Dynamic Bargaining over Redistribution in Legislatures

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June 2012

Abstract. This paper studies legislative bargaining over redistribution in the context of a Neoclassical growth model where agents are heterogeneous in their initial capital. In each period, members of a legislature negotiate over the current capital tax. Tax revenues finance lump-sum redistribution. A key feature of the bargaining process is that the status quo is endogenous: the capital tax chosen in the current period becomes the default option in the next legislative session. We argue that the endogenous status quo serves a disciplinary role: policymakers may not propose (or accept) high taxes because doing so may improve, via a change of the status quo, the bargaining power of low wealth legislators in future sessions. We find equilibrium capital taxes below 35% under different calibrations of the model. Finally, we analyze how redistribution and taxation vary as we change the distribution of agenda setting power, the distribution of wealth within the legislature, and institutional features of the bargaining protocol.

JEL Classification: E6, H0.
Keywords: Redistribution, Time Consistency, Capital taxes, Legislative Bargaining, Markov-perfect Equilibria.

* We greatly benefited from comments by Marco Bassetto and participants at SED 2011 Meetings in Ghent, 2011 ESEM Meetings in Oslo, 2011 Lacea-Lames Meetings in Santiago, 2011 CPEG Meetings, City University of Hong Kong, Ecole Polytechnique, EIEF, LUISS, Paris-Dauphine, and Sciences-Po.
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1. Introduction

In order to understand the determinants of government size, redistribution and taxation, a growing literature in macroeconomics analyzes the political process governing policy decisions. The standard approach in *macroeconomics* is to focus on median-voter equilibria. We depart from this literature by explicitly modeling post-election *legislative bargaining*. Our change of framework is motivated by the observation that in actual democracies public choices are usually the result of some sort of negotiation among elected policymakers.\(^1\)

This paper studies sequential bargaining over redistribution in the context of a standard Neoclassical growth model. We assume that individuals are heterogeneous in their initial wealth and that linear taxes on capital income finance lump-sum redistribution. The key element of the bargaining process analyzed in this paper is the *endogeneity of the status quo* (or default) policy. That is, if there is disagreement in the legislative game, the level of taxation (and redistribution) chosen in the previous legislative session is implemented. Thus, the result of the legislative bargaining in any given period affects, by changing the default option, the bargaining process in all subsequent periods. Quantitatively, we show that this additional mechanism has an important disciplinary role reducing policymakers’ temptation to set taxes at confiscatory levels. In particular, for different parameterizations of the model we find that equilibrium capital income taxes are empirically reasonable (on average below 35%).

There are two main approaches to study capital taxation: the traditional normative approach taken by the literature on optimal capital taxation and the positive approach, used in, for example, the recent macro-dynamic-political economy literature. The two approaches lead to different implications. The normative approach prescribes that, in a wide range of environments, the tax on capital should be zero in the long-run.\(^2\) Conversely, the positive literature has shown that, without assuming either ad-hoc constraints or history-dependent strategies, the tax on capital is very close to 100%.\(^3\) This paper contributes to the positive

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\(^1\)The legislative bargaining approach, which was pioneered by Baron and Ferejohn (1989), is widely adopted in political economy. However, to our knowledge, very few papers have used it in the context of a standard macro model. Among the papers using the median voter approach see Alesina and Rodrik (1994), Persson and Tabellini (1994), Krusell and Rios-Rull (1999), Azzimonti *et al.* (2006), and Corbae *et al.* (2009). See Section 2 for a review of the related literature.

\(^2\)This is the classical result under commitment of Chamley (1986) and Judd (1985). Positive capital taxes are obtained in Aiyagari (1995), Conesa *et al.* (2009), and Piketty and Saez (2012).

\(^3\) For instance, in Klein *et al.* (2008) and Azzimonti *et al.* (2006) the equilibrium capital taxes without
literature by generating reasonable taxation levels and providing a suitable framework to study the consequences of different constitutions on macroeconomic outcomes.

The economy is populated by: (i) consumers, who trade a full set of Arrow securities in order to allocate resources over time; (ii) competitive firms; (iii) and legislators who periodically vote to determine the current capital tax rate. Tax revenues are used to distribute a common lump-sum transfer to all consumers. Consumers as well as legislators differ with respect to their wealth. Legislators vote in order to maximize the utility of the consumers with their same level of wealth. Since taxes are proportional to capital income, capital taxation is a way of redistributing from consumers with high wealth to consumers with low wealth.

Legislative bargaining unfolds as follows. In each period one member of the legislature (the agenda setter) is randomly selected to make a take-it-or-leave-it proposal. If the proposal is rejected, the capital tax from the previous period (the status quo) is kept in place for one more period. If it is accepted, which happens with a probability equal to the measure of legislators favoring the proposal, the tax is implemented and the current policy becomes the default option in the next legislative session. Note that the status quo becomes a payoff-relevant state in the model: forward looking legislators must then internalize the consequences of the current decision on future legislative sessions via its effect on the status quo.

A key feature of our environment is that politicians have endogenous time-inconsistent preferences over taxes and redistribution. Under commitment, legislators with pretax income below the mean would select maximum taxes in the current period (to maximize redistribution) and zero taxes in the long-run (to minimize distortions on savings decisions). However, once capital has been accumulated, taxing capital is no longer distortive. In the absence of commitment, legislators are thus tempted to raise capital taxes up to the maximum possible level in order to redistribute.

We solve for Markov-perfect equilibria of the dynamic game between legislators. Our results show that legislative bargaining with an endogenous status quo strongly reduces pol-

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4As argued by Tsebelis (2002, p. 8), the status quo is often the explicit or de facto outside option in actual budget negotiations. Rasch (2000) identifies the countries where this provision is part of the formal rules.

5See Bassetto and Benhabib (2006).
icymakers’ temptation to raise taxes ex-post. The economic mechanism which disciplines legislators operates through two channels. First, the role of the status quo as the default option generates endogenous policy persistence. Policy changes may be rejected in equilibrium because some legislators may prefer the current status quo policy to most (or some) proposed capital taxes. The existence of this status-quo bias implies that legislators have to balance their present desire for high redistribution with their distaste for long-term savings distortions. Second, in equilibrium policy proposals are shown to be monotone increasing in the status quo. The probability of high tax proposals is thus increasing in the status quo. As a result, keeping a low status quo is a way to strategically manipulate (namely, improve) equilibrium proposals of future agenda setters.\(^6\)

It is important to emphasize that such long-run considerations would not arise in models focusing on median-voter equilibria, wherein the median voter is able to impose her preferred policy regardless of the policy outcome that was voted in the previous period. As a result, in contrast to this model, the status quo policy is not a payoff-relevant state variable.

By means of numerical simulations, we compute policy proposals and acceptance strategies (for all status quos, levels of aggregate capital, and legislators’ wealth) that are consistent with a sequential equilibrium of the competitive economy. For various parameterizations, we find capital income taxes that are (on average) below 35\%. Thus, legislative bargaining delivers equilibrium capital taxes well below the ones usually obtained by Markov equilibria where, as in this paper, decision makers sequentially choose the current capital tax. In order to obtain empirically reasonable tax rates, the literature usually assumes an implementation lag: that is, voting today is over the capital tax for next period.\(^7\) The lesson from this literature is that there needs to be a wedge between policymakers’ preferences and policy implementation in order to generate empirically reasonable levels of taxation and redistribution. From this point of view, we believe that this paper is a step toward understanding the institutional determinants and aggregate implications of this wedge.

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\(^6\)Strategic manipulation in models with political turnover is analyzed, among others, by Alesina and Tabellini, (1990), Persson and Svensson, (1989), and Azzimonti, (2011). Note that, due to time consistency problems, current legislators have also incentives to strategic manipulate their future selves (see Laibson, 1997). Usually, the literature considers this type of manipulation separately from the one that is due to political turnover.

\(^7\)As also argued in Azzimonti et al. (2006, p. 602), “the nature of implementation lags in actual tax constitutions is not apparent.”
After computing the politico-economic equilibrium, we investigate how tax levels and the size of government are affected by changes in the political environment.

We begin by studying the consequences of giving more bargaining power to legislators with low asset wealth. This might be related to rising inequality which could lead to representatives of poor constituencies occupying key offices in the legislature. We conduct two distinct experiments. In the first experiment, we increase the probability that poor legislators are selected to make policy proposals, and in the second we increase the probability that poor legislators are able to oppose policy changes. Our simulations indicate that a significant shift of power towards the poor raises taxes and redistribution by a small amount. This is because it generates two opposite effects that work against each other. On the one hand, since poor legislators gain more from redistribution, the first experiment implies that inefficient policies are proposed more often and the second that tax cuts are more likely to be rejected. On the other hand, the fact that less fiscally responsible legislators have more power increases the marginal benefit of keeping taxes low in order to constrain future legislators. Because of the latter disciplinary effect, agenda setters change their behavior and propose lower taxes. All in all, expected taxes do not increase by much. Potentially, this may explain why the empirical relation between inequality and amount of redistribution is weaker than what is predicted by median-voter models, where inequality has a strong positive effect on redistribution.⁸

We also modify the bargaining process by adopting a bicameral system instead of an unicameral one. As expected, requiring two concurrent votes to pass legislation aggravates status-quo bias. First, we find that legislators propose more gradual policy changes in order to maximize the probability of acceptance. Second, since higher policy persistence increases the cost of going to the next period with a high status quo, we obtain more fiscal discipline (lower policy proposals). Simulations show that expected tax levels go down when bicameralism is adopted.

A parameter that plays an important role in the numerical simulations is the depreciation rate of capital. In particular, we find that with partial depreciation average taxes are three times larger than with full depreciation. The underlying reason is intuitive. With full depreciation the stock of capital in the next period coincides with aggregate savings; capital is thus extremely elastic to private sector’s expectations. Since in the model expectations depend

on the current policy, this explains why policymakers find it politically more costly to set high taxes when capital fully depreciates. Finally, in the model with partial depreciation we allow taxes on wealth, instead of income. We expect that a larger tax base might increase the temptation to set high taxes. In spite of this temptation, in the numerical simulations taxes on wealth are well below confiscatory rates (around 10%). This shows that the disciplinary mechanism described in this paper is effective even when there are no constitutional limits to confiscation. Also, we find that allowing taxes on wealth lowers average consumption and output, thus suggesting a negative effect on welfare.

2. Literature Review

Our work is closely related to recent macro political-economy papers. The pioneering work by Krusell et al. (1997) proposes a notion of politico-economic equilibrium where political outcomes chosen by a forward looking median voter must be consistent with a sequential equilibrium of the competitive economy. Using this framework, Krusell and Rios-Rull (1999) extend the Meltzer and Richard (1981) static model to a dynamic setting. They consider a calibrated version of the Solow model where agents are heterogeneous with respect to their income, markets are complete and preferences are homothetic. In contrast to this paper, they assume that the median voter theorem holds and agents vote on the tax in the next period. Their findings show that the size of transfers predicted by the model is close to that in the US data. More recently, Corbae et al. (2009) consider a similar setting in which individuals have uninsurable idiosyncratic labor efficiency shocks and conclude that in the US, the median model would predict an excessively large increase of redistribution following the increase in wage inequality in the 80s and 90s. Bachmann and Bai (2011) study the political determination of government purchases in the context of a neoclassical growth model with heterogeneous agents. Instead of using the median-voter approach, they use a social welfare function with weights dependent on the wealth of the households to aggregate preferences.

Bassetto (2008) is one of the few papers that incorporates a bargaining process into a standard macro model. He considers an economy where two overlapping generations Nash-bargain over tax rates, transfers, and government spending. In the model, the current policy decision affects capital accumulation and thus changes the strategic position of each generation in the next negotiation. Aguiar and Amador (2011) consider a growth model with political turnover; incumbent governments prefer consumption to occur when they are in
power and, thus, have an incentive to expropriate capital. They focus on self-enforcing equilibria supported by threat of switching to the autarky equilibrium. Acemoglu \textit{et al.} (2008) and Yared (2010) analyze a dynamic economy where rent-seeking politicians choose taxation and public good provision; they study an electoral accountability model where citizens discipline the politician by threatening to remove him from office.

Alesina and Tabellini (1990), Persson and Svensson (1989), Amador (2003), and Azzimonti (2011) show that governments affect the policy carried out by future governments by manipulating their successors’ constraints via some state variable (e.g., debt or investment). In our setting, the dynamic linkage across periods is created by the status quo. Another key difference from this paper is that they assume that the winning party is a policy dictator and, consequently, there is no need of negotiating. Their main result is that strategic manipulation generates inefficiency (such as, excessive debt or low investment). Notice that in contrast to this literature, political turnover is beneficial in our model: the risk of losing power gives current policymakers the incentive to strategically maintain a low status quo.\footnote{In a different context than ours, the beneficial effect of political turnover has been pointed out in Acemoglu \textit{et al.} (2011) and Callander (2011).}

Several politico-economic papers have used models of legislative bargaining to study policymaking. In Battaglini and Coate (2007, 2008) and Battaglini \textit{et al.} (2010), decisions about pork barrel spending, public good, and debt are made by a legislature of representatives from several districts. They analyze how policies respond to shocks in public spending needs and how they vary over the business cycle.\footnote{Azzimonti \textit{et al.} (2011) analyze the impact of a balanced-budget rule.} Riboni (2010) builds a dynamic agenda setting model in a stylized Barro-Gordon economy in order to study monetary policymaking. As in this paper, the endogenous status quo plays a key disciplinary role. He finds conditions under which monetary policy committees perform better than single central bankers. Austen-Smith (2000) compares the overall level of taxation and redistribution in two systems: a two-party median voter model and a three-party proportional representation model in which taxes are determined through legislative bargaining. Persson \textit{et al.} (1997, 2000) analyze alternative legislative-bargaining games in order to study the size and composition of government spending under presidential and parliamentary regimes. Their theoretical results help explain the empirical evidence that the size of government in presidential regimes is smaller than in
Finally, this paper is related to the literature on legislative bargaining with an endogenous status quo. General characterization of such games is elusive. Baron (1996) analyzes a one-dimensional problem and finds that in the long-run the policy converges to the alternative preferred by the median committee member. This result is obtained because the current proposer, by choosing an alternative closer to the median ideal point, is able to constrain future changes by legislators on the opposite side of the median. The computational results by Duggan and Kalandrakis (2011) also indicate that when players are sufficiently patient, the endogeneity of the status quo induces core convergence.\footnote{Among other papers in this literature, see Kalandrakis (2004), Bernheim \textit{et al.} (2006), and Diermeier and Fong (2010).}

3. The Model

3.1. Overview

The model economy includes three types of decision makers: consumers who consume and invest, firms that rent inputs and produce the only good in the economy, and legislators who decide the tax on capital in every period. It is important to keep in mind the general timing of events (see Figure 1). At the beginning of each period \( t \), firms make their production decision, and then legislators meet and bargain over the current tax \( \tau_t \). Finally, knowing the political outcome, consumers make their consumption and saving decisions.

Throughout, we focus on Markov Perfect equilibria where strategies depend on the payoff-relevant state variable. At time \( t \), the state variable in the political game is given by the predetermined level of capital \( k_t \) and the status quo level of taxation \( q_t \), where \( q_t = \tau_{t-1} \). Any equilibrium of the political game can be represented by a stochastic Markov process with \( \Gamma(\tau_t|q_t,k_t) \) determining the probability of a tax rate \( \tau_t \) given a capital stock \( k_t \) and status quo \( q_t \).

Consumers at time \( t \) make savings decisions after observing the political outcome \( \tau_t \). Therefore, the state variable in the consumers’ problem is given by the current level of taxation (the status quo for next period) and the current level of capital \( k_t \). Given initial
capital, any competitive equilibrium can be summarized by the law of motion of aggregate capital, denoted by \( G(k_t, \tau_t) \).

In Section 3.2, we describe the competitive equilibrium given an arbitrary stochastic process for policies. In Section 3.3, we describe the political game. In Section 4, we present a simple example to help build intuition. In Section 5, we present the numerical solutions. Section 6 concludes.

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### Figure 1. Timing of Events within a Period.

3.2. The Economy

In the economy, time is infinite and indexed by \( t = 0, 1, \ldots \). There is continuum of consumers of measure one. Consumers are heterogenous in their initial wealth and indexed by \( \theta^i \); consumers of type \( \theta^i \) are initially endowed with \( \theta^i k_0 \) units of capital, where \( \theta^i \in \Theta \) and \( k_0 \) is the aggregate stock of capital at \( t = 0 \). Let \( \mu(\theta^i) \) be the measure of consumers of type \( \theta^i \). For simplicity, we assume \( E(\theta^i) = 1 \).

Uncertainty is captured by a publicly observable state \( s_t \in S \) in period \( t \). Let \( s^t \) be the history of shocks up to time \( t \) and let \( Pr(s^t) \) denote the probability of history \( s^t \).\(^{13}\) The state \( s_t \) is reveled before consumers make their consumption and saving decisions. As will be explained in Section 3.3, the only source of uncertainty in this economy comes from the political process.

Consumers are endowed with one unit of labor, which is inelastically supplied. Their total income is the sum of real wage \( w_t(s^t) \), a lump-sum transfer from the government \( T_t(s^t) \), and the after tax return on capital holdings.

\(^{13}\)The probability of any given history \( s^t \) is computed through the probabilities of the events leading to \( s^t \) in the usual way.
We assume that markets are complete. We let \( a^i(s^t, s_{t+1}) \) denote type \( \theta^i \)'s purchases of Arrow securities at time \( t \), history \( s^t \) conditional on the realization of event \( s_{t+1} \) in the next period; the price of each security is \( q(s^t, s_{t+1}) \). A tractable way of formulating the market structure is to assume that each security pays one unit of capital upon the realization of \( s_{t+1} \).

Thus, when choosing allocations consumers are subject to the following budget constraints:

\[
c^j_t(s^t) + \sum_{s_{t+1}} q(s^t, s_{t+1}) a^i(s^t, s_{t+1}) = w_t(s^t) + T_t(s^t) + R_t(s^t) a^i(s^t),
\]

for all \( \{s^t\}_{t=0}^{\infty} \). The return on asset holdings is \( R_t(s^t) = (1 - \tau_t(s^t)) r_t(s^t) \), where \( r_t(s^t) \) is the rental rate of capital and \( \tau_t(s^t) \) is the proportional tax on the returns from asset holdings. In order to streamline the analysis of this section we have assumed that capital depreciates fully. However, none of the results shown here depend on this assumption, and we show results with partial depreciation in the numerical solutions of Section 5.4.

At time \( t \) an agent of type \( \theta^i \) orders stochastic sequences of consumption according to the expected utility that they deliver:

\[
E_t \left( \sum_{j=1}^{\infty} \beta^{j-t} u(c^j_t(s^j)) \right),
\]

where \( E_t(.) \) denotes the expectation conditioned on time \( t \) information with respect to the probability distribution of the random variables \( \{s^t\}_{t=0}^{\infty} \), \( \beta \in [0, 1) \) is the discount factor and per-period utility is given by

\[
u(c^j_t(s^t)) = \log(c^j_t(s^t)),
\]

where \( c^j_t(s^t) \) denotes the time \( t \) consumption of an individual of type \( \theta^i \).

There is a continuum of firms that rent capital and labor services to produce the unique consumption good. Production combines labor with capital using the following constant-returns-to-scale production function:

\[
f(k_t(s^t)) = k_t(s^t)^\alpha.
\]
Since there is perfect competition, firms choose capital and labor to satisfy the following conditions:

\[ r_t(s^t) = f'(k_t(s^t)), \]
\[ w_t(s^t) = f(k_t(s^t)) - r_t(s^t)f'(k_t(s^t)). \]

The government does not issue debt or consume, so the government budget’s constraint is for all \( \{s^t\}_{t=0}^{\infty} \)

\[ \tau_t(s^t) r_t(s^t) k_t(s^t) = T_t(s^t). \]

Given \( k_0 \), a law of motion for aggregate capital \( G(k_t, \tau_t) \), and an arbitrary Markov process for taxes, \( \Gamma(\tau_t|\tau_{t-1}, k_t) \), it is possible to generate a stochastic path for all \( \tau_t \) and \( k_t \). We now define the competitive equilibrium of our economy for a given sequence of policies.

**Competitive Equilibrium Definition:** Let \( \Gamma(\tau_t|\tau_{t-1}, k_t) \) and the initial distribution of wealth be given. A Competitive Equilibrium is a stochastic sequence of fiscal policies \( \{T_t(s^t), \tau_t(s^t)\}_{t=0}^{\infty} \) allocations \( \{c_t(s^t), \{a^i(s^t, s_{t+1})\}_{s_{t+1}}\}_{t=0}^{\infty} \) for all \( \theta^i \), and prices \( \{w_t(s^t), r_t(s^t), \{q(s^t, s_{t+1})\}_{s_{t+1}}\}_{t=0}^{\infty} \) such that:

1) Given prices and the sequence of tax and transfers, the allocation for every consumer \( \theta^i \) maximizes (2) subject to (1) for all \( \{s^t\}_{t=0}^{\infty} \).

2) Factor prices satisfy firms’ first order conditions for all \( \{s^t\}_{t=0}^{\infty} \).

3) Given prices and aggregate allocations, the sequence of fiscal policies is generated by \( \Gamma(\tau_t|\tau_{t-1}, k_t) \) and the government’s budget constraint for all \( \{s^t\}_{t=0}^{\infty} \).

4) Markets clear:

\[ c_t(s^t) + k_{t+1}(s^t) = f(k_t(s^t)), \quad \text{for all } \{s^t\}_{t=0}^{\infty} \]

where

\[ c_t(s^t) = \int \mu(\theta^i)c^i_t(s^t)d\theta^i \quad \text{for all } \{s^t\}_{t=0}^{\infty} \]
and

\[ k_{t+1}(s^t) = \int_{\Theta} \mu(\theta^i) a^i(s^t) d\theta^i, \text{ for all } \{s^t\}_{t=0}^{\infty}. \]

Suppose that at time \( t = 0 \) a consumer with share \( \theta^i \) observes the current tax \( \tau_0 \) and she expects that in the future policies will be given by \( \{T_t(s^t), \tau_t(s^t); \forall s^t\}_{t \geq 1} \). Let \( \phi(\theta) \) be the equilibrium proportion of consumption of agent \( \theta^i \) with respect to the average consumer.\(^{14}\) It can be shown that her maximized present value of utility is given by\(^{15}\)

\[ \hat{V}(k_0, \tau_0, \theta^i) = \log(\phi(\theta^i, k_0, \tau_0)) + \hat{V}(k_0, \tau_0, 1) \] (8)

where

\[ \phi(\theta^i, k_0, \tau_0) := \left[ 1 + \frac{(1 - \beta)(\theta^i - 1) \alpha f(k_0)(1 - \tau_0)}{c_0} \right] \] (9)

That is, her present discounted value of utility can be decomposed into two additive parts: the first term depends on the consumption share, as defined in (9), while the second term is the present discounted utility of the average consumer for whom \( \theta^i \) is 1. This result is due to the fact that the utility function is homothetic and markets are complete. Thus, the agents’ decisions are proportional to each other, and knowing the decision of one agent is enough to characterize the decisions of all other agents.

As shown by Bassetto and Benhabib (2006), the optimal capital tax under commitment for an agent with \( \theta^i \leq 1 \) is at the upper bound in the first period and converges to zero in the long run.\(^{16}\) The intuition for this result is similar to the Chamley’s result, even though in our economy the government has access to lump sum taxation and there is not an exogenous stream of government spending to be financed. Legislators want to provide redistribution via lump sum transfers, while minimizing the distortions caused by capital taxation. Since capital

\(^{14}\)Because markets are complete and the utility function is homothetic this proportion is constant and independent of time and of the state of nature.

\(^{15}\)Bassetto and Benhabib, (2006) showed this result for economies without uncertainty and where consumers do not value leisure (as here). Piguillem and Schneider (2009) generalize the result to economies with endogenous labor supply, uncertainty and complete markets.

\(^{16}\)In fact, from (9) we obtain that if \( \theta^i < 1 \) (respectively \( \theta^i > 1 \)) the first term of expression (8) is always increasing (decreasing) in \( \tau_0 \).
is fully inelastic in the first period and completely elastic in the distant future, it is optimal to raise as much tax revenues as possible at the beginning and avoid future distortions.

Crucially, note that the optimal plan is time-inconsistent: legislators who sequentially vote on capital taxes have the temptation to increase capital taxes ex-post. Potentially, in the absence of commitment, this may lead to a “bad” policy outcome in which taxes are at the upper bound in all $t$ and savings are low. It bears stressing that all agents with $\theta^i < 1$ share this temptation. The lower $\theta^i$, the higher the temptation to raise taxes ex-post. This is because individuals with low $\theta^i$ get a larger amount of redistribution for any given positive value of $\tau_0$. In the next section, we will argue that legislative bargaining with an endogenous status quo substantially reduces the severity of the time-inconsistency problem.

3.3. Legislative Bargaining

We focus on post-election legislative bargaining and abstract from the election stage. There is a continuum of legislators with different levels of wealth. Each legislator is indexed by her current share of asset wealth $\theta \in \Theta_L$. We assume that legislators act in order to maximize the utility of the consumers with their same level of wealth. Legislators’ wealth shares are distributed with density $\mu_l(\theta)$ with support $\Theta_L = [\theta, 1]$, so that the richest legislator has wealth share equal to the average consumer in the economy. Therefore, all members of the legislature –although to different degrees– gain from redistribution and have time consistency problems. This assumption is not crucial but it makes it clear that taxes and transfers are not low in our model because some legislators lack the temptation to tax capital ex-post.\footnote{Also note that, since in most countries a vast majority of voters have wealth below the average, in practice elected officials have to offer some degree of redistribution to their constituents in order to keep their seats.}

In order to make our problem much more tractable we assume that the distribution $\mu_l(\theta)$ is constant over time. In the absence of this assumption, income inequality is a political state variable since the current tax affects the relative wealth of legislators and, consequently, their incentives to tax in the future.\footnote{Azzimonti et al. (2006) shows that in the median voter model, it is enough to keep track of the median’s assets (that is, “political” aggregation is obtained). In our model, every legislator can be selected to be agenda setter. Therefore, if the distribution $\mu_l(\theta)$ were not constant, we would have to keep track of the entire distribution of wealth within the legislature.}

The policy choice that is voted upon is the capital tax for the current period. Once the capital tax is selected, the lump-sum transfer is residually determined using equation (7).
Let $q_t$ denote the current status quo. At each $t$, legislative bargaining unfolds as follows.

(i) A randomly selected member of the legislature (the agenda setter) makes a take-it-or-leave-it offer $\tau_t$.

(ii) All legislators simultaneously cast a vote: either “yes” or “no”.

(iii) Proposals pass with probability equal to the measure of legislators who vote “yes”.

(iv) If $\tau_t$ is accepted, it becomes the capital tax for the current period and the default option for next period: $\tau_t = q_{t+1}$.

If $\tau_t$ is rejected, $q_t$ is implemented.

As is standard in the legislative bargaining literature, we suppose that some legislators have “agenda-setting powers”: they have the ability to determine which bills are considered on the floor.\textsuperscript{19} To keep the model tractable, in each period only one legislator, named agenda setter, has the right to propose a tax.\textsuperscript{20} The identity of the agenda setter $\theta^s$ changes in each period and is a continuous random variable with density function $\mu^s(\theta^s)$ in the interval $[\theta, 1]$. Thus, recognition probabilities are i.i.d. over time.

Point (iii) deserves some discussion. Note that acceptance is probabilistic: the higher the number of legislators that favor the proposal, the higher the probability of acceptance. This implies that proposals may be rejected even if a simple majority (over 50%) of legislators are in favor of it. In a typical legislature, this may happen when minority legislators have the ability to delay or veto the approval of the bill. Also note that point (iii) implies that a proposal may pass (although with smaller probability) when it is favored by a minority in the legislature. In some other circumstances, this might be the result of vote trading across issues or party discipline.\textsuperscript{21} Acceptance is certain only when all legislators prefer the proposal to the status quo, and rejection is certain when all legislators prefer the status quo.

\textsuperscript{19}The chairs of important committees (such as, the Rules Committee in the US House) are usually endowed with agenda-setting powers. Also, legislatures often cede agenda-setting powers to executive offices, such as, the president or premier.

\textsuperscript{20}Counter-proposals are not allowed. That is, bargaining is under closed rule.

\textsuperscript{21}For instance, suppose that there is a party which has a majority of seats and that its policy stance is decided by the median legislator within the party. Then, if there is strict discipline within the party, a policy change may pass with the support of only 25 percent of the legislature.
We defend the probabilistic acceptance on two grounds. First, the assumption captures the idea that some uncertainty is inherent in the political process. In a richer model, uncertainty as to whether the bill will pass could arise when the agenda setter does not perfectly observe legislators’ preferences. Second, probabilistic acceptance introduces an additional source of uncertainty to our model besides the one concerning the agenda setter’s identity. The extra noise makes numerical computations much more tractable.

We focus on pure Markov strategies. Since strategies are stationary, the problem can be formulated in a recursive way, and in what follows we drop the time index. A proposal strategy for agenda setter $\theta^s$ is a function of aggregate capital $k$, and the status quo $q$: $\tau(\theta^s) : \mathbb{R}_+ \times [0, \bar{\tau}] \to [0, \bar{\tau}]$. After observing the proposal, legislator $\theta$ votes according to a voting rule $\alpha(\theta) : \mathbb{R}_+ \times [0, \bar{\tau}] \times [0, \bar{\tau}] \to \{\text{yes, no}\}$.

As is commonly assumed in the voting literature, we suppose that legislators vote as if they were pivotal. Legislator $\theta$ supports proposal $\tau$ against the status quo if and only if $\tau$ provides higher utility than $q$. That is,

$$\alpha(k, q, \tau; \theta) = \begin{cases} \text{"yes"} & \text{if } \hat{V}(k, \tau, \theta) \geq \hat{V}(k, q, \theta), \\ \text{"no"} & \text{otherwise.} \end{cases}$$

We let $A(k, q, \tau)$ denote the set of legislators who support the proposal,

$$A(k, q, \tau) = \left\{ \theta \in \Theta_L : \hat{V}(k, \tau, \theta) \geq \hat{V}(k, q, \theta) \right\}. \quad (11)$$

We denote the probability that proposal $\tau$ is accepted given the pair $(k, q)$ by $Pr^a(k, q, \tau)$. As assumed in point (iii), $Pr^a(k, q, \tau)$ is equal to the measure of set $A(k, q, \tau)$.

$$Pr^a(k, q, \tau) = \begin{cases} \int_{A(k, q, \tau)} \mu(l(\theta)) d\theta & \text{if } \tau \neq q, \\ 1 & \text{if } \tau = q \end{cases} \quad (12)$$

Note that when $\tau = q$ the probability of acceptance is one. In fact, rejecting the proposal would not make any difference: policy $q$ would be adopted regardless of the vote.

---

22 Stochastic rejection also arises in the model by Baron and Ferejohn (1989) when counter-proposals are allowed (open rule).

23 This rules out Nash equilibria where all legislators accept a proposal they do not like because a single rejection would not change the voting outcome.
Since consumers make decisions after the legislature votes, saving decisions depend on current capital and on the current capital tax $\tau$.\footnote{Note that $\tau$ affects savings decision because it constitutes the default option in the next legislative session. Also note that the current tax does not affect the current income of the average individual.} The law of motion of aggregate capital is denoted by $G(k, \tau).

If legislator $\theta^s$ is randomly chosen as the agenda setter, her optimal proposal maximizes the expected present value of utility given the current stock of capital and the current status quo:

$$
\tau(k, q; \theta^s) = \arg \max_{\tau \in [0, \bar{\tau}]} Pr^a(k, q, \tau) \hat{V}(k, \tau, \theta^s) + (1 - Pr^a(k, q, \tau)) \hat{V}(k, q, \theta^s)
$$

subject to

$$
k' = G(k, \tau); \quad \forall \tau
$$

The first term of the objective function is the utility of implementing $\tau$ from expression (8) multiplied by the probability that $\tau$ is accepted. The second term is the utility of keeping the status quo, multiplied by the probability that $\tau$ is rejected. Note that this is a non-trivial problem since the agenda setter must realize the consequences of her proposal on the current and future probabilities of acceptance, on proposal rules of future agenda setters and on savings decisions.

Using the proposal rule and the probability of acceptance, the probability that each $\tau$ is implemented given a state is:

$$
\Gamma(\tau|q, k) = \begin{cases} 
Pr^a(k, q, \tau) \int_{\tau=\tau(k,q;\theta^s)} \mu^s(\theta^s) d\theta^s & \text{if } \tau \neq q \\
\int_{q=\tau(k,q;\theta^s)} \mu^s(\theta^s) d\theta^s + \int_{0}^{\tau} \left( \int_{\tau'=\tau(k,q;\theta^s)} (1 - Pr^a(k, q, \tau')) \mu^s(\theta^s) d\theta^s \right) d\tau' & \text{if } \tau = q
\end{cases}
$$

Expression (15) has a simple interpretation. From the first line, the probability of making a policy change to $\tau$ is equal to the measure of agenda setters that would propose $\tau$ multiplied by the probability that the proposal is accepted. The second line is the probability of maintaining the status quo. This can happen when $q$ is proposed, the first term, and when other proposals...
are rejected, the second term. Notice that the latter term is what explains endogenous policy persistence in the model.

We now proceed to define the \textit{Politico-Economic Equilibrium}. We require the Markov process for taxes implied by the political game to be optimal given the law of motion of aggregate capital implied by the competitive equilibrium, and vice versa. For more details about the algorithm used in the computations see Section 3.4 and Appendix A.

\textbf{Politico-Economic Equilibrium Definition:} A politico economic equilibrium is: value functions for all legislators $\hat{V} : \mathbb{R}_+ \times [0, \bar{\tau}] \times \Theta \rightarrow \mathbb{R}$, proposal rules for all legislators $\tau(\theta^*) : \mathbb{R} \times [0, \bar{\tau}] \rightarrow [0, \bar{\tau}]$, approval rules for all legislators $\alpha(\theta) : \mathbb{R}_+ \times [0, \bar{\tau}] \times [0, \bar{\tau}] \rightarrow \{\text{yes, no}\}$, a Markov process for taxes characterized by $\Gamma(\tau|q, k)$, and the law of motion of aggregate capital $G : \mathbb{R}_+ \times [0, \bar{\tau}] \rightarrow \mathbb{R}_+$ such that

\begin{enumerate}
\item[a)] Given $\Gamma(\tau|q, k)$, the law of motion of aggregate capital is generated in the competitive equilibrium and $\hat{V}$ is given by (8).
\item[b)] Given $G(k, \tau)$ and $\hat{V}$,
\item[b.1)] Approval rules satisfy (10).
\item[b.2)] The tax proposal solves problem (13).
\item[b.3)] $\Gamma(\tau|q, k)$ is generated by equation (15).
\end{enumerate}

3.4. Computational Strategy

The numerical problem consists of solving one fixed point, the \textit{Politico-Economic Equilibrium} (PEE) characterized by $\Gamma(\tau|q, k)$, which depends on another fixed point, the \textit{Competitive Equilibrium} (CE), characterized by the law of motion of aggregate capital $G(k, \tau)$. Loosely speaking our strategy amounts to first solving the CE given $\Gamma(\tau|q, k)$. This generates an aggregate decision rule and new value functions. Then, we use the outputs from the CE to generate a new $\Gamma(\tau|q, k)$ and we repeat this procedure until convergence. In Appendix A, we describe the algorithm, but some details are worth mentioning.
We solve the CE using a variant of Carroll (2006)’s endogenous grid method. Since the CE exhibits aggregation, it is enough to solve the problem of the mean agent. Thus, we start the iterations assuming a $G(k, \tau)$ and then apply the Carroll (2006) method to the saving problem of the mean agent. Then, we set $G(k, \tau)$ equal to the saving policy function of the mean agent and repeat the procedure until the aggregate saving rule is consistent with the saving rule of the mean agent. The main difference from the solution of a standard CE problem is that fiscal policies are endogenous, thus implying that the future tax depends on the future stock of capital. This can create problems for equilibrium existence and convergence of numerical algorithms (when the equilibrium exists). However, as shown by Coleman (1991) and Greenwood and Huffman (1995), when the tax function is monotone increasing in the level of capital the problem disappears. We confirm in the numerical solutions that the tax function is indeed monotone increasing in the capital stock.\footnote{See Santos, (2002) for an extensive discussion of existence of Markov Equilibria in non-optimal economies. The main difference between our economy and the ones in these papers is the inclusion of the past tax as a state variable. For this reason, we cannot apply those results directly to our model.}

We stress that at least one PEE always exists; in particular, the “bad equilibrium” where the legislature sets the tax at the upper bound in every period, and agents invest foreseeing this strategy. Intuitively what happens here is that when the aggregate law of motion of capital is completely inelastic to the current tax policy, it is optimal for the agenda setter to propose the highest possible tax and for the legislature to approve it. Since we are interested in equilibria in which aggregate savings react to the tax policies, we start the iteration of the PEE assuming that $\Gamma(\tau|k, \tau) = 1$. That is, it is initially assumed that taxes always remain at the same level. This allows us to search for the equilibrium where savings actually react to current taxes.

Finally, one important step in solving for the PEE is the computation of the acceptance probability. Again, the aggregation result greatly simplifies this task. We use the fact that $\hat{V}(k, q, \theta)$ satisfies the single crossing property to compute $Pr^a(k, q, \tau)$.\footnote{See Piguillem and Schneider (2009) for a formal proof.} That is, the difference between $\hat{V}(k, \tau, \theta)$ and $\hat{V}(k, q, \theta)$ is monotone in $\theta$. This implies that there is at most one legislator, denoted by $\theta^*(k, q, \tau)$, who is indifferent between $\tau$ and $q$. That is, using (8) and (9) we obtain
\[ \theta^*(k, q, \tau) = \frac{[f(k) - G(k, q)] \Xi(k, q, \tau) - [f(k) - G(k, \tau)]}{(1 - \beta)rk[1 - \tau - \Xi(k, q, \tau)(1 - q)]} + 1, \] (16)

where

\[ \Xi(k, q, \tau) := e^{[\hat{V}(k, q, 1) - \hat{V}(k, \tau, 1)]}. \]

Notice that if \( \Xi(k, q, \tau) > 1 \) the average individual is better off with the status quo. In this case, because of the single crossing property, we have that the proposal passes with probability equal to the measure of legislators with share of wealth below the cutoff \( \theta^* \). Then,

\[ P_r^a(k, q, \tau) = \begin{cases} \int_0^{\theta^*(k, q, \tau)} \mu^l(\theta) d\theta & \text{if } \Xi(k, q, \tau) \geq 1, \\ 1 - \int_0^{\theta^*(k, q, \tau)} \mu^l(\theta) d\theta & \text{otherwise.} \end{cases} \] (17)

4. Example

In this section we present a simple example to explain the mechanism behind the full dynamic model presented in Section 3. Time is still infinite. However, to keep things tractable we assume that the legislature chooses taxes only in periods 0 and 1. The tax that is set in period 1 remains for all \( t \geq 1 \).

We first compute consumers’ value functions given \( \tau_0 \) and \( \tau_1 \). Later, we discuss how taxes are set through legislative bargaining.

After solving the consumer’s problem, we obtain that for all \( t \geq 1 \)

\[ k_{t+1} = (1 - \tau_1) \alpha \beta k_t. \] (18)

Using the results in Piguillem and Schneider (2009), similarly to expressions (8) and (9), we obtain that the present-value utility (as of time 1) of an agent with share of wealth \( \theta \) is given by

\[ v_1(\tau_1, k_1, \theta) = \frac{\log(\phi_1(\tau_1, \theta))}{1 - \beta} + v_1(\tau_1, k_1, 1) \] (19)

where

\[ \phi_1(\tau_1, \theta) = 1 + (1 - \beta)\alpha \frac{(1 - \tau_1)(\theta - 1)}{1 - (1 - \tau_1)\alpha \beta}. \] (20)
and

\[ v_1(\tau_1, k_1, 1) = \frac{\alpha \log(k_1)}{1 - \beta \alpha} + \frac{1}{1 - \beta} \left[ \log(1 - (1 - \tau_1)\alpha \beta) + \frac{\beta \alpha \log((1 - \tau_1)\alpha \beta)}{1 - \beta \alpha} \right]. \tag{21} \]

Moving backwards, in period \( t = 0 \)

\[ v_0(\tau_0, k_0, \theta) = \frac{\log(\phi_0(\tau_0, \theta))}{1 - \beta} + v_0(\tau_0, k_0, 1) \tag{22} \]

where

\[ v_0(\tau_0, k_0, 1) = \alpha \log(k_0) + \log(1 - (1 - \tau_1)\alpha \beta) + \beta v_1(\tau_1, (1 - \tau_1)\alpha \beta k_0, 1) \tag{23} \]

and

\[ \phi_0(\tau_0, \theta) = 1 + (1 - \beta)\alpha \frac{(1 - \tau_0)(\theta - 1)}{1 - (1 - \tau_1)\alpha \beta}. \tag{24} \]

One important feature of (19) and (22) is that \( \tau_t \) does not interact with \( k_t \). From (20) and (24) note that the share \( \phi \) of agent \( \theta \) does not depend on the capital stock either. Also, notice that the value function of the average agent \( (\theta = 1) \) does not depend on \( \tau_0 \). This is because the average agent neither wins nor loses from redistribution. The only tax that affects her is \( \tau_1 \) (via consumption and savings). For all agents other than the average one \( (\theta \neq 1) \), \( \tau_0 \) affects welfare through the share \( \phi \). In particular, if \( \theta < 1 \) the share is increasing in \( \tau_0 \) and decreasing otherwise.

We now move to the description of how \( \tau_1 \) and \( \tau_0 \) are determined in the political game. Compared to the full model, in this example legislative bargaining is simplified along two dimensions. First, we suppose that legislators are of two types only: their share of aggregate wealth is either \( \theta^p \) or \( \theta^m \), with \( \theta^p < \theta^m < 1 \). That is, legislators who are poorer than the average must bargain with legislators who are even poorer than them. The measure of legislators with share \( \theta^m \) is \( 1 - \gamma \), while the measure of legislators with share \( \theta^p \) is \( \gamma \). Assume \( \gamma < 0.5 \). The second simplification is that decisions pass by simple majority rule. Since legislators of type \( \theta^m \) constitute the majority in the legislature, a proposal passes if and only if it is acceptable to them. In what follows, we name legislators of type \( \theta^m \) as the median.
In each period $t$, with $t = 0, 1$, one legislator is randomly selected to be the agenda setter in the legislature. The agenda setter is of type $\theta^m$ (resp. $\theta^p$) with probability $1 - \gamma$ (resp. $\gamma$). As discussed in Section 3.3 the agenda setter is allowed to make a take-it-or-leave-it offer, $\tau_t$. The legislature either approves it or rejects it. Recall that in this example, the decision made at time 1 stays in place for all $t \geq 1$. If the proposal at time 0 is rejected, the status quo (or default option) $q_0$ is implemented. If the proposal at time 1 is rejected, the default option $q_1$ is implemented for all $t \geq 1$.

4.1. Legislative Bargaining at $t = 1$

We now find the political outcome at time 1. In Figure 2 we fix $k_1$ and, using (19), we plot $v_1(\tau_1, k_1, \theta^m)$ and $v_1(\tau_1, k_1, \theta^p)$. Figure 1 shows that $v_1(\tau_1, k_1, \theta^m) > v_1(\tau_1, k_1, \theta^p)$, that the value functions are single peaked and that the preferred tax by legislators of type $\theta^p$ is greater than the one preferred by legislators of type $\theta^m$ (that is, $\tau^*(\theta^p) > \tau^*(\theta^m)$).

At $t = 1$ the most preferred policy by an individual with share $\theta$ satisfies the first order condition
This can be rewritten as

\[ \frac{1}{\phi(\tau_1, \theta)} \frac{-(\theta - 1)}{1 - (1 - \tau_1)\beta\alpha} - \frac{\tau_1\beta}{(1 - \tau_1)(1 - \beta\alpha)} = 0 \]  

(26)

The political outcome depends on two elements: (i) the identity of the agenda setter and (ii) the location of the status quo. The former matters because a policy change needs to be proposed and the agenda setter is the only one that can make a proposal. The location of the status quo matters because it constitutes the default option in case of disagreement.

Two cases must be distinguished: the agenda setter at \( t = 1 \) is a legislator of type \( \theta^m \) or of type \( \theta^p \). The former case is immediate to solve. When the median legislator is also the agenda setter, \( \tau^*(\theta^m) \) is obviously proposed. Since legislators of type \( \theta^m \) constitute the majority, the proposal passes. We now consider the case in which the agenda setter is of type \( \theta^p \). Since legislators of type \( \theta^p \) constitute a minority, a policy proposal will pass if and only if it is preferred by the median to the status quo. Crucially, note that when \( q_1 \) lies between \( \tau^*(\theta^p) \) and \( \tau^*(\theta^m) \) (see the shaded interval in Figure 2) no policy change is possible and \( q_1 \) will stay in place for all \( t \geq 1 \). This is because it is impossible to increase the utility of the agenda setter \( \theta^p \) without decreasing the utility of the median. The agenda setter would like to move the policy closer to her ideal point, but this change would be rejected by the median. When instead the status quo lies outside the shaded interval, we have that a policy change is possible. For instance, if \( q_1 > \tau^*(\theta^p) \), both legislators want lower taxation. The agenda setter \( \theta^p \) proposes \( \tau^*(\theta^p) \), which is accepted. Finally if \( q_1 < \tau^*(\theta^m) \) both legislators want higher taxes. Given that the poor legislator is the agenda setter and has all the bargain power, she would extract all the surplus from the median. That is, instead of proposing \( \tau^*(\theta^m) \), she proposes a tax that it would make the median indifferent between the proposal and the status quo.\(^{27}\) Let \( \tau^i_m(q) > \tau^*(\theta^m) \) be the proposal when \( q_1 < \tau^*(\theta^m) \).

It is now immediate to compute the expected tax in the second period before the identity of the agenda setter is known:

\(^{27}\)If the status quo is low enough, the policy that makes the median indifferent would be higher than \( \tau^*(\theta^p) \). In this case, the agenda setter would be able to pass her preferred policy \( \tau^*(\theta^p) \).
Expression (27) makes clear that when \( \theta^p \) is the agenda setter (an event occurring with probability \( \gamma \)), the median is not able to pass her preferred tax. From the perspective of \( \theta^m \) the final outcome worsens when the status quo is further away from \( \tau^*(\theta^m) \). In particular, when \( q_1 \) is close to 1, the bargaining power of the agenda setter \( \theta^p \) is so high that she is able to pass her preferred policy \( \tau^*(\theta^p) \). Finally, it is worth to mention that when \( \gamma = 0 \) our model of legislative bargaining would yield the median voter outcome.

4.2. Legislative Bargaining at \( t = 0 \). Exogenous vs Endogenous Status quo

We now analyze the political outcome at \( t = 0 \). We will consider two institutional frameworks. First, we assume that \( q_0 \) and \( q_1 \) are both exogenous. Second, we assume that (as in the main model) the status quo at time \( t = 1 \) is endogenous: \( q_1 = \tau_0 \). As we argue below, these two institutions lead to very different outcomes.

When the status quo is exogenous, the bargaining at \( t = 0 \) is trivial. Notice from (22) that because \( \theta^p, \theta^m < 1 \) all legislators unanimously want \( \tau_0 = 1 \), which is therefore accepted. A key feature of bargaining with exogenous status quo is that legislators cannot affect future outcomes. In fact, the expected tax at \( t = 1 \) does not depend on \( \tau_0 \), either directly or indirectly (via capital).

Suppose now that \( \tau_0 \) becomes the default option in case of disagreement at \( t = 1 \). After replacing \( q_1 \) with \( \tau_0 \) in (27), it is immediate to see that \( \tau_1 \) now depends on \( \tau_0 \). That is, the current legislature can, through the status quo, strategically manipulate the future one. This channel is absent in the standard Markov politico-economic equilibrium.

We let \( s_0(\tau_0) \) denote the saving rate at time 0. In the model with endogenous status quo, savings now depend on \( \tau_0 \) since \( \tau_0 \) affects expectation about future taxes. The value function of legislator \( \theta \) is

\[
v_0(\tau_0, k_0, \theta) = \frac{\log(\phi_0(\tau_0, \theta))}{1 - \beta} + v_0(\tau_0, k_0, 1)
\]  

(28)

With a more general utility function, there would be an indirect link through capital accumulation, as in Klein et al. (2008). As they show, this mechanism is not enough to discipline legislators.
where $\phi_0(\tau_0, \theta)$ is given by (24) and

$$v_0(\tau_0, k_0, 1) = \alpha \log(k_0) + \log(1 - s_0(\tau_0)) + \beta E[v_1(\tau_1(\tau_0), s_0(\tau_0)k_0, 1)].$$

(29)

When the status quo is endogenous legislative bargaining at $t = 0$ is different since legislators realize that $\tau_0$ affects, via the status quo, the expected tax at time 1.

The goal of this example is not to fully characterize the legislative bargaining outcome at $t = 0$. More simply, we want to understand how having an endogenous status quo changes legislators’ considerations at time 0. For instance, we ask the following question: Will $\tau_0 = 1$ still maximize the indirect utility of the median at $t = 0$ when the status quo is endogenous?

Note that if $\tau_0 = 1$ passes, in the following period the tax will be $\tau^*(\theta^p)$ with probability $\gamma$. Note instead that if $\tau^*(\theta^m)$ passes at $t = 0$, it will also pass at $t = 1$, see (27), and stay in place for all $t \geq 1$. Since $\tau^*(\theta^p) > \tau^*(\theta^m)$, choosing $\tau_0 = 1$ is then costly in the long run compared to choosing $\tau^*(\theta^m)$. The larger $\gamma$ and $\beta$ the larger this cost. As a result, we obtain that in general the median legislator does not choose $\tau_0 = 1$ and, depending on the parameters, she could choose $\tau_0$ close to $\tau^*(\theta^m)$, the long run committed policy.

The message of this example is that when the status quo is endogenous, having 100% taxation (or any high status quo) at $t = 0$ would lower the median’s bargaining power when the poor is the agenda setter at $t = 1$. As a result, $\tau_0 = 1$ is not optimal anymore. The existence of disagreement at $t = 1$ among legislators is what makes it credible that high status quo taxes will stay in place. Notice in fact that even though all politicians agree on the need of initial full redistribution, they disagree on the level of redistribution that they would like to keep in the long run. An institution with exogenous status quo, and therefore without direct intertemporal political links, does not make use of this disagreement to achieve better outcomes.

Two additional features of the bargain protocol should be mentioned. First, as $\theta^p$ approaches $\theta^m$ the tax in period 0 goes to 100%. In the limit, when there is no disagreement within the legislature, legislators would not care about lowering their bargaining power. In fact, the median foresees that future agenda setters will bring taxes down to $\tau^*(\theta^m)$, regardless of the status quo. Thus, she proposes taxes as high as possible at $t = 0$. Second, as $\gamma$ goes to zero, the tax in period 0 also goes to 100%. In this case, the median legislator realizes that she will likely have the power to lower taxes at $t = 1$. As a result, she does not have
to keep taxes low at \( t = 0 \). From this point of view, both the uncertainty about the future agenda setter and the disagreement about future policies are key to sustain good (low tax) equilibria.

It is important to notice that the distinction between having an endogenous or an exogenous default would have drastic consequences if legislators had the chance to re-set taxes also in the third period (once and for all). Following the same line of argument used above, we obtain when the status quo is exogenous, the expected tax in the second period would be 100\%, thus generating zero savings in the first period and an utility of minus infinity. When instead the status quo is endogenous, expected taxes in the second period would be lower than 100\%; savings in the first period would then be higher. In the next Section we find through numerical solutions that the endogenous status quo helps sustain low taxes even when legislators are allowed to choose taxes at all \( t \).

5. Results

First, we simulate the economy described in Section 3.2, where capital fully depreciates. Throughout our numerical simulations we set \( \beta = 0.96, \alpha = 0.3 \) and upper bound for taxes \( \bar{\tau} = 0.8 \).\(^{29}\) Due to data limitations, a careful calibration of the distribution of powers and wealth shares in the legislature is problematic and therefore outside the scope of this paper. For tractability, we assume that the share of wealth in the legislature is distributed according to a truncated exponential in the interval \([-5, 1]\). The share \( \theta^s \) of the selected agenda setter is distributed according to a truncated normal, again in the interval \([-5, 1]\). In Sections 5.2 and 5.3 we will explore how sensitive results are to changes in the distributional assumptions.

In Subsection 5.4, we will allow for partial capital depreciation (we set \( \delta = 0.1 \)). In the economy with partial depreciation we analyze two possibilities. First, we suppose that taxes are on wealth. Second, we constrain the legislator to tax only the return to asset holdings. This allows us to analyze the consequence of giving legislators more discretion.

\(^{29}\)Given full depreciation of capital, if we set \( \bar{\tau} = 1 \) policymakers, by choosing the upper bound, could eliminate all inequality in the first period and thus all future temptations to rise taxes ex-post. Therefore, we assume \( \bar{\tau} < 1 \). The assumption is a reduced form way of capturing a richer environment where agents have exogenous labor skills that regenerate inequality in every period.
5.1. Proposal and Acceptance Strategies

The most important outputs of the numerical simulations are the proposal strategies and the acceptance probabilities, which we now describe. In Figure 3, we fix the level of capital and illustrate the proposed capital tax (on the vertical axis) as a function of the status quo for different values of $\theta_s$.\(^{30}\)

\[\begin{array}{cc}
\text{Proposed tax (given capital)} & \text{Status quo} \\
-0.1 & 0.0 \\
0.1 & 0.2 \\
0.3 & 0.4 \\
0.5 & 0.6 \\
0.7 & 0.8 \\
0.9 & 0.1 \\
\end{array}\]

\[\begin{array}{cc}
\text{Proposed tax} & \theta = 0.20 \\
\theta = 0.40 & \\
\theta = 0.55 & \\
\theta = 0.75 & \\
\end{array}\]

Figure 3: Proposal Strategies

Two features of the proposal rules are worth noting. First, the poorer the legislator (that is, the lower her $\theta_s$) the higher the proposed tax for any given status quo. This is because poor legislators gain more from redistribution and consequently are more willing to accept the long run distortions associated with an increase of the status quo. For instance note that a poor agenda setter ($\theta_s = 0.2$) proposes $\tilde{\tau}$ for most status quos, while a relatively richer agenda setter ($\theta_s = 0.75$) proposes zero for most status quo policies. Second, proposal rules are monotone increasing in the status quo.\(^{31}\) For example, the upper curve in Figure 3 shows that a poor agenda setter proposes taxes lower than $\tilde{\tau}$ when the initial status quo is around

\(^{30}\)Throughout Section 5.1, we present results under the following distributional assumptions. The underlying (before truncation) wealth distribution is assumed to be $\lambda e^{\lambda (\theta - 1)}$ with $\lambda = 2$; the underlying density for the recognition probability is assumed to be normal with mean 0.1 and standard deviation 0.2.

\(^{31}\)Probabilistic acceptance contributes to this result, which highly facilitates the numerical analysis. Note that in the static agenda-setting model under simple majority rule (see Figure II, panels B and C, in Riboni and Ruge-Murcia, 2010) proposal rules are not monotone in the status quo. This is because an extreme status quo gives the proposer more leverage and makes her able to pass a larger policy change than a more moderate status quo.
zero and that her proposal approaches $\bar{\tau}$ as $q$ increases.

The positive slope of the proposal rule is an important element of our disciplinary mechanism. It provides strategic manipulation of future agenda setters: by passing low taxes current policymakers reduce the expected proposals of future agenda setters.

Figure 4: Acceptance Probabilities

Figure 4 illustrates the acceptance probabilities of proposal $\tau$, which is shown on the horizontal axis. As in Figure 3, we compute strategies keeping capital fixed. Each line in Figure 4 corresponds to a different status quo policy. Note that acceptance probabilities are below one unless the proposal coincides with the status quo, as per (17). When the proposal coincides with the status quo, legislators have no other choice than accepting the proposal. When the proposal differs from the status quo, some legislators oppose the change, which makes the probability of rejection strictly positive and generates the jump discontinuity when $\tau = q$. The fact that rejection occurs with positive probability creates policy persistence. Since policymakers gain from high taxes today but they would like to commit to low taxes in the future, policy persistence attenuates the temptation to tax at high rates.

Another feature worth noting is that the probability of acceptance is decreasing in the distance between the status quo and the proposal. Large policy changes are less likely to be accepted because an increasing number of people are made worse off. To understand this, consider first a proposal to infinitesimally cut taxes. In this case, the legislators who oppose
the change would be those who prefer a tax increase. Consider now a large tax cut and notice that the group of legislators opposing this change are not only those who prefer a tax increase, as before, but also some legislators who prefer a smaller tax cut.

Finally, note that in general there is an asymmetry between the left and the right jump from the status quo. For instance, when the status quo is 0.53 the probability of accepting a tax increase is smaller than the probability of accepting a tax cut. This is because a tax rate of 0.53 is too high from the perspective of the majority of legislators. When instead the status quo is relatively low, the asymmetry is in the opposite direction.

In Figure 5, we fix a level of capital and draw the expected tax for all status quo policies. We do so by computing the expected proposal using the equilibrium acceptance probabilities as weights. This graph is important because saving decisions are determined by the expectation of future taxes. The expected capital tax predicted by our model is quite reasonable: it ranges from 0.14 (when the current status quo is zero) to 0.23 (when the status quo is 0.8). Therefore, on average, very high taxes are not expected to stay in place for long periods. Therefore, savings will be relatively high even when the current tax is at the upper bound.
5.2. Long-Run Summary Statistics

Table 1 presents summary statistics for 10000 simulated legislative sessions. Each row corresponds to different combinations of recognition probabilities and wealth distribution in the legislature. We present in Columns 1 and 2 the first moments of both distribution: that is, $E(\theta^*)$, the expected share of the agenda setter, and $E(\theta)$, the expected share of wealth in the legislature. In Columns 3 and 4, we show the average capital tax and the average size of government (which is measured by the ratio between lump-sum transfers and total output). In Columns 5 and 6 we report, respectively, the autocorrelation, $P(\tau, \tau_{-1})$ and standard deviation. Finally, in Columns 7 and 8 we show the minimum and the maximum simulated tax.

All average taxes are well below the upper bound tax rate. Note that we obtain low taxes even when the average wealth share in the legislature is close to zero (see the first row). As expected, if both the average legislator and the average agenda setter become richer, average taxes decrease. In all our simulations the implemented tax for some sessions is zero and the approved tax is always below the upper bound.

The standard deviation of policy decisions is decreasing in the distance between the average share of the legislators and of the agenda setter. Intuitively, larger distances imply stronger disagreement within the legislature, and more disagreement leads to fewer policy changes and more status-quo bias. A similar argument can explain why we obtain high autocorrelation when the difference between $E(\theta^*)$ and $E(\theta)$ is high.

An interesting observation from this table is that stronger disagreement among agenda setters and legislators triggers more fiscal responsibility. To see this, comparing row 2 with 1 (or row 4 with 3), observe that the maximum implemented tax decreases when there is more disagreement within the legislature. Intuitively, agenda setters become more fiscally responsible (propose relatively lower taxes) when they face a legislature prone to favor high taxes. We will explore this mechanism in more detail in Subsection 5.3.
Table 1. Summary Statistics

<table>
<thead>
<tr>
<th>E(θ^*)</th>
<th>E(θ)</th>
<th>E(τ)</th>
<th>E(T/Y)</th>
<th>P(τ, τ_{-1})</th>
<th>σ(τ)</th>
<th>min</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.410</td>
<td>0.020</td>
<td>0.178</td>
<td>0.053</td>
<td>0.475</td>
<td>0.092</td>
<td>0</td>
<td>0.552</td>
</tr>
<tr>
<td>0.410</td>
<td>0.500</td>
<td>0.134</td>
<td>0.040</td>
<td>0.489</td>
<td>0.120</td>
<td>0</td>
<td>0.676</td>
</tr>
<tr>
<td>0.600</td>
<td>0.020</td>
<td>0.138</td>
<td>0.041</td>
<td>0.528</td>
<td>0.078</td>
<td>0</td>
<td>0.507</td>
</tr>
<tr>
<td>0.600</td>
<td>0.500</td>
<td>0.115</td>
<td>0.034</td>
<td>0.490</td>
<td>0.110</td>
<td>0</td>
<td>0.642</td>
</tr>
<tr>
<td>0.600</td>
<td>0.602</td>
<td>0.104</td>
<td>0.031</td>
<td>0.480</td>
<td>0.085</td>
<td>0</td>
<td>0.630</td>
</tr>
<tr>
<td>0.800</td>
<td>0.785</td>
<td>0.058</td>
<td>0.013</td>
<td>0.450</td>
<td>0.090</td>
<td>0</td>
<td>0.520</td>
</tr>
</tbody>
</table>

In Figure 6 we show a sample path for capital taxes with the initial status quo at 0.5. After a few periods, the capital tax drops and tends to oscillate within a “reasonable” range between 0 and 20 percent. While average taxes are relatively low, Figure 6 shows that our model exhibits large cyclical deviations around the average. Admittedly, the high variance of taxes obtained here does not likely match the variability of public policies observed in most countries. This is driven mainly by the assumption that recognition probabilities for the agenda setters are i.i.d.

Figure 6: Sample Path for Taxes
Our model provides a tractable framework that can be used to analyze comparative statics. As we argue below, the existence of strategic interdependence between legislators over time implies that changes in the political environment will have non-trivial effects on legislators’ strategies. First, we consider a shift of power towards legislators representing poor constituencies (see Sections 5.3.1 and 5.3.2). In Section 5.3.3, we analyze a bargaining protocol wherein proposal must be approved by two chambers in order to pass. Finally, in Section 5.4 we consider a model with partial capital depreciation and compare taxes on wealth with taxes on capital income.

5.3.1. Shift of Agenda Setting Power. Table 1 has already shown that a decrease in the expected wealth share of the agenda setter does not have drastic consequences for equilibrium outcomes. This is because it generates two opposite effects that balance each other. On the one hand, poorer legislators, who prefer higher taxes, are recognized more often. On the other hand, the fact that future agenda setters will likely be poorer increases the incentive of current agenda setters to propose low taxes by increasing the cost of moving into the next period with a higher status quo. In order to understand the latter effect, we look in detail at the equilibrium proposals and acceptance probabilities when the distribution of agenda setting power within the legislature changes. We fix the average wealth share in the legislature (throughout \( E(\theta) = 0.5 \)) and decrease the average wealth share of the recognized agenda setter from 0.6 to 0.41. Figure 7 compares the proposal rules (upper row) and the probability of acceptance (lower row), respectively, after (left panel) and before (right panel) the power shift.
The upper row of Figure 7 illustrates that the proposals made by an agenda setter of any given wealth share are lower when future agenda setters are expected to be poor compared to the proposals made when future agenda setters are expected to be rich. This is why the proposal rules in the upper-left panel of Figure 7 are below those in the upper-right panel. For instance, consider the tax proposed by a very poor agenda setter ($\theta_s = 0.2$). When the expected share of future agenda setters is 0.41, her proposal is consistently below the upper bound tax rate for all status quo policies. When instead rich legislators are more likely to be recognized, the proposal rule starts at a higher level and reaches $\bar{\tau}$ when the status quo is above 0.4. The intuition behind this result is that a shift of agenda setting power toward the poor has a *disciplinary effect*. Since a larger number of future agenda setters are expected to
be fiscally irresponsible (propose tax increases), it is more valuable to strategically use the status quo to manipulate them.

Notice that we observe the same disciplinary effects on acceptance probabilities. As shown in the lower panels of Figure 7, when the expected agenda setter becomes poorer, the legislature is less likely to accept tax increases and reject tax cuts.

However, as mentioned before, a power shift towards the poor also induces a standard composition effect on the pool of realized agenda setters. Since rich legislators propose, on average, lower taxes, if they are less likely to be recognized, equilibrium taxes tend to increase.

Comparing row 2 with row 4 in Table 1, note that the overall effect of a sizeable power shift toward poor legislators is positive, but quite small.\textsuperscript{32}

5.3.2. Changing the Wealth Distribution in the Legislature. We now consider a shift of the wealth distribution of the legislature to the left, so that the legislature now includes more individuals representing poorer constituencies. Since the probability of acceptance depends on the distribution of wealth in the legislature, this gives poor individuals more power to block proposals. In the simulations, we consider a shift in the expected share in the legislature $E(\theta)$ from 0.6 to 0.5 (while keeping $E(\theta^s) = 0.6$).

\textsuperscript{32}In unreported results, we also considered a decrease in the dispersion of recognition probabilities that preserves the mean of $E(\theta^r) = 0.6$. This lowers the probability that agenda setters with preferred policies at the extremes of the political spectrum are selected. We find that average tax levels do not significantly change.
As expected, the lower panels of Figure 8 show that tax cuts are less likely to be approved and tax increases are less likely to be rejected with a poorer legislature. However, as in the previous subsection, the upper panels in Figure 8 show that this shift induces agenda setters to propose lower taxes. We obtain this disciplinary effect because high taxes are more persistent and therefore are a more costly status quo. As a result of these two opposite effects, average taxes and transfers increase only by a small amount (compare rows 4 and 5 in Table 1).

5.3.3. Bicameralism. We now suppose that in order to pass, a proposal must be approved by two chambers. For simplicity, assume that in the two chambers, legislators’ wealth shares are distributed according to the same density. As before, in each chamber the probability of approval is equal to the measure of legislators who prefer the policy change. Since we assume that the two votes are independent, the overall probability that the proposal passes
is simply the square of expression (12).

Figure 9: Unicameralism (Left Panels) vs Bicameralism (Right Panels)

Figure 9 illustrates the proposal rules (upper panels) and acceptance probabilities (lower panels) in the two systems. Equilibrium behavior under bicameralism (unicameralism) is shown at the right (left). As expected, we find that the constitutional change induces more status quo bias: policy changes less likely pass in a bicameral system. Moreover, it affects the slope of equilibrium proposal rules. In the bicameral legislature, proposals are closer to the 45 degrees line. This is because legislators propose taxes closer to the status quo in order to increase the probability of acceptance. For instance, note that tax increases proposed by poor agenda setters ($\theta^s = 0.2$) are more moderate in the bicameral case when the status quo is close to zero. Finally, by increasing policy persistence, bicameralism makes it more

\[ \text{Notice that the probabilities of acceptance in the bicameral system are not exactly equal to the square of the ones under unicameralism. This is because voting rules, as described in (10), are themselves affected by the constitutional change.} \]
costly to go to the next period with a high status quo. As a result, proposal rules are now lower. Numerical simulations show that in our stylized bicameral system taxes are lower, autocorrelation increases and public policies are less volatile.

Table 2. Bicameralism

<table>
<thead>
<tr>
<th>Constitution</th>
<th>$E(\theta^s)$</th>
<th>$E(\theta)$</th>
<th>$E(\tau)$</th>
<th>$P(\tau, \tau_{-1})$</th>
<th>$\sigma(\tau)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unicameralism</td>
<td>0.6</td>
<td>0.5</td>
<td>0.193</td>
<td>0.494</td>
<td>0.197</td>
</tr>
<tr>
<td>Bicameralism</td>
<td>0.6</td>
<td>0.5</td>
<td>0.162</td>
<td>0.535</td>
<td>0.175</td>
</tr>
</tbody>
</table>

5.4. Partial Depreciation of Capital

In the economy analyzed so far, capital fully depreciates. Note that when the depreciation rate is one, capital in the next period coincides with current savings. This implies that expectations of high taxes would drive capital to low levels (possibly zero) in only one period. In other words, full depreciation makes future capital extremely elastic.

When instead the depreciation rate $\delta$ is less than one, low savings would have a weaker impact on the stock of capital available in the next period. This diminishes the political cost of going to the next period with a high status quo tax and increases legislators’ temptation to choose high taxes. This intuition is confirmed in the first row of Table 3, where we present average taxes and transfers in an economy with $\delta = 0.1$: average taxes are now more than 3 times larger than in the economy with full depreciation.

Table 3. Partial Depreciation

<table>
<thead>
<tr>
<th>Type of Taxation</th>
<th>$E(\theta^s)$</th>
<th>$E(\theta)$</th>
<th>$E(\tau)$</th>
<th>$P(\tau, \tau_{-1})$</th>
<th>$\sigma(\tau)$</th>
<th>Output</th>
<th>Consumption</th>
<th>$E(T/Y)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Income</td>
<td>0.64</td>
<td>0.72</td>
<td>0.347</td>
<td>0.522</td>
<td>0.281</td>
<td>1.114</td>
<td>0.970</td>
<td>0.059</td>
</tr>
<tr>
<td>Wealth</td>
<td>0.64</td>
<td>0.72</td>
<td>0.101</td>
<td>0.448</td>
<td>0.213</td>
<td>1.064</td>
<td>0.940</td>
<td>0.137</td>
</tr>
</tbody>
</table>

Next, we maintain the assumption that $\delta = 0.1$ but consider the possibility that legislators are able to tax wealth, as opposed to just capital income. This implies that legislators are less constrained in their choices. We expect that this larger tax base might increase the temptation to set high taxes ex-post. In spite of this, the second row of Table 3 shows that average taxes are well below confiscatory rates (close to ten percent). In order to understand the effect of more discretion on welfare we look at output and consumption levels. In our
simple calibration, passing a constitutional amendment which does not allow taxes on wealth increases average consumption by about 3 percent.

6. Conclusions

Our analysis is motivated by two broad questions: given that wealth is often concentrated in the hands of a minority, why do elected governments rarely choose extremely high levels of taxation and redistribution? Also, how can we explain the great deal of variation in these policies across countries?

The classic paper by Meltzer and Richard (1981) provides two influential answers to both questions. First, they show that when the mean income rises relative to the income of the median voter, taxes rise. The wide dispersion of inequality across countries (measured by the median to mean pretax wealth ratio) is then viewed as a prime candidate to explain why government size differs across countries. Second, they argue that the median voter does not choose high (in their model, labor) taxes knowing that such taxes would distort private decisions, lower aggregate income, and eventually reduce the amount available for redistribution.

The debate is, however, far from being settled. Subsequent empirical analysis has questioned the prediction that more inequality promotes redistribution, and it remains difficult to explain why governments restrain from taxing current, sunk capital.

In this paper, we study a model where redistribution is decided in post-election bargaining rather than by the median voter. This point of departure from the literature in macroeconomics is key to generate novel answers to our motivating questions.

We find that policymakers may not propose (or accept) high capital taxes because this increases the status quo, and thus the bargaining power of low wealth agents in future negotiations. Taking this future cost into account, we find that reasonably low capital taxes become time consistent. We also obtain levels of transfers as a percentage of GDP that are broadly in line with what we see in the data. Note that these results are obtained without resorting to reputational arguments or introducing ad-hoc constraints on the governments’ set of choices.

Comparative statics analysis shows that the political environment and the number of checks and balances specified in the constitution are key determinants of government size.
Among other experiments, we consider a shift of proposal power toward representatives of poor constituencies. We show that on the one hand, since poor policymakers gain more from redistribution, they are more likely to propose higher capital taxes. However, we also show that poor legislators having more agenda-setting power increases the political cost of going to the next period with a high status quo. As a result, we find that legislators behave in a more fiscally responsible way. All in all, these two opposite effects imply that taxes and transfers do not increase much when the poor have more power. Since a power shift towards poor legislators might be related to increased inequality, our results could explain why the empirical relationship between inequality and government size is weaker than what is predicted by macro models adopting the median-voter approach.

The economic consequences of political institutions have been studied by several authors using stylized models, often in a partial equilibrium and static setting. Our paper is then a first step to understand the effects of constitutional rules on economic outcomes in the context of a canonical Neoclassical growth model. However, much remains to be done in order to capture more realistic features of policymaking. We believe that this constitutes an important direction for future research.
Appendix A. Algorithm

Given measure $\mu^s$ of agenda setters and $\mu^l$ of median legislators, construct grids $K$, $T$, and $\Theta$ for, respectively:

1. Capital stock $k \in [k_{\text{min}}, k_{\text{max}}]$.
2. Tax $\tau \in [0, \bar{\tau}]$.
3. Share of average capital $\theta \in [\theta_{\text{min}}, 1]$.

We choose $\theta_{\text{min}}$ low enough to make sure that there is a measure zero of $\theta$’s below it.

Guess an initial Markov process for taxes $\Gamma_0(\tau|q,k): T \times T \times K \to [0,1]$. To allow for sensitivity of the competitive equilibrium to the actions of the political game we start the simulations with $\Gamma_0(\tau|\tau,k) = 1$ for all $k$, $\tau$.

Finally, we fix the tolerance level for the political game, $\epsilon > 0$.

Step 1 (Solve Competitive Equilibrium) Given $\Gamma_0$ solve for the equilibrium law of motion for capital: $k' = G_1(k, \tau)$ for $(k, \tau) \in K \times T$, using the endogenous grid method of Carroll (2005).

The key observation is that under complete markets the aggregation theorem holds, and we only need to solve for the optimal decision of the average agent. Since the fixed grid is $K$, the output from this step would be the matrix $k_0 \in \mathbb{R}^2$ such that $k = G_1(k_0, \tau)$ for all $(k, \tau) \in K \times T$. Then, using linear interpolation we obtain the mapping $G_1: K \times T \to \mathbb{R}$.

Step 2 (Compute value functions) Given $\Gamma_0$ and $G_1(k, \tau)$ compute the value function for the average agent, $\hat{V}(k, \tau, 1)$, using the standard iteration of the value function (starting with $\hat{V}(k, \tau, 1) = 0$) and interpolating for values of $k$ outside the grid. Further, again because of the aggregation theorem, the value function for each agent $\theta$ can easily be computed as $\hat{V}(k, \tau, \theta) = \log(\phi(\theta)) + \hat{V}(k, \tau, 1)$ for all $\theta$, using expression (9).
Step 3 \((\text{Update Markov process for taxes})\) Using equation (16) compute, for each \(k\), the legislator \(\theta^\ast(k, \tau, q)\) who is indifferent between the status quo \(q\) and a new policy \(\tau\). Then, the probability of acceptance of a tax \(\tau\) given status quo \(q\) and capital stock \(k\), is given by (17). In addition, given the acceptance probability, \(\hat{V}(k, \tau, \theta)\) and \(G_1(k, \tau)\) we can compute the optimal choice for each agenda setter using equation (13): \(\tau(k, \tau, \theta)\). Since we are not certain about the properties of the objective function we use a global method to choose the maximum. That is, we evaluate the objective function for all possible combinations of \(k\) and \(\tau\) and choose the maximum value.

Both \(Pr^\alpha(k, q, \tau)\) and \(\tau(k, \tau, \theta)\) then imply a new Markov process for taxes using (15).

Step 4 \((\text{Updating})\) Check the distance between the assumed process for taxes and that implied by the policy game. If \(\text{norm}(\Gamma_0 - \Gamma_1) < \epsilon\) stop: the equilibrium is found. Otherwise go to Step 1, updating \(\Gamma_0\) with \(\alpha \Gamma_1 + (1 - \alpha) \Gamma_0\) for some \(\alpha \in (0, 1)\).
Bibliography


Piguellem Facundo and Anderson L. Schneider (2009) “Heterogeneous Labor Skills, the Median Voter and Labor Taxes” mimeo, EIEF.


