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Abstract

I present a tractable dynamic model of political economy where disagreements about the composition of public spending result in implementation of short-sighted policies. The relative price of investment to consumption is excessively large in equilibrium due to over-taxation. Investment rates are too low which slows down growth along the transition. In the long run, this results in output, consumption and welfare being inefficiently low. The larger is the degree of polarization, the greater is the inefficiency. Political stability mitigates the effects of polarization by making the incumbent internalize the dynamic inefficiencies introduced by the choice of growth-retarding policies.

JEL Classification: E61, E62, H11, H29, H41, O23
Keywords: Barriers to Investment, Commitment, Probabilistic Voting, Markov Equilibrium, Time Consistency, Polarization, Speed of Convergence, Development.

*Correspondence: Marina Azzimonti. 3.152 BBR, University of Texas at Austin. Austin, TX, 78712. e-mail: azzimonti@eco.utexas.edu. All errors are mine. A previous version of this paper circulated under the name 'On the dynamic inefficiency of governments'.

1 Introduction

One of main driving forces of growth and development is private investment. However, we see large distortions in the price of investment relative to consumption across countries, capturing *barriers to investment* (examples are capital income taxes, investment taxes, permits, etc). These, by distorting investment decisions, slow down growth and result in lower levels of consumption and income per capita. [1]

A key observation is that the price of investment is correlated with socio-political variables reflecting frictions in the government's decision-making process, such as the *degree of polarization* and the level of *political instability*. Figure 1 shows that for a cross-section of countries—excluding non-democracies—greater polarization results in larger barriers to investment (right panel), while this is mitigated by the degree of political stability (left panel).[2] These socio-political variables are also found to be related to the size of governments and economic development, as discussed in further detail in the next subsection. In this paper, I present a tractable dynamic model of political economy that explains such relationships.

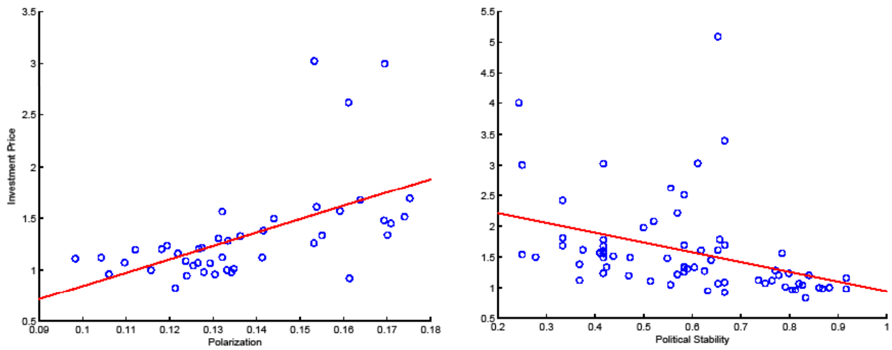

Figure 1: Price of investment and socio-political variables.

The analysis herein assumes that the role of the government is to provide public goods, which are financed via investment taxes. There are two groups or regions in the economy, and while agents agree on the size of governments, they disagree over the composition of expenditure. The intensity of such disagreements is captured by the *degree of polarization*. Groups are represented by parties which alternate in power via a democratic process, and election outcomes are uncertain. The *degree of political stability* (i.e. frequency of turnover) is determined in a voting equilibrium. The private sector is modeled as a standard neoclassical economy. Individuals work for and rent capital to competitive firms, and consume private and public goods. They are forward looking and vote for the party that yields them higher expected utility.

There is no commitment technology, so promises made during the campaign are not credible unless they are optimal ex-post (i.e. when the party takes power). I characterize time-consistent outcomes as symmetric Markov-perfect equilibria.[3] First, I derive the incumbent's optimality

[1] Restuccia and Urrutia (2001) show some support of this hypothesis by constructing a panel for the price of aggregate investment over consumption and documenting that the relative price of investment is negatively correlated with investment rates.

[2] Price of investment (1980s average) from Restuccia and Urrutia (2001). Political Stability (1980s average) from the PRS data set; the variable name is 'Government Stability'. Polarization is obtained from Lindqvist and Ostling (2007) who define a measure of polarization from survey responses about the role of the government. Dictatorships are excluded from the datasets using the Gastil scale, taken from Easterly and Levine (1997). Both variables have been normalized to belong to the interval [0,1].

[3] Thus, the equilibrium described herein is a "fundamental" equilibrium capturing the effects that are inherent

condition for a general case, as well as characterize the determinants of political turnover in the equilibrium of a voting model. Second, I solve for this equilibrium in closed form and derive testable implications from the theory. Third, I compute the economy for a more general parameterized case.

I find that societies that are very polarized tend to grow at a lower rate and converge to lower levels of income per capita in the long run. The model hence provides a rationality-based explanation of the empirical relationship found by Easterly and Levine (1997) and others between polarization (ethnic diversity) and growth. Due to political uncertainty, governments are endogenously *short-sighted*—at least more so than the groups they represent. As a consequence, they tend to overspend, and since public spending is financed through distortionary taxation, there is under-investment and lower levels of income per capita in the long run. Moreover, the speed of convergence decreases, implying that measured growth rates are lower along the transition path. This dynamic inefficiency is mitigated by the degree of incumbency advantage, which increases political stability. This result is consistent with the negative correlation between political instability and private investment found for example, in Barro (1991), and Alesina, Ozler, Roubini, and Swagel (1996). The stronger is the advantage of the incumbent over the opposition, the higher is the investment rate, and the faster is the growth to a better steady state. This stability, however, comes at a cost: the persistence of one government leads to persistent underspending on public goods of the type preferred by the group out of power. The degree of inefficiencies caused by political failures is characterized in the analytical example, where the solution is shown to be Pareto-inferior to that in the second best (for any arbitrary set of Pareto-weights), as long as the outcome of elections is uncertain.

The main intuition behind the results is best understood from the Euler equation faced by the incumbent in power, which is composed of four terms, each involving a source of inefficiency arising from socio-political frictions. The first term captures the trade-offs faced by a government that lacks commitment and only has access to distortionary taxation in an homogeneous society. It contains a weighted sum of wedges to (i) private investment and (ii) the marginal utility of private and public consumption, and is analogous to the optimality condition derived in previous literature (see, for example, Klein, Krusell and Rios-Rull, 2008). It implies that governments with no commitment choose larger taxes, as the detrimental effect of current taxes on previous investment is ignored by the incumbent in power. The second term captures the extra distortion generated by heterogeneity in society—but abstracting from political instability—: the party in power does not internalize the effects of its policy on the group out of power and this implies an extra wedge relative to the optimality condition of a benevolent planner. This term is usually present in environments with a common pool problem, and generally results in over-spending and over-taxation. The third term summarizes the effect of political instability: the government wants to decrease the level of resources available to next period's policymaker (increasing taxes today) so as to restrict spending on local public goods that his group does not value. This distortion is common in models with political uncertainty, such as Alesina and Tabellini (1990) for the case of government indebtedness in a two period model. This last effect might be counterbalanced by the fourth term, as long as the current incumbent expects to re-gain power sometime in the future. Larger taxes today have a negative effect in the opposition's policy that will deter future investment, and this must be taken into account by the current policymaker. This effect only appears in infinite-horizon economies with incumbency advantage and has not been derived in other papers in the literature. It implies a weighted sum of the previous distortions into the

in the dynamic game itself, whether of finite-or infinite-horizon. The equilibrium here is thus the limit of finite-horizon equilibria: its characteristics do not significantly depend on the time horizon, so long as the time horizon is long enough. See Dixit, Grossman, and Gul (2000) for efficient allocation rules that are not Markov in the political game.

future, and it is particularly relevant for long-run outcomes.

A discussion of the empirical motivation can be found below, followed by a description of this work relative to the existing literature. The model is described the Section 2. The political game and the Markov-perfect equilibrium are defined in Section 3. The incumbent's Euler equation is characterized in Section 3.2 under the extra assumption of differentiability. Analytical solutions for are presented in section 3.3, where qualitative testable implications are derived. Section 3.4 computes the model for a more general parameterization. Section 4 concludes.

1.1 Empirical motivation

Easterly and Levine (1997) documented that heterogeneity, measured by an index of ethno-linguistic fractionalization, has a direct negative effect on the level of income per capita and economic growth. This study triggered a large empirical literature on the relationship between socio-political variables and economic outcomes. While polarization and fractionalization were used interchangeably in many studies, subsequent work has tried to distinguish these two concepts.[4]For example Alesina, Devleeschauwer, Easterly, Kurlat, and Wacziarg (2003) provide new measures of ethnic, linguistic, and religious polarization. They redo the experiments of Easterly and Levine (1997) and find that polarization leads to lower GDP per capita and negatively affects growth rates. Lindqvist and Ostling (2007) use responses of a survey about economic policy to derive an alternative measure of polarization and find that politically polarized countries are poorer. Montalvo and Reynal-Querol (2005) find that while ethnic fractionalization significantly reduces growth, ethnic polarization does not. They find instead that ethnic polarization has a large and negative impact on economic development through the reduction of investment and the increase of government consumption, which indirectly affect growth. Hall and Jones (1999) find that the more homogeneously a country is Catholic or Muslim, the higher is their output per worker. his paper develops a formal political economy model that provides micro-foundations for the empirical relationships between ethnic (and cultural) diversity and economic development. Consistently with the empirical facts, it predicts that polarization is negatively correlated with income per capita, investment and growth rates, and output per worker, while it is positively related to the size of governments.

The model also provides a micro-foundation for some of the findings relating political instability and growth. The empirical link between institutions and economic development in ethnically polarized societies was first pointed out in a systematic way by Barro (1991). He finds that political instability, measured as assassinations per million population and coups/revolutions per year, has a significant negative effect on growth from 1960 to 1985 for a panel of countries. He also finds a strong negative correlation between the size of governments (measured by public consumption) and private investment. Asteriou, Economides, Philippopoulus, and Price (2000) find that increases in the probability of re-election (measured by the popularity of the government) increase growth in the UK. Alesina, Ozler, Roubini, and Swagel (1996) study a sample of 113 countries for the period 1950-1982 and find that increases in political instability significantly reduce growth. Roubini and Sachs (1989a,b) relate the post-1973 patterns of public-sector spending as a share of GDP in the OECD countries to the characteristics of their political institutions. Devereux and Wen (1998) also provide empirical support for the bias towards spending. They show that sociopolitical instability (using the Barro and Lee index) has a positive effect on the ratio of government spending to GDP. The model's predictions are also consistent with these correlations.

[4]See Esteban and Ray (1994). Fractionalization measures often capture just the *number* of different groups in society but not the intensity of disagreement. Polarization is more closely related to the *distance* between two or more groups, and their relative population shares in society.

A main point in this paper is that the conflict arising in polarized societies results in governments choosing inefficient policies that slow down growth. Our hypothesis is that the larger the degree of polarization, the higher the barriers to investment, which reduces the incentives to invest. [5] Restuccia and Urrutia (2001) provide support for the link between large investment distortions and low investment rates, which result in low growth rates. Our contribution over their work is to introduce a link between socio-political variables and investment distortions, as shown in Figure 1. [6]

Since both variables are highly correlated (their correlation is -0.51), it is interesting to decompose their effect on the relative price of investment. A simple OLS regression presented in Table 1 reveals that polarization and political stability are significant.[7]

Table 1: Dependent variable : relative price of investment

Variable	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)
Intercept	0.515	(0.641)	-1.777	(1.865)
Polarization	9.532**	(3.383)	25.816*	(12.896)
Political stability	-0.763*	(0.394)	2.982	(2.890)
Polar.*Polit. stability			-27.204	(20.802)
R^2	0.368		0.394	
F-stat	12.226**		13.322**	

To understand this, consider a one standard deviation (0.02) increase in polarization from its mean of 0.138. Using the second regression, this implies an increase of 0.18 in the relative price of investment. Increasing political stability from its 0.65 mean by a s.d. (0.17), results in a decrease of 0.14 instead. Consistent with these estimates, the model delivers a positive correlation between the investment distortion and polarization, and a negative relationship with political stability.

1.2 Literature review

There are a number of papers emphasizing that parties may choose not to implement policies that increase welfare because their reelection is uncertain. The argument in this literature is that the government may be less inclined to improve the legal system, to overspend on public goods (which only benefit a specific group), to create excessive levels of debt or to under-invest in productive public capital.[8] The contribution of this paper lies in the analysis of a dynamic infinite-horizon political economy model embedded in a neoclassical environment, where policy affects private

[5] There are alternative formulations (like the use of income taxes and capital income taxes) which would lead to similar outcomes to the ones described in this paper.

[6] Hsieh and Klenow (2007) argue the higher relative price of investment in poor countries is due to lower efficiency in producing investment goods (a productivity puzzle), rather than to distortions in investment. This is based on the fact that the price of investment has practically no correlation to real GDP per worker, while the price of consumption is lower in poor countries. While I will be focusing on a closed economy model, the results presented here would be consistent with their findings as long as the non-tradeable component of investment is relatively cheaper in poor countries—since this would offset the effect of a higher tax rate, resulting in the investment price having a low correlation with income—.

[7] Interestingly, even when a measure of TFP is included (from Hall and Jones, 1999), both coefficients are still jointly significantly different from zero, but TFP is instignificant. * denotes significance at 5%, and ** at 1% level.

[8] Svensson (1998) analyzes the effects on the legal system. Persson and Svensson (1989) and Alesina and Tabellini (1990) study the interaction between changes in the identity of the policymaker and excessive debt creation in two period models, while Caballero and Yared (2008) extend these to an infinite horizon model of taxation smoothing. Besley and Coate (1998) and Persson and Tabellini (2000) present models where the government under-invests.

investment and long run outcomes. A forward-looking government must take into account how future policymakers will react to current changes in investment caused by taxes and how this in turn will affect the availability of resources if power is regained. This dynamic strategic effect cannot be captured in two-period models. Acemoglu, Golosov and Tsivynski (2008a), Devereux and Wen (1998), and Woo (2005) do analyze infinite-horizon models where under-investment and overspending arise, but mainly because policymakers have different preferences (and hence objectives) than private agents. In the first case politicians try to maximize rents from being in power, and hence are completely self-interested. In the other two cases, parties care only about public goods but disregard agents' welfare (that is, they ignore the effects of policy on private consumption). In a very interesting recent paper, Acemoglu, Golosov and Tsivynski (2008b) extend these ideas to an environment where policymakers may be benevolent, and the whole set of sustainable equilibria is characterized (with Pareto weights capturing the strength of political institutions). One of the main differences is that they focus on a repeated model of production where labor is endogenous, but there is no capital investment. This eliminates dynamic links between policy at different points in time (the dynamics in their model arises from reputation concerns). They also assume that parties alternate in power exogenously, but find that the set of sustainable allocations is independent of political instability. While the study of sustainable equilibria would be an interesting extension to this paper, it is an open question whether the positive correlation between investment taxes and political stability would hold in the best equilibrium.

This paper also contributes to a growing literature on political failures that result from a fundamental lack of commitment of the government. While existing models with repeated voting find strategic interactions, most of them have to rely on numerical methods to characterize the Markov-perfect equilibrium, as in Krusell and Rios-Rull (1999), or Azzimonti, de Francisco, and Krusell (2008). Hassler, Mora, Storesletten, and Zilibotti (2004), on the other hand, find analytical solutions in an overlapping generations setup where policy is decided by majority voting, but assume away political uncertainty. As here, Hassler, Storesletten, and Zilibotti (2007) find that expenditures in a consumable public good can be inefficient, but in a model where two-period lived agents vote over redistributive policy. Unlike in their work, distortionary taxation deters private investment in this paper, which allows us to analyze the effects of policy on economic growth during the transition and compare long run outcomes. In a partial equilibrium model (also without capital), Battaglini and Coate (2008) introduce productive public goods financed by the government. Instead of focusing on political parties, they assume that policy (i.e. spending on an unproductive public good, pork barrel expenditures, and taxation) is decided through legislative bargaining. In their work the probability of being able to choose expenditures is exogenous and only depends on the number of legislators, while it is endogenous here and depends on future expected policy. Moreover, we focus on the dynamic distortions caused in private investment by large governments, while they emphasize the effects on the labor supply and the provision of durable public goods.

This paper also extends existing literature by endogenizing the probabilities of re-election in a dynamic setup. By allowing agents to vote, the degree of political uncertainty is jointly determined with public policy. A key assumption in this paper is that politicians do not have commitment to platforms, but are instead citizen candidates. As a result, the incumbent maximizes the utility of the group they represent and disregards the welfare of other groups. This is contrary to standard probabilistic voting with commitment to platforms, where the politician's maximization problem is equivalent to that of a benevolent planner without commitment (see for example Sleet and Yeltekin, 2008 or Farhi and Werning, 2008). Because of the symmetry assumption, I find that the probability of re-election is independent of the stock of capital. See Lagunoff and Bai (2008) for an interesting reduced form environment based on Battaglini and

Coate's (2008) model, where the re-election probability depends on the aggregate state of the economy in a parametric form by assuming that policy-makers face a Faustian trade-off.

The model that is most closely related this one is that by Amador (2003), which also analyzes the inefficiencies generated by the common pool problem in a dynamic model. His basic mechanism, like the one in this paper, is based on the trade-offs described in Alesina and Tabellini (1990). Amador analyzes an infinite-horizon economy where politicians also have a bias towards the present: they are too impatient and behave as hyperbolic consumers. This results in inefficient overspending and excessive deficit creation. The contributions over his work are: the introduction of private investment and distortionary taxation, the endogenous determination of political turnover, and the link between socio-political variables and economic outcomes. In a recent paper, Aguiar and Amador (2009) analyze the effects of these two socio-political variables on expropriation rates, which affect economic growth by deterring investment by multinational firms. Their focus is on the flow of capital across countries in open economies, while I analyze the effects of investment distortions on the domestic market. Methodologically, they characterize reputation equilibria, while I consider Markov-perfect equilibria.

The model that is closest in terms of the motivation is that by Padro-i-Miquel (2007), which analyzes the pervasive effects of ethnic differences in taxation, spending, and development in a dynamic economy. The main difference is that policy-makers are partisan and alternate in power via a democratic process in my paper, while there is no institutionalized succession of autocrats (whose objective is to maximize rents from power) in Padro's paper.

2 The basic model

2.1 Economic environment

Consider an infinite-horizon neoclassical economy populated by agents that live in one of two regions, the north N and the south S, of measure $\mu^J = \frac{1}{2}$, $J = \{N, S\}$. Agents work in the production sector for a competitive wage, rent capital to firms, and enjoy the consumption of private and public goods. While they have identical income and identical preferences over private consumption, there is disagreement on the composition of public expenditures due to the fact that the government can provide *local* public goods (e.g. parks, museums, local infrastructure and schooling). Agents are assumed to differ, not only in their preferences over the composition of expenditures, but also in another dimension that is completely unrelated to economic policy (religious views, charisma of the politician, etc.). Preferences over this *political dimension* imply derived preferences over the policymakers. The instantaneous utility is assumed to be separable in the consumption of public and private goods, and the political shocks are assumed to be additive. For agent j in region J we have

$$\underbrace{(1-\rho)u(c_{jt}^J) + \rho v(g_t^J)}_{\text{economic}} + \underbrace{\xi_{jt}}_{\text{ideological}}, \tag{1}$$

where u and v are increasing and concave, with $v(0) \equiv \bar{v}$, c_{jt} denotes the consumption of private goods and g_t^J is the level of discretionary spending on local goods in region J. The variable ξ_{jt} summarizes the utility derived by agent j from political factors (to be described later in more detail). Notice that an agent living in the north derives no utility from the provision of a good in the south (and vice versa), so in principle there will be disagreement in the population on the desired composition of public expenditures, but not on its size, since both types have the same marginal rate of substitution between private and public goods.

The parameter $\rho \in [0, 1]$ can be interpreted as a measure of the degree of *polarization* in society. If ρ was equal to zero, agents would only derive utility from private consumption and there would be no disagreement in the population. As ρ increases, agents put more weight in the provision of public goods. Since these can be partly targeted to different regions, it implies that agents views will be further away from each other so the society is more polarized. As $\rho \to 1$ the disagreement becomes extreme. This parameter will be the key variable governing the size of government distortions in cross country comparisons.

Agents finance private consumption and investment with their capital and labor income. The government raises revenues by taxing investment at the proportional rate τ_t. The constitution allows parties to choose different spending levels on public goods, but restricts them to discriminate taxation levels across agents, so agents' budget constraint is

$$c_{jt} = w_t l_{jt} + r_t k_{jt} - (1 + \tau_t)\iota_{jt},$$

where capital evolves according to $k_{j,t+1} = \iota_t + (1 - \delta)k_{jt}$, and δ denotes the depreciation rate. Every agent is endowed with k_0 units of initial capital.

Private goods are produced by competitive firms that have access to a constant returns to scale technology: $y_t = F(K_t, L_t)$, where L_t is aggregate labor and K_t is the stock of capital. The cost of producing $g > 0$ units of a local public goods is given by $x(g)$, and $x(0) = 0$. Assuming that there is no debt, the government must balance its budget every period, so its constraint reads as: [9]

$$\sum_J x(g_t^J) = \tau_t \iota_t.$$

The proceeds from taxation are displayed in the right hand side of the equation, while the left hand side contains the sum of expenditures in local public goods.

Definition 1: *A competitive equilibrium given public spending $\{g_t^N, g_t^S\}_{t=0}^{\infty}$ is a sequence of allocations, $\{c_{jt}, l_{jt}, k_{j,t+1}, \iota_{jt}, K_{t+1}, L_t\}_{t=0}^{\infty}$, tax rates $\{\tau_t\}^{\infty}$ and prices $\{w_t, r_t\}_{t=0}^{\infty}$ such that: (i) Agents maximize utility subject to their budget constraint, (ii) firms maximize profits, so $w_t = F_2(K_t, L_t)$ and $r_t = F_1(K_t, L_t)$,* (iii) *markets clear $\sum_J \mu^J k_{J,t+1} = K_{t+1}$, $\sum_J \mu^J l_{Jt} = L_t$, and (iv) the government budget constraint is satisfied.*

Aggregate consumption and investment will be denoted by c_t and ι_t respectively. In this economy, prices and aggregates determined in a competitive equilibrium are independent of region specific characteristics as shown next.

Equivalence: *consider two CE with a different composition of local public goods s.t. their per-period aggregate cost $x(g_t^N) + x(g_t^S)$ is unchanged $\Rightarrow$ the sequences of $\{c_, K_{t+1}, \iota_t, \tau_t\}$ in the two equilibria are identical.*

To see this, notice that since leisure is not valued, the supply for labor is inelastic ($l_t = 1$).[10] Agents' saving decisions satisfy

$$(1 + \tau_t)u_c(c_{jt}) = \beta[r_{t+1} + (1 - \delta)(1 + \tau_{t+1})]u_c(c_{j,t+1}).$$

Because of the separability between private and public consumption assumed in the utility function, investment is affected only by the tax rate, and is independent on the type of public

[9] I abstract from debt, since the application of this model is mainly for developing economies. Under lack of commitment, these have a high probability of defaulting. It would be interesting to introduce debt with a default choice to this environment, but it is beyond the scope of this paper, and hence left for future research.

[10] The model can be easily extended to include an endogenous labor decision. Since this would involve more notation and no significant changes in the main results, I decided not to include the extension in this version of the paper.

good being provided. Since the government taxes both regions at the same rate, their citizens save the same amount (recall that k_0 is the same in all regions) and regional investment is identical to the overall country investment. This implies that individual and average capital holdings coincide, $k_{j,t+1} = K_{t+1}$. The level of consumption is, as a result, also identical across regions. Prices and aggregate allocations are independent of the distribution of types, and we can think of the outcomes of the competitive equilibrium as resulting from a representative agent.

We can then drop the superscript j for individual allocations and write the government budget constraint as

$$\sum_J x(g_t^J) = \tau_t[K_{t+1} - (1-\delta)K_t].$$

The current government decides on the level of taxation and expenditures in each type of public good, taking as given private investment. In what follows, I will make use of the following function, which will simplify notation significantly,

$$\mathcal{T}(K, K', g) = \frac{x(g^N) + x(g^S)}{K' - (1-\delta)K}. \tag{2}$$

where $g = \{g^N, g^S\}$ denotes the composition of spending.

2.2 A planning problem

Before describing the outcome under political competition (where different parties alternate in power), it is useful to characterize the optimal allocations chosen by a benevolent social planner. The planner takes the initial level of capital K_0 as given, and chooses the sequence $\{c_t, K_t, g_t^N, g_t^S\}_{t=0}^{\infty}$ that maximizes the weighted sum of utilities, where the weight on type J agents is given by λ^J (with $\lambda^N + \lambda^S = 1$). Its maximization problem follows.

$$\max \sum_J \lambda^J \sum_{t=0}^{\infty} \beta^t[(1-\rho)u(c_t) + \rho v(g_t^J)], \tag{3}$$

subject to the resource constraint, with $f(K_t) \equiv F(K_t, 1)$,

$$\sum_J x(g_t^J) + c_t + K_{t+1} = f(K_t) + (1-\delta)K_t.$$

As long as the planner gives a positive weight to each agent, the optimal allocation of public good J will be such that its marginal utility is proportional to the marginal utility of private consumption.[11]

$$(1-\rho)u_c(c_t)x_g(g_t^J) = \lambda^J \rho v_g(g_t^J) \tag{4}$$

By varying λ^j between 0 and 1 it is possible to trace the Pareto frontier that characterizes the optimal provision of public goods. Concavity of u implies that if type S agents have a higher weight in the social welfare function, more of their desired public good will be provided (at the expense of type N agents).

The optimal investment choice satisfies

$$u_c(c_t) = \beta u_c(c_{t+1})[f_k(K_{t+1}) + 1 - \delta] \tag{5}$$

[11] It is important to note that the planner is constrained to offer all households the same consumption allocation (that is, $c_t^N = c_t^S$, $\forall t$). This is imposed in order to capture the constraint faced by the government in the political equilibrium (where parties cannot tax agents at different rates). If the planner only cares about the well-being of, say, agent N, it will set $g_t^S = 0 \, \forall t$ and g_t^N so as to equate the marginal rate of substitution between private and public goods to 1.

Hence, the planner chooses K_{t+1} to equate the marginal costs in terms of foregone consumption to the discounted marginal benefits of the investment. Departures from these two equations define *gaps* or *wedges* from optimal allocations. As they will be used in the following sections, we define

$$\Delta_{gt} \equiv -(1-\rho)u_c(c_t)x_g(g_t^J) + \lambda^J \rho v_g(g_t^J)$$

and

$$\Delta_{kt} \equiv (1-\rho)[-u_c(c_t) + \beta u_c(c_{t+1})[f_k(K_{t+1}) + 1 - \delta]].$$

3 The political game

The role of the government in this economy is to provide public goods. Given the disagreement between groups over which public good should be provided, political parties will endogenously arise in a democratic environment. I analyze a stylized case where there are two parties, N and S, representing each region in the population and competing for office every period.

There are two key features that distinguish political parties from a benevolent social planner. The first one is that parties only care about the well-being of their constituency, rather than trying to maximize the welfare of the whole population.[12] The second one is that politicians lack a commitment technology. This has implications in two dimensions. Firstly, investment taxes introduce a source of time-inconsistency in the government's problem even in the absence of political uncertainty, so the second best cannot be achieved (see Klein, Krusell and Rios-Rull, 2008 for a description). Secondly, because promises made over the campaign are non-binding. This implies that political competition does not induce politicians to maximize a utilitarian welfare function (as in the traditional Lindbeck-Weibull model, studied more recently in Sleet and Yeltekin, 2008 or Farhi and Wening, 2008), but rather the utility of the party in power.

We can divide each period t into two stages: the Taxation Stage and the Election Stage. At the Taxation Stage, an incumbent from group i chooses τ, g^N, and g^S knowing the state of the economy (K) and the distribution of the political shocks but not their realized values. Hence, policy is chosen under uncertainty: with some probability the incumbent will be replaced by a candidate from a different party. After production, consumption and investment take place, ξ' is realized. The probability of re-election can be calculated by forecasting how agents would make their voting decisions for different realizations of the shock.

At the Election Stage, agents vote for the party that gives them higher expected lifetime utility. They need to forecast how the winner of the election would choose policy. The assumptions of rationality and perfect foresight imply that their predictions are correct in equilibrium. Next section, we will solve the problem backwards.

3.1 Markov-perfect equilibrium

There is no commitment technology, so promises made by any party before elections are not credible. The party in power plays a game against the opposition taking their policy as given. Alternative realizations of history (defined by the sequence of policies up to time t) may result in different current policies. In principle, this dynamic game allows for multiple subgame-perfect equilibria, that can be constructed using reputation mechanisms. I will rule out such mechanisms and focus instead on Markov-perfect equilibria (MPE), defined as a set of strategies that depend

[12] In that sense this is a *partisan model*. A politician from party J is just like any other agent in that group. In contrast, other models in the literature assume that politicians can extract rents from being in power, so their objective is to maximize the probability of winning the next election. See Persson and Tabellini (2000) for a discussion on *opportunistic models*.

only on the current—payoff relevant—state of the economy. The equilibrium characterized here corresponds to the limit of the finite horizon game. [13]

Given the sequence of events, and the separability between the economic and political dimensions, the only payoff-relevant state variable for the government is the stock of capital, K. The equilibrium objects we are interested in are: the spending rule in good J followed by incumbent i, $\mathcal{G}_i^J(K)$, its probability of re-election $p_i = p_i(K)$, and the rule governing the evolution of aggregate capital under i's policies, $K' = \mathcal{H}_i(K)$, where primes denote next period variables. We will start the analysis from the Taxation Stage where an elected incumbent chooses policy, and then move to describe the election process, as well as the determination of probabilities of re-election.

Election Stage

The utility derived from political factors, ξ, has three components: an individual ideology bias (denoted by φ^j), an overall popularity bias (ψ) and an incumbency advantage term (χ). In particular, [14]

$$\xi_j = \left(\psi + \varphi^j\right) I_i + \chi\, \tilde{I}_{i,i^-},$$

where I and $\tilde{I}$ are indicator functions such that $I_N = 1$ and $I_S = 0$, $I_{i,i} = 1$ and $I_{i,i^-} = 0$, if $i \neq i^-$. The subindex i denotes the identity of the party in power, and i^- represents last period's value of i. The individual specific parameter φ^j measures voter j 's ideological bias towards the candidate from party N. Its distribution is assumed uniform $\varphi^j \backsim \left[-\frac{1}{2\phi}, \frac{1}{2\phi}\right]$.[15]

These shocks are *iid* over time, hence 'candidate specific.' Each period, a given party presents a candidate and voters form expectations about the candidate's position on certain moral, ethnic or religious issues, orthogonal to the provision of public goods. Examples are attitudes towards crime (gun control or capital punishment), drugs (i.e. whether to legalize the use of marijuana), immigration policies, abortion, etc. A value of zero indicates neutrality in terms of the ideological bias, so agents only care about the economic policy, while a positive value indicates that agent j prefers party N over S. Individuals belonging to the same group may vote differently.

The parameter ψ represents a general bias towards party N at each point in time, measuring the average relative popularity of candidates from that party relative to those from party S.[16] It captures candidates' personal characteristics such as honesty, leadership, integrity, charisma, trustworthiness, etc. Candidates with higher values of ψ are preferable. The popularity shock is *iid* over time and distributed according to $\psi \backsim \left[-\frac{1}{2\Psi}, \frac{1}{2\Psi}\right]$.

As noted in the empirical literature, the party in power is more likely to win an election. Among the reasons, it has been argued that the public is familiar with the incumbent. This creates an incumbency advantage, which in the model is captured by the parameter χ. Everything else equal, voters prefer an incumbent over a challenger when $\chi > 0$.

[13] In a recent paper, Bhaskar, Mailath and Morris (2009) showed that for a set of perfect information games with sequential move, as long as players have bounded memory (i.e. their strategies do not depend on the infinite past) and the equilibrium is putrifiable (i.e. robust to small perturbations in agents payoffs), all equilibria are Markovian. Their setup, however, does not include a dynamic state variable.

[14] I build on the specification presented in Persson and Tabellini (2000). Note that I am abusing notation since ξ does not only depend on i, but also on i^- and j.

[15] This is a usual assumption in the literature. See Persson and Tabellini (2000).

[16] Political scientists refer to this parameter as *valence*, referring to "issues on which parties or leaders are differentiated not by what they advocate but by the degree to which they are linked in the public's mind with conditions or goals or symbols of which almost everyone approves or disapproves"(Stokes, 1992).

At the election stage, voters compare their lifetime utility under the alternative parties. The maximization problem of voter j in group S is given by

$$\max\left\{V_S(K',i)\,,\,W_S(K',i)+\psi'+\varphi^{j\prime},\right\};$$

where $V_S(K',i) = V_S(K'_g) + \chi\,\tilde{I}_{S,i}$ and $W_S(K',i) = W_S(K') + \chi\,\tilde{I}_{N,i}$. If the incumbent today belongs to the same party (so $I_{NN} = 1$ and $I_{NS} = 0$) then there is some extra utility associated with the incumbency advantage effect. The maximization problem of an agent in group N is analogously defined.

Determination of probabilities

Let us turn now to the intermediate stage between taxation and voting. The shocks have not yet been realized and we are trying to determine the probability of re-election that each party will face. Individual $j \in S$ votes for N whenever the shocks are such that $V_S(K',i) < W_S(K'_g,i) + \psi' + \varphi^{j\prime}$. We can identify the *swing voter* in group S as the voter whose value of $\varphi^{j\prime}$ makes him indifferent between the two parties

$$\varphi_i^S(K') = V_S(K',i) - W_S(K',i) - \psi'.$$

All voters in group S with $\varphi^{j\prime} > \varphi_i^J(K')$ also prefer party N.

The same type of analysis can be performed for agents in group N, so there is a swing voter in each group. The value of φ_i^J depends on the difference in utilities of having group S vs. group N being in office, on the realization of the popularity shock, and on the identity of the party in power at the time of elections. The share of votes for party N is:

$$\begin{aligned}\pi_{iN} &= \sum_J \mu^J P\left(\varphi^{j\prime} > \varphi_i^J(K')\right)\\ &= \frac{1}{2}[1-\phi\sum_J \varphi_i^J(K')].\end{aligned}$$

Under majority voting, party N wins if it can obtain more than half of the electorate; that is, if $\pi_{iN} > \frac{1}{2}$. This occurs whenever its relative popularity is high enough. There exists a threshold for the ψ, denoted by $\psi_i^*(K')$ such that N wins for any realization $\psi > \psi_i^*(K')$. After performing some algebra using the expression above, we find that

$$\psi_i^*(K') = V_S(K',i) - W_S(K',i) + W_N(K',i) - V_N(K',i), \tag{6}$$

The threshold is given by a weighted sum of the differences in the utility of the swing voter under each party, and it is a function of the stock of capital.

Since $\varphi_i^J(K')$ depends on the realized value of ψ, π_{iN} is a random variable. If N was currently in power, its probability of re-election would be given by $p_N(K') = P(\psi' > \psi_N^*(K'))$, which is equivalent to:

$$p_N(K') = \frac{1}{2} - \psi_N^*(K')\Psi. \tag{7}$$

S's probability of re-election is

$$p_S(K') = \frac{1}{2} + \psi_S^*(K')\Psi. \tag{8}$$

The current level of consumption in public goods does not affect the voting decision (i.e. no retrospective voting). Voters do not 'punish' politicians/parties for their past behavior but decide instead in terms of their future policy choices.

Taxation Stage

At this stage, the incumbent must decide on the optimal spending level g, knowing that it will be replaced by a different policymaker with some probability $p_i(K')$. As standard in the literature, current governments choose their policy taking into account that future governments will play according to the Markov-perfect equilibrium rule. See Klein, Krusell, and Rios-Rull (2008, KKRR thereafter) for a description of equilibria in a simpler setting (their taxation problem is similar, but they abstract from political turnover). To fix ideas, consider the problem faced by the incumbent of type N [17]

$$\max_{g^N, g^S \geq 0} (1-\rho)u(c) + \rho v(g^N) + \beta\{p_N(K')V_N(K') + [1 - p_N(K')]W_N(K')\} \tag{9}$$

where V_N denotes the utility of an agent residing in region N when his party is in power and W_N his utility when out of power (to be described later). Consumption follows

$$c = f(K) + (1-\delta)K - \sum_J x(g^J) - K' \equiv \mathcal{C}(K, K', g),$$

where $g = \{g^N, g^S\}$ and K' is the level of tomorrow's capital, that satisfies the agents' first order condition,

$$(1+\tau)u_c(c) = \beta E_{iN}\left[[f_k(K') + (1-\delta)(1+\tau_i')]u_c(c_i')\right], \tag{10}$$

where $\tau = \mathcal{C}(K, K', g)$, $\tau_i' = \mathcal{T}(K', \mathcal{H}_i(K'), \mathcal{G}_i(K'))$, and $c_i' = \mathcal{C}(K', \mathcal{H}_i(K'), \mathcal{G}_i(K'))$. E_{iN} denotes the expectation over policies followed by tomorrow's incumbent, given that party N is currently in power. Equation (10) defines a functional equation that determines future capital as a function of current capital and government spending, $K' = H_N(K, g)$. This equation determines agents' optimal reactions to a one-period deviation from the current government of g from the equilibrium rule that an incumbent of type N would follow, $\mathcal{G}_N(K)$. Agents know that a future government of type i plays according to the equilibrium strategy, so $g' = \mathcal{G}_i(K')$, where capital follows $K'' = \mathcal{H}_i(K')$. Consistency implies that $\mathcal{H}_i(K) = H_i(K, \mathcal{G}_i(K))$. Agents in all regions save at the same rate, so Equivalence holds even in the presence of political uncertainty.

It is clear from the problem above that party i sets $g^J = 0$, $J \neq i$. Slightly abusing notation, we use $\mathcal{G}_i(K)$ to denote the equilibrium amount spent by incumbent i on the local public good i. The description of the problem is completed by defining the functions $V_N(K)$ and $W_N(K)$:

$$V_N(K) = (1-\rho)u(\mathcal{C}_N(K)) + \rho v(\mathcal{G}_N(K)) \tag{11}$$

$$+\beta\{p_N(\mathcal{H}_N(K))V_N(\mathcal{H}_N(K)) + [1 - p_N(\mathcal{H}_N(K))]W_N(\mathcal{H}_N(K))\}, \text{ and}$$

$$W_N(K) = (1-\rho)u(\mathcal{C}_S(K)) + \rho\bar{v} + \beta\{p_S(\mathcal{H}_S(K))W_N(\mathcal{H}_S(K)) + [1 - p_S(\mathcal{H}_S(K))]V_N(\mathcal{H}_S(K))\} \tag{12}$$

where $\mathcal{C}_i(K) \equiv \mathcal{C}(K, \mathcal{H}_i(K), \mathcal{G}_i(K))$. Equation (11) represents the value function of a type N when his group is currently in power while eq.(12) is the utility when out of power, given the opposition S's policy decisions. There are two differences between these functions. The first one is that when the incumbent's party is out of power, $g = 0$. The second one is that the expected utility is different, because p_N represents the probability of re-election of incumbent type N (so if the group is currently out of power, it regains power with probability $1 - p_S$).

The political uncertainty, combined with the conflict over the provision of public goods, creates incentives to act strategically. Even though parties represent their constituencies and

[17] In this formulation, I follow Persson and Tabellini (2000) and assume that parties maximize utility net of shocks. The qualitative nature of results does not change if shocks are included, but the notation becomes much more cumbersome.

have no derived value of being in office, they will try to manipulate the probability of being re-elected (which allows them to implement the desired policy in the future). Moreover, by controlling the level of investment via changes in the tax system, they can indirectly affect policy decisions of future policymakers by changing the amount of capital available to them. This can be seen in the last term of the first-order condition with respect to g, for incumbent N

$$-(1-\rho)u_c(c)x_g(g) + \rho v_g(g) + H_{Ng}(K,g)\left[-(1-\rho)u_c(c)\right. \tag{13}$$
$$\left.+\beta\left\{p_N(K')V_{NK}(K') + [1-p_N(K')]W_{NK}(K') + p_{NK}(K')[V_N(K') - W_N(K')]\right\}\right] = 0,$$

where $p_{NK}(K') = \frac{\partial p_N(K')}{\partial K'}$ and $K' = H_N(K,g)$.

An increase in g has a direct effect on current utility, since it diverts resources from private to public consumption, as shown in the first term. The marginal benefit is given by the increase in the marginal utility of public goods v_g, given by the second term. Notice that the benefit received by the current group is generally larger than that of a benevolent planner due to the fact that incumbents have a higher weight on their own group when $\lambda^N < 1$. There is an indirect effect, as an increase in g is financed with distortionary taxes on investment: facing larger taxes, agents decide to cut on investment. This is captured by the change in K' since $H_{Ng} < 0$. The reduction in K' has a contemporaneous effect that raises the marginal utility of current consumption, but at the expense of affecting future utility. When K' decreases, expected future utility goes down from the contraction of resources. Agents living in region N suffer a decrease of utility of $V_{NK}(K') = \frac{\partial V_N(K')}{\partial K'}$ if they win the next election (which occurs with probability p_N) and $W_{NK}(K') = \frac{\partial W_N(K')}{\partial K'}$ otherwise (which occurs with probability $1-p_N$). Given that the identity of the decision-maker changes over time, the envelope theorem doesn't hold in this environment, so the traditional Euler equation will not be satisfied.

Finally, a change in investment today modifies the problem faced by voters, which in turn affects the probability of re-election. A rational incumbent realizes this and thus takes into account the effect of the reduction of K' on its likelihood of winning. It is reasonable to expect that $V_N(K') > W_N(K')$, a party is better off while in power. However, the sign of $p_{NK}(K')$ is, in principle, ambiguous.

Politico-economic equilibrium

We can now define a political equilibrium that takes into account agent's voting decisions.

Definition *A Markov-perfect equilibrium with endogenous political turnover is a set of value and policy functions such that:*

i. Given the re-election probabilities and government policy, agents maximize utility and firms maximize profits: the functions $\mathcal{H}_i(K)$, $V_i(K)$, and $W_i(K)$ solve eqns. (10), (11) and (12) respectively.

ii. Given the re-election probabilities and firms' and agents' optimal decisions, the function $\mathcal{G}_i(K)$, solves incumbent i's maximization problem, given by eq. (9).

iii. Given the optimal rules of government, agents, and firms, $p_N(K)$ and $p_S(K)$ solve eq. (7) and eq. (8).

We look for a symmetric Markov-perfect equilibrium, where the incumbent chooses the same aggregate level of spending in public goods regardless of its type $g_N^N = g_S^S \equiv \mathcal{G}(K)$ and faces the same re-election probability $p_N(K') = p_S(K') \equiv p(K)$. This is a natural selection due to the fact that ideology shocks are symmetric and the economy satisfies the 'equivalence' property. [18]

[18] The composition of expenditures will of course be different, since $g_S^N =$ and $g_N^S = 0$.

It is straightforward to show that if both parties face the same probability of re-election it is best for them to choose symmetric policy functions. Inspection of eqs.(9), (11), and (12) reveals that they face exactly the same maximization problem when in power. The value functions when out of power are also identical. Therefore, they will choose the same taxation levels, which implies $\mathcal{H}_N(K) = \mathcal{H}_S(K) \equiv \mathcal{H}(K)$ and $\mathcal{C}(K) = f(K) + (1-\delta)K - x(\mathcal{G}(K)) - \mathcal{H}(K)$. Hence, the path of taxes and consumption is deterministic.

In general $p(K)$ is a non trivial function of the state variable and requires the use of numerical methods for its characterization. However, in a symmetric Markov-perfect equilibrium it is possible to show that the probability of re-election takes a very simple form: it is a constant. The probabilities of re-election are given by eqs.(7) and (8). Assume that both parties follow the same policy rules while in power and guess a constant probability of re-election: $p_S(K) = p_N(K) \equiv p$. Since policy rules are symmetric, $V_S(K', S) - V_N(K', S) = \chi$ and $W_N(K', S) - W_S(K', S) = \chi$. This implies that $\psi_S^*(K') = \chi$ and $\psi_N^*(K') = -\chi$. Replacing these into eqs. 7 and 8, we verify that:

$$p_N(K') = p_S(K') = \frac{1}{2} - \Psi\chi. \tag{14}$$

Since it is impossible to distinguish between the utility gains from incumbency advantage χ and the density of popularity shocks Ψ in this model, we will combine both in the parameter $\tilde{\Psi}$ and refer to it as the 'incumbency advantage term'.

It is worth noticing that while the probabilities are endogenously determined, they do not depend on the state variable K. The intuition is as follows: an increase in g today implies an increase in current taxes, which reduces K'. This results in a loss of $\varphi_{iK}^{S\prime} = V_{SK}' - W_{SK}'$ swing voters in group S and an increase of $\varphi_{iK}^{N\prime} = W_{NK}' - V_{NK}'$ swing voters in group N (assuming that V is steeper than W, the argument also holds if W was steeper). By symmetry, and the fact that incumbency advantage is additive, $\varphi_{iK}^{S\prime} = \varphi_{iK}^{N\prime}$, so the threshold $\psi_i^*(K')$ does not change. No candidate is able to change policy today and obtain a net gain in the number of votes, hence they set policy so that the marginal effect of the last unit invested on the probability of re-election is actually zero. This would not hold if agents had a different size or the distribution of φ was region-dependent. An immediate empirical prediction is that the degree of political turnover should not be affected by the economic conditions of a country.

3.2 Differentiable Markov-Perfect equilibrium (DMPE)

In order to further characterize the trade-offs faced by an incumbent when choosing investment, I will assume that policy functions are *differentiable*. KKRR made this assumption (in a different context) arguing that there could be in principle an infinitely large number of Markov equilibria. By assuming differentiability, the problem delivers a solution that is the limit to the finite horizon problem. Moreover, it allows us to derive the government Euler equation (GEE) even if the envelope theorem does not hold.

The politico-economic equilibrium studied here implies several distortions relative to the first best derived in section 2.2. The incumbent's first order condition with respect to local public goods spending displayed in eq. 13 can be re-written as an Euler equation and decomposed into the weighted sum of the wedges described before. This is done in Proposition 1, where primes denote next period's variables.

Proposition 1: *Define*

$\Delta^{Hmg} = \Delta_g + H_g\Delta_k + \beta\Delta_g' g_g'$, where $g_g' = -H_g\frac{H_k'}{H_g'}$,

$\Delta^{Het} = (1-\lambda^J)\rho[v_g + \beta g_g' v_g']$,

$\Delta^{DE} = (1-p)\beta\rho v_g' \mathcal{G}_k' H_g$, and

$\Delta^{IA} = (2p-1)\beta H_g \frac{\mathcal{H}_k'}{H_g'}\{\Delta^{Hmg\prime} + \Delta^{Het\prime}\}$.

Then, incumbent J's first order condition can be written as a weighted sum of these terms

$$\Delta^{Hmg} + \Delta^{Het} - \Delta^{DE} - \Delta^{IA} = 0. \tag{15}$$

Proof See Appendix 5.

An increase in spending is financed by a rise in investment taxes. Because taxes are distortionary, and because parties have no commitment, the governments' Euler equation involves a trade-off between current and future gaps relative to the first best. The first term, Δ^{Hmg} would be equal to zero in an homogeneous society. The expression up to this point is analogous to that derived in KKRR, who study a similar environment under a benevolent planner without commitment and identical agents. The first term in Δ^{Hmg} is just the gap between the marginal utility of private consumption and that of public consumption (Δ_g, defined in section 2.2). Its second term is the distortion in private investment Δ_k, weighted by the decrease in aggregate capital caused by higher taxes. The last term captures tomorrow's wedge Δ_g' weighted by the indirect effects of current taxes on future spending, where g_g' can be interpreted as the change in g' that keeps K'' unchanged.

The second term in the GEE, Δ^{Het}, incorporates the effect of heterogeneity on the incumbent's policy, abstracting from political instability. A heterogeneous society being ruled by a dictator belonging to one of the two groups would set g so as to satisfy $\Delta^{Hmg} + \Delta^{Het} = 0$. The latter term thus incorporates the distortions arising from the *common pool* problem: all groups pay taxes, but only a proportion of them receive the benefits in the form of local public goods. The term $\Delta^{Het} \neq 0$ because incumbent J has a weight of 1 on region J while the planner only paces weight λ^J on this group.

The effects of political uncertainty on public spending are apparent in the third term, Δ^{DE}. When the incumbent is not re-elected, a marginal increase in spending today changes the opposition's spending in public goods tomorrow, via the induced decrease in K'. This reports a cost in terms of foregone consumption next period with no utility benefit since the incumbent derives no utility from that public good. Because the current incumbent does not internalize the full costs of raising taxes when $p < 1$, it tends to over-spend in public goods. This can also be interpreted as the current incumbent wanting to 'tie the hands' of its successor in order to restrict its spending. The disagreement over the composition of public goods together with the political uncertainty promote growth-retarding policies which deter investment, so policymakers act as being more short-sighted than the groups they represent.[19]

The last term in the GEE is the *incumbency advantage effect*, Δ^{IA}. The party in power knows that not only future spending will be altered when K' decreases, but also the future incumbent's distortions $\Delta^{Hmg\prime} + \Delta^{Het\prime}$. This term was absent in the previous literature involving political instability, because most of the papers focused on two-period economies, so there were no incentives to invest in the last period, $\mathcal{H}_k(K') = 0$. Papers that did analyze infinite horizon economies assumed no persistence ($p = \frac{1}{2}$), which also causes the term to disappear.[20] The sign of the incumbency advantage term depends on current expectations about the behavior of future governments and on the degree of political instability.

[19]This effect is similar to that observed in Persson and Svensson (1989). Besley and Coate (1998) find that disagreements over redistribution policies can result in inefficient levels of investment. Milesi-Ferreti and Spolaore (1994) also obtain strategic manipulation, but for an alternative environment.

[20]For two-period economy examples, see Persson and Svensson (1989) or Persson and Tabellini, (2000). For an infinite horizon economy see Amador (2003).

Finally, notice that the government's Euler equation (eq.15) depends on derivatives of an unknown equilibrium function: $H_k(K', g')$ and $H_g(K', g')$. In such an environment, the traditional methods to prove existence and uniqueness cannot be used. Most studies have to rely on numerical methods to characterize equilibrium functions. Even calculating the steady state level of capital is nontrivial.[21]

3.3 Qualitative implications in an example economy

Under more specific assumptions over the production technology and the utility function it is possible to find an analytical solution. In this section, I characterize it and derive qualitative implications from the theory. Changes in two fundamental parameters capturing socio-political dimensions will be considered: the degree of polarization ρ and the degree of incumbency advantage, $\tilde{\Psi}$, which directly affects political instability in our model.

Assumption 1: *Suppose that: (i) utility is logarithmic,* $u(c) = \log c$ *and* $v(g) = \log(g + G)$*, (ii) technology is Cobb-Douglas,* $F(K, L) = AK^{\alpha}L^{1-\alpha}$*, (iii) there is full depreciation* $\delta = 1$ *and (iv) the cost of public goods is linear:* $x(g) = g + G$ *when* $g > 0$ *and* $x(0) = 0$*.*

Note that $v(0) = \log(G) = \bar{v}$, so that utility is well defined when no public good is provided to this region (which occurs every time the group is out of power). The assumption that the fixed cost of providing public goods is equal to G is a normalization that allows us to find closed form solutions.

Under these assumptions, aggregate investment is proportional to output $y = AK^{\alpha}$, and decreasing in spending, $H(k, g) = \alpha\beta y - G - g$ while consumption is proportional to output, $c = (1 - \alpha\beta)y$. Because consumption and investment are linear in output, it is reasonable to guess that public goods spending satisfies $\mathcal{G}(K) = \eta y - G$, where η is the value that makes eq.(15) hold. As long as mandatory spending is low enough, the government will be able to afford the provision of local public goods (i.e. $g > 0$). A sufficient condition for this is that $G < \eta AK_0^{\alpha}$, where K_0 is the initial level of capital (assumed to be below its long run value). The following proposition shows that this guess is indeed correct in the Markov-perfect equilibrium.

Proposition 2 *Under Assumption 1, there exists a unique symmetric MPE that satisifes*

$$\mathcal{T}(K) = \frac{\eta}{\alpha\beta - \eta}, \quad \mathcal{G}(K) = \eta AK^{\alpha} - G \quad , and \quad \mathcal{H}(K) = (\alpha\beta - \eta)AK^{\alpha},$$

where η *is given by*:

$$\eta = \frac{\rho\alpha\beta(1 - \alpha\beta)[\alpha\beta(2p - 1) - 1]}{\rho[\alpha\beta(1 + \alpha\beta) - 1 + \alpha\beta p(1 - 2\alpha\beta)] - \alpha\beta(1 + \alpha\beta(1 - 2p))}. \tag{16}$$

Proof: Replace the functional forms in Assumption 1, the solution for $H(K, g)$, and the guess $G + \mathcal{G}(K) = \eta y$ into eq.(15) and verify that η satisfies eq. (16).

In equilibrium, the government taxes investment at a time-invariant rate, which determines the relative *price of investment* across countries. A constant share η of GDP is spent on public goods. This share is known as the *size of a government*, the main endogenous variable affecting economic performance in our model.

Remark: *The price of investment is larger in countries where the government is large. As a result, investment rates are lower.*

[21] Krusell and Rios-Rull, (1999) and Azzimonti, Sarte, and Soares, (2009) use linear quadratic approximations while Azzimonti, de Francisco, and Krusell (2008) use the numerical method discussed in KKRR (2008) to find steady states.

An agent's marginal propensity to invest is negatively related to the share of public spending on output. As the following corollary shows, this slows down growth during the transition and results in lower levels of output in the steady state.

Corollary 1 *The economy converges to a unique steady state where* $\bar{K} = (\alpha\beta - \eta)^{\frac{1}{1-\alpha}}$, $\bar{y} = A\bar{K}^{\alpha}$, $\bar{c} = (1-\alpha\beta)\bar{y}$ *and* $\bar{g} + G = \eta\bar{y}$. *The speed of convergence is given by*

$$\gamma \equiv \frac{\partial K'}{\partial K} = (\alpha\beta - \eta)K^{\alpha-1},$$

so countries with similar initial conditions and technology, but a larger government grow at lower rates towards their steady state. Moreover, they are permanently poorer in the long run. Long run welfare, conditional on being in power, satisfies

$$\bar{V}(\eta) = \kappa \left\{(1-\rho)[1+\beta(1-2p)]\log \bar{c} + \rho(1-\beta p)\log(\bar{g}+G) + \rho\beta(1-p)\bar{v}\right\},$$

where $\kappa = \frac{1-\beta p}{(1-\beta p)^2 - (\beta(1-p))^2}$, *and when out of power*

$$\bar{W}(\eta) = \frac{\kappa}{1-\beta p}\left\{(1-\rho)[1+\beta(1-2p)]\log \bar{c} + \rho\beta(1-p)\log(\bar{g}+G) + \rho(1-\beta p)\bar{v}\right\}.$$

Given that the share η is the driving force of convergence speed and long run outcomes, it is interesting to analyze what parameters ultimately determine it. The size of governments is not only a function of economic variables—the discount factor β and the capital share α—but also depends on socio-political variables: the degree of polarization in society ρ and the degree of political instability p. [22]

The effects of polarization and instability

In the next two corollaries we focus on the effects of socio-political variables in economic outcomes, during both the transition and the long run.

Corollary 2: *Polarized societies (that share the same level of political stability) have larger governments, a higher price of investment, lower investment rates, and converge more slowly to lower levels of GDP than un-polarized societies. Moreover, their long run welfare is smaller.*

This can be seen from the fact that private investment, the speed of convergence, and the steady state value of capital are negatively related to η, since $\mathcal{H}_\eta < 0$, $\gamma_\eta < 0$ and $\bar{K}_\eta < 0$, and that η is increasing in ρ,

$$\frac{\partial \eta}{\partial \rho} = \frac{(\alpha\beta)^2(1-\alpha\beta)(1+\alpha\beta(1-2p))^2}{M^2} > 0,$$

where $M = \rho[\alpha\beta(1+\alpha\beta) - 1 + \alpha\beta p(1-2\alpha\beta)] - \alpha\beta(1+\alpha\beta(1-2p))$. Thus, the model predicts that the *price of investment* is positively correlated with polarization, consistently with the evidence presented in Figure 1 (left panel) and Table 1. Moreover, the sign of the cross derivative is also consistent with the results in Table 1, since $\frac{\partial^2 \eta}{\partial \rho \partial p} < 0$.

The partial effect of political instability on economic variables (assuming ρ is constant) is summarized in Corollary 3,

Corollary 3: *Stable societies (that share the same degree of polarization) have smaller governments, a lower price of investment, higher investment rates, and converge faster to larger levels of GDP than unstable societies. Moreover, their long run welfare is larger.*

[22] Actually, the independent variable governing political instability is the incumbency advantage term $\tilde{\Psi}$. Since there is a one to one relationship between the two, and only p is directly observable in the data, we will phrase the results in terms of changes in p.

This results from the negative relationship between η and p,

$$\frac{\partial \eta}{\partial p} = -\frac{1}{M^2}(\alpha\beta\rho)^2(1-\alpha\beta)^2 < 0.$$

This experiment compares two countries with the same level of ρ but a different degree of incumbency advantage, $\tilde{\Psi}$, and hence different p. The model predicts a negative correlation between the *price of investment* and political stability, consistently with the evidence presented in Figure 1 (right panel).

The current policymaker foresees that if he loses the next election, the opposition will spend part of the resources on a public good that reports no utility gains for his constituency. Hence, the benefits from an extra unit of investment, obtained by keeping the size of government small, are not fully internalized. This causes the incumbent to behave *myopically* (that is, more short-sighted) and over-spend today on unproductive public goods. Investment is then too costly relative to consumption (since the price of investment is affected by taxation), so agents under-invest. The effect is stronger the lower the probability of remaining in power. As $p \to 1$ the economy has no political turnover, so we can think of the planner as a benevolent dictator. A dictator sets $\eta^D = \frac{\alpha\beta(1-\alpha\beta)\rho}{\rho(1-\alpha\beta)+\alpha\beta} > 0$.

The dynamic inefficiency of governments

It is interesting to note that while the size of governments is smaller under dictatorships $\eta \geq \eta^D$, so the economy converges to a steady state with larger output, welfare may not be larger since one of the groups never receives transfers. How costly this is for society depends on the stand we take on the welfare function, which ultimately depends on the Pareto weights of each group. Rather than presuming a particular set of weights, we will characterize the set of possibilities in the first best (the Pareto Frontier, PF) and second best (SB), and compare them to the combinations of utilities that can be achieved in the political equilibrium.

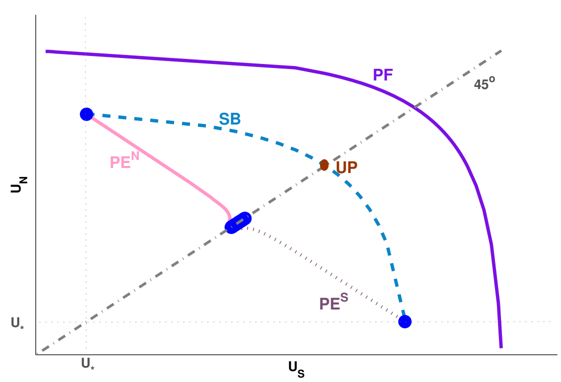

Figure 2: Political distortions and welfare

The Pareto Frontier is given by the pairs $[U_N^{FB}, U_S^{FB}]$, where U_J^{FB} denotes the steady state welfare of group J in the first best. Under Assumption 1, and assuming an interior solution for both g^N and g^S, U_J^{FB} is given by [23]

$$U_J^{FB}(\lambda^J) = \frac{1}{1-\beta}\left[\log(\bar{K}_{FB}^{\alpha} - \bar{K_{FB}} + G) + \log\left((1-\rho)^{1-\rho}\rho^{\rho}\right) + \rho\log\lambda^J\right],$$

where $\bar{K}_{FB} = (\alpha\beta)^{\frac{1}{1-\alpha}}$ is the efficient level of capital in steady state. Figure 2 presents a graphical representation of PF, where group N's weight λ^N decreases as we move from left to right in the plot. Even if a group has zero weight, their utility is bounded by $\bar{v}$ and the fact that the planner is constrained to give equal consumption to both types. This problem is thus equivalent to that of a government with access to type-independent lump-sum taxes. The intersection between PF and the 45^o line represents the solution under a utilitarian planner.

Notice that the steady state level of capital is independent of λ^J, so regardless of the welfare function we can immediately see that the PE is *Pareto inefficient*: capital converges to $\bar{K} = (\alpha\beta - \eta)^{\frac{1}{1-\alpha}}$, which is smaller than $\bar{K}_{FB}$ as long as $\eta > 0$. The largest value of K in the PE is achieved when $p = 1$. Thus while political stability improves welfare, a dictator will not achieve full efficiency.

The Second Best Frontier (SB)

Now, given that we are restricting the set of tax instruments by ruling out lump-sum taxation, a more useful comparison would be to a *benevolent planner* (BP). We can compute the set of steady state welfare pairs that characterize the second best (SB) by solving the problem of a planner (that puts weights λ^J to group J). A BP maximizes equation 3 subject to allocations, prices, and policy being part of a competitive equilibrium (described in Definition 1). When the solutions are interior, steady state welfare of group i is given by [24]

$$U_J^{SB}(\lambda^i) = \frac{1}{1-\beta}\left[(1-\rho)\log[(1-\alpha\beta)\bar{K}_{SB}^{\alpha}] + \rho\log\left[\frac{\rho(\bar{K}_{SB} - (\alpha\beta)^2\bar{K}_{SB}^{\alpha})}{(1-\rho)\alpha\beta}\right] + \rho\log\lambda^J\right],$$

where $\bar{K}_{SB}$ is the steady state level of capital in the second best, that solves $\bar{K}_{SB}[\alpha\beta(1-\rho)+\rho] = (\alpha\beta)^2\bar{K}_{SB}^{\alpha} + \alpha\beta(1-\rho)G$. It can be shown that $\bar{K}_{SB}$ is smaller than $\bar{K}_{FB}$.

Combinations of $[U_N^{SB}, U_S^{SB}]$ (obtained by varying λ^J) trace out the SB frontier. The distance between FB and SB along any ray from the origin in Figure 2 reflects the degree of inefficiencies caused by distortionary taxes. It is interesting to note that in this particular example, the solution is *time consistent*, so SB also represents allocations under no commitment.[25]

Conditional long-run welfare (PE^J)

Now, let us turn to the representation of the political equilibrium in the long run. While capital converges to a steady state value $\bar{K}$, utility is stochastic since as parties alternate in power, the provision of g^J changes. One way to represent the PE is given by the value of welfare of a particular group, conditional on being in or out of power. Because this depends on p, we plot the pairs $[\bar{V}^J, \bar{W}^J]$—defined in Corollary 1—for all possible values of $p \in [0,1]$. The line PE^N in Figure 2 represents pairs achieved when group N is the incumbent (analogously with

[23]There could be corner solutions, depending on the relative weights of each group. When λ^J is high, $g^J = 0, g^I > 0$, $U_J^{FB} = \frac{1}{1-\beta}\left[(1-\rho)\log(\bar{K}_{FB}^{\alpha} - