where K, rather than Φ, appears as a state variable due to quasi-aggregation. Recall that S is the period after the election, when the agents need to evaluate all of the potential policies that may be implemented by the next government. Since V_S is an equilibrium object it depends on the equilibrium path for taxes, so agents are evaluating short-run deviations from equilibrium when assessing the net benefits of different tax rates.

From simulating the model I compute τ^* for each agent in the economy and every period. After ordering voters according to their policy preferences I compute, for every period, preferred tax rates for each percentile, where median voter's preferences correspond to the 50 percentile. Figure 5 shows the mean across periods of τ^*, comparing the model economies of high and low inequality. In the left panel we can see that preferred taxes are larger for every percentile of voters in the high inequality case. This is the result of income and wealth concentration at the top of the distribution, which reduces the tax burden of all of the other groups for the same level of total transfers, as well as due to the greater risk agents face in the high inequality economy. Were there a majority voting system, then taxes would rise with inequality, in line with Downs [1957], Romer [1986] and Meltzer and Richard [1981], but adding the insurance motive as in Corbae et al. [2009].

But the most relevant result in the context of this paper is the higher dispersion of tax preferences in the high-inequality economy. To see this I normalize preferences by the median voter in the right panel of Figure 5. There we can see that the distance between the tax preferred by a certain percentile and the one preferred by the median voter widens with inequality. For instance, when switching from a low to a high-inequality economy, the voter situated in the 40th percentile prefers a tax rate that is about 1% higher, while the one in the 60th percentile prefers a tax rate that is 1.3% lower.

One explanation for the positive relationship between income inequality and political polarization is that, since tax preferences are monotonic on income, the higher dispersion in this variable translates directly in a higher preference dispersion. To see if this is the only channel behind this result I estimate the elasticity between income and the preferred tax rate using the simulated data at the individual level. If this elasticity were the same in the low and high-inequality economies then only the direct effect would explain the result. However I find a higher sensitivity in the high-inequality economy, where the elasticity is about 20% larger in absolute value than in the low-inequality economy. This suggests that income and wealth concentration and higher idiosyncratic

risk have heterogeneous effects on tax preferences, contributing not only to a higher tax preferred by the median voter but to political polarization as well.

Politics

Different tax preferences across economies lead to different policy proposals by parties. Since most agents prefer higher tax rates in the high-inequality economy parties respond proposing higher taxes on average. But policy preferences are more polarized and voters more divided in the high-inequality economy. Since the political structure described in the last section gives parties the incentive to fulfill voters' preferences, and not only to win the election, this polarization translates into more extreme policies, with parties moving further away from median preferences.

Figure 6 shows policy proposals by parties as functions of aggregate capital k (normalized by its average value). As expected, the tax rate proposed by each party is higher in the high-inequality economy, and mostly independent of the level of aggregate capital. The same happens with respect to the tax rate in place at the moment of the election (not shown). The feature that is relevant for this paper is the gap observed between party proposals, which is larger in the high-inequality economy. To see this more clearly on the right panel I show the difference between the tax proposed by each party and the average between the two parties. The difference in the high-inequality economy is close to 4 points, while the one in the low-iequality economy is less than 2 points, and about half of that for very high levels of capital.

Hence parties move away from median voter preferences, reducing their probability of election but improving voters' welfare. Figure 7 shows how this trade-off works. It depicts the fraction of votes θ, the probability of winning Π and utility W of party R when choosing potential tax rates (in the horizontal axis) after the L party has proposed a tax rate close to 47% (marked with a vertical line). If R proposes a higher tax rate, the fraction of votes and probability of winning are very low because L positioned itself with a higher tax rate than the one preferred by the median voter. Reducing the tax generates a discrete jump in θ since the R party can set a tax that is lower than that proposed by L but, at the same time, higher than the one preferred by the median voter. These gains in votes stop when R is far enough from the median, when θ and Π start decreasing monotonically due to voters that become closer to L than to R. But utility (red) peaks at the left of the point where votes are maximized. Moving further from L the party R is able to increase the utility of its voters, even while loosing part of them. For these voters that are lost by R the proposals by R and L give similar utility and then they don't have a strong enough impact on R's utility to avoid the drop in the tax proposal. However, lowering it too much hurts the party both in terms of voters and in terms of average preferences of those who vote for R.

Macroeconomics

Similarly to most of political economy models linking inequality and redistribution, more inequality translates into higher taxes, affecting investment and labor supply. But unlike models where policies are set according to median voter preferences, in this model politics additionally produce business cycles. Because each party proposes different tax rates and each of them have positive probabilities to be elected, the existence of policy switches generates movements in macroeconomic aggregates. Since, as we have seen, inequality influences the distance between the tax proposals made by parties, policy switches and their aggregate effects vary across economies.

Table 5 reports mean and standard deviations of the main aggregate variables and prices in the high and low-inequality economies, after simulating them for a long period of time. The first column shows tax rates. The average levels are consistent with the preferences of the median voters. They lead to more output Y, labor N, capital K and consumption C in the low-inequality economy. Hence, endogenous redistribution counteracts the effect of higher idiosyncratic risk on precautionary savings and aggregate capital. Output and labor are about 10% larger, while capital and consumption are about 6% larger in the low-inequality economy. Wages are close to 2% larger and the gross interest rate is 8 points lower.

Taxes are more volatile in the high-inequality economy, consistently with the results presented in the last subsection. The standard deviation is 3.3%, compared to the 1.5% observed in the low-inequality economy. This translates into higher volatility of all the macro variables and prices. For instance, the standard deviation of output is 1.8% in the high-inequality economy, which compares to a 1.4% observed in the low-inequality economy. The greatest difference is observed for capital, with a standard deviation that is more than 1 point larger in the high-inequality economy.

Volatility is not only explained by the ex-post effect of tax changes. In the model agents face uncertainty with respect to future policies since parties alternate in power stochastically. The macroeconomic effects of uncertainty has been well explored. Closely to the mechanism in this paper, Canes-Wrone and Park [2012], Julio and Yook [2012] and Julio [2016] have empirically found drops in different economic variables around elections, arguing that the effect is explained by political uncertainty. The novelty of the model presented in this paper regarding this channel is that its magnitude depends on inequality. In a more unequal economy the distance between tax proposals widens, increasing uncertainty and therefore its effects on agents' decisions and macroeconomic variables. Aguirre [2023] finds empirical evidence on this in a panel of mostly developed economies and, for a longer period of time, in the US.

Figure 8 reports the path for consumption, investment and output between elections, for the high and low-inequality economies. It shows the percentage change of each variable with respect to the first period that a government is in power $s = 1$. Recall that elections occur at the end of period $s = 3$. On the left panel we can see that consumption falls continuously before an election in the two economies, but the drop is larger in the high-inequality economy. This result is in line

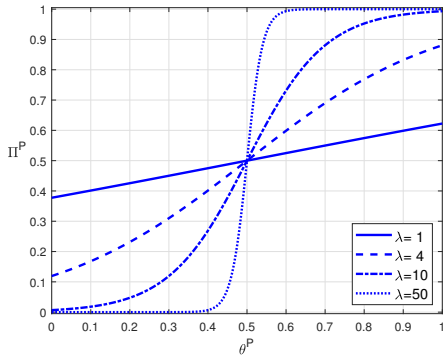
with a precautionary behavior by agents facing uncertainty about taxes and transfers. The effect persists after the election since, as we describe below, output also continues below its initial level after the election. In the center panel we can see a similar pattern for investment, although larger in magnitude. In the high-inequality economy the fall is about 1% in the second period, around twice as much as the fall that occurs in the low-inequality economy. After that it recovers, although without converging to the level observed in the first period. The fall in output, shown in the right panel, is initially smaller in the high-inequality economy. This is due to a stronger adjustment in labor, as agents increase its supply when facing more uncertainty. But in period 3 is already below the level achieved in the low-inequality economy. The effect persists after the election due to the lower level of capital in place after two periods of low investment. These results are consistent with the empirical findings in Aguirre [2023], where both consumption and investment fall before an election, in a magnitude that is increasing in the initial level of inequality.

6 Conclusions

This paper builds a model of heterogenous agents, incomplete markets and idiosyncratic shocks extended with a political mechanism that deviates from the commonly used median voter result. On the economic dimension the model allows for a rich heterogeneity in terms of income and wealth. On the political side it allows for realistic party competition. Economic heterogeneity generates disperse preferences over policies, to which parties endogenously respond proposing tax rates that deviate from the levels preferred by the median voter, but maintaining positive election probabilities. This structure leads to tax, and hence macroeconomic fluctuations, in magnitudes that are contingent on the distribution of income and wealth. The model is solved using political quasi-aggregation, and it can be extended to analyze different policies and institutional settings.

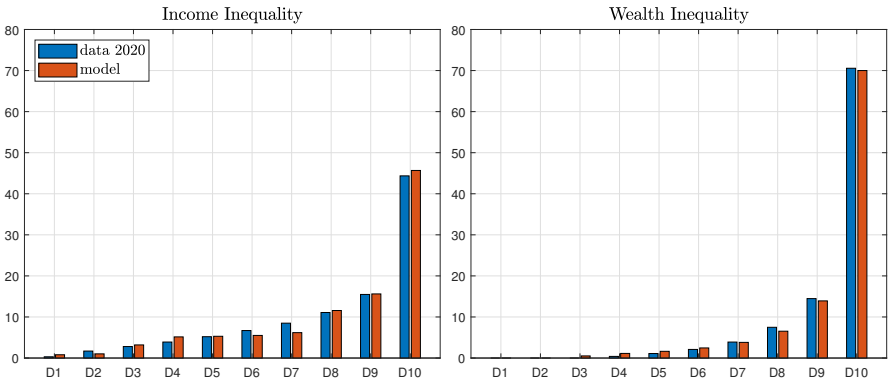
I use the model to show the political and macroeconomic effects of inequality. To do this I compare the results of two different calibrations corresponding to a high-inequality and a low-inequality economies. Results show more disperse preferences and more extreme policy proposals in the high-inequality economy. This is, inequality leads to higher degrees of political polarization and to larger swings in policies. This in turn affects the economy. I show that the high-inequality economy is more volatile and suffers more considerably from policy uncertainty, with negative macroeconomic effects.

Figures



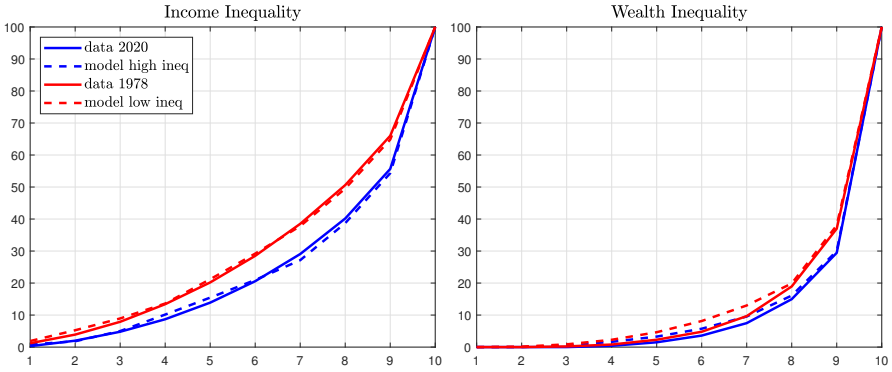
Note: Function Γ, which maps the fraction of votes obtained by a party θ^P and the probability of winning an election Π^P, for different vales of λ.

Figure 1: Function Γ: Votes and Probability of Winning



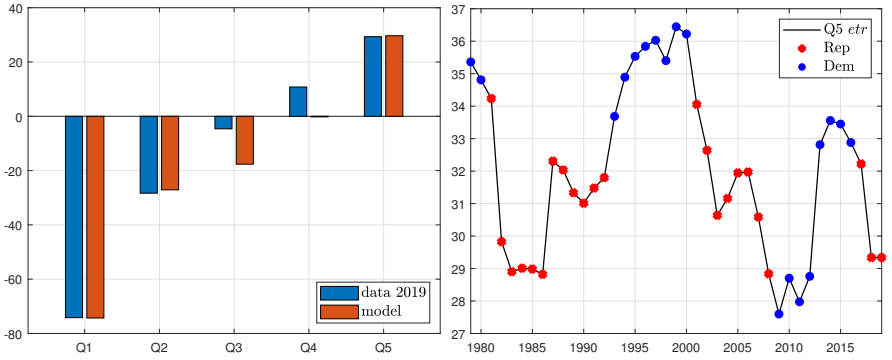
Note: Fraction of total income (left) and wealth (right) accumulated by each decile of the corresponding distribution in the data for 2020 (blue) and the model (red).

Figure 2: Calibration: Income and Wealth Distribution



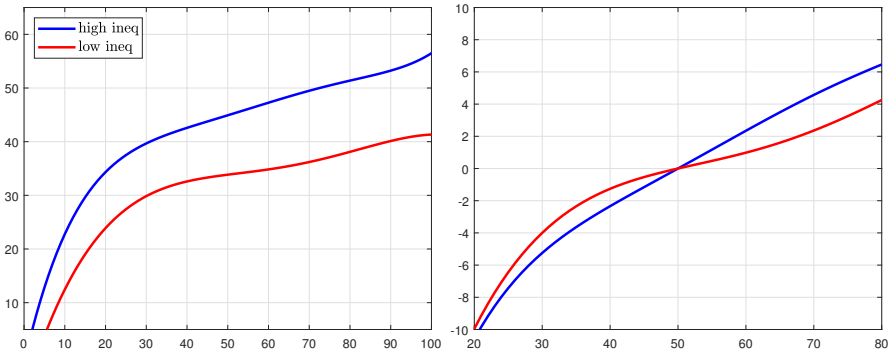
Note: Lorenz curves for income (left) and wealth (right), comparing data for 2020 and the high-inequality model economy (blue) and data for 1978 and the low-inequality model economy (red).

Figure 3: Calibration: Income and Wealth Distribution, Hi and Low Inequality



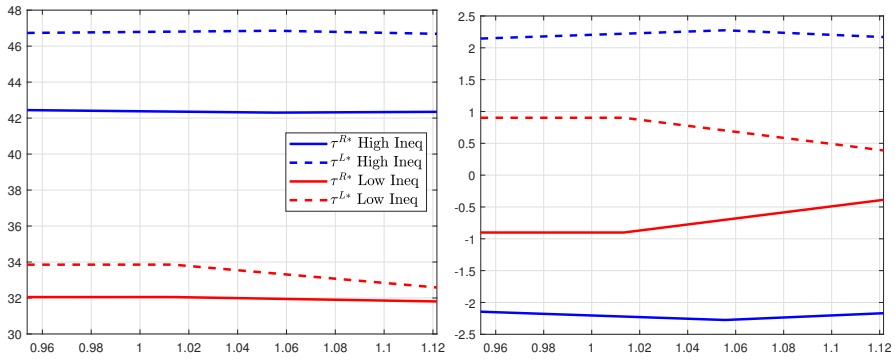
Note: Effective tax rates *etr* are the fraction of disposable income that is paid in taxes minus the fraction received as transfers. Data is computed from the statistics published by the CBO. Left: for each quintile of the market income distribution (data in 2019). Right: time series of the *etr* paid by the richest quintile. Red (blue) points are years with a Republican (Democrat) government.

Figure 4: Calibration: Effective Tax Rates



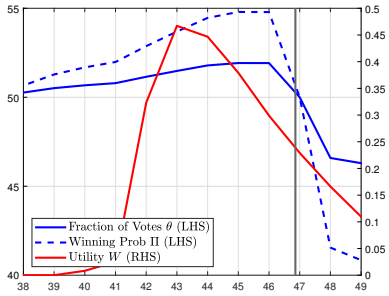
Note: Preferred tax rate (τ^*) for each percentile of the model population. High (blue) vs. low-inequality (red) economies. Right: same statistic normalized by the preferred tax rate of the median agent.

Figure 5: Policy Preferences



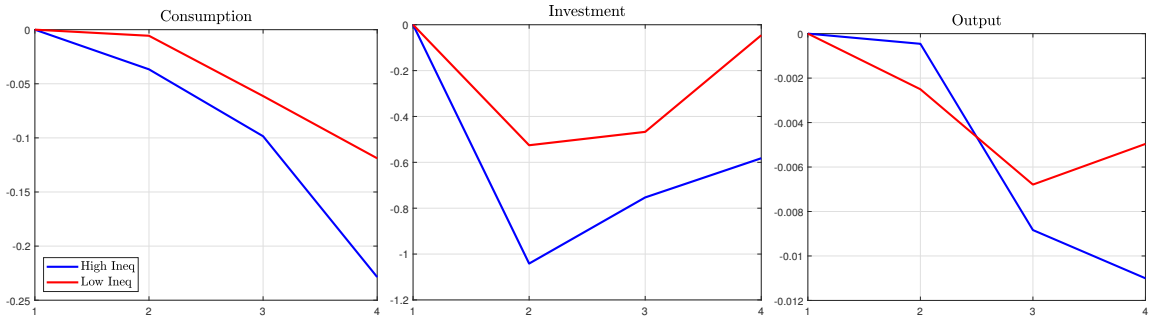
Note: Right: tax proposals by the R party τ^{R*} (solid) and the L party τ^{L*} (dashed) in the high (blue) and low-inequality (red) economies, as a function of aggregate capital (normalized by its average) evaluated at the average tax rate. Left: same series normalized by average proposals.

Figure 6: Policy Proposals



Note: Fraction of votes θ, winning probability Π and utility W of a party when proposing the tax rate marked in the horizontal axis, when the other party proposes the tax rate marked with the vertical line. Results are evaluated at the average levels of capital and taxes.

Figure 7: Party Utility



Note: average value of consumption (left), investment (center) and output (right) for periods $s = 1, 2, 3, 4$, where elections occur at the beginning of $s = 4$. Results from simulation of the high-inequality (blue) and low-inequality (red) economies.

Figure 8: Macroeconomic Effects of Elections

Tables

Grid and Stationary Distribution

	$\epsilon(1)$	$\epsilon(2)$	$\epsilon(3)$	$\epsilon(4)$	$\epsilon(5)$
ϵ grid	0.2	0.7	1.8	7.5	61.4
γ_ϵ^* (%)	25.2	49.4	23.3	2.0	0.05

Transition Matrix

	$\epsilon'(1)$	$\epsilon'(2)$	$\epsilon'(3)$	$\epsilon'(4)$	$\epsilon'(5)$
$\epsilon(1)$	0.55	0.45	0	0	0
$\epsilon(2)$	0.23	0.57	0.20	0	0
$\epsilon(3)$	0	0.42	0.55	0.03	0
$\epsilon(4)$	0	0	0.39	0.60	0.01
$\epsilon(5)$	0	0	0	0.51	0.49

Table 1: Calibration: Labor Efficiency Process

Grid and Stationary Distribution

	$\upsilon(1)$	$\upsilon(2)$	$\upsilon(3)$
υ grid	-0.75	1.06	1.49
γ_υ^* (%)	62.9	16.7	20.4

Transition Matrix

	$\upsilon'(1)$	$\upsilon'(2)$	$\upsilon'(3)$
$\upsilon(1)$	0.67	0.17	0.16
$\upsilon(2)$	0.79	0.11	0.10
$\upsilon(3)$	0.37	0.21	0.42

Table 2: Calibration: Excess-Return Process

	Income Distrubution					Wealth Distrubution			
	Data 2020	Model High Ineq	Data 1978	Model Low Ineq		Data 2020	Model High Ineq	Data 1978	Model Low Ineq
Q1	0.3	0.8	1.2	2.2	Q1	0.0	0.0	0.0	0.0
Q2	1.7	1.1	2.7	3.4	Q2	0.0	0.2	0.0	0.4
Q3	2.8	3.9	4.0	3.7	Q3	0.0	0.6	0.2	1.0
Q4	3.9	4.7	5.5	5.7	Q4	0.4	1.2	0.6	1.6
Q5	5.2	4.9	6.8	7.4	Q5	1.1	1.8	1.5	2.3
Q6	6.7	5.2	8.3	7.8	Q6	2.1	2.6	2.5	3.1
Q7	8.5	6.5	10.0	8.3	Q7	3.9	3.8	4.9	4.1
Q8	11.1	13.2	12.1	12.1	Q8	7.5	6.2	9.3	6.7
Q9	15.5	14.8	15.4	14.8	Q9	14.5	14.0	18.0	19.9
Q10	44.4	45.0	34.0	34.7	Q10	70.6	69.4	63.0	60.9

Note: Fraction of total income (left) and wealth (right) accumulated by each decile of the corresponding distribution, comparing data for 2020 and the high-inequality model economy and data for 1978 and the low-inequality model economy.

Table 3: Calibration: Income and Wealth Distribution

	Q1	Q2	Q3	Q4	Q5
Mean	-71.5	-17.6	6.1	18.1	32.0
SD	3.6	9.2	7.6	4.8	2.6
Mean Dem gov	-72.5	-20.2	4.8	17.4	33.3
Mean Rep gov	-70.6	-15.6	7.2	18.7	31.0

Note: Effective tax rates *etr* are the fraction of disposable income that is paid in taxes minus the fraction received as transfers. Data is computed from the statistics published by the CBO.

Table 4: Calibration: Effective Tax Rates (*etr*), Main Statistics

		τ	Y	N	K	C	w	r
High-Inequality Economy	Mean	45 %	0.28	0.27	0.59	0.16	0.40	5.8 %
	St. Dev.	3.3 %	1.8 %	1.7 %	3.2 %	2.3 %	0.9 %	0.2 %
Low-Inequality Economy	Mean	33 %	0.30	0.31	0.63	0.17	0.41	5.2 %
	St. Dev.	1.5 %	1.4 %	1.5 %	2.0 %	1.9 %	0.6 %	0.1 %

Table 5: Macroeconomic Statistics

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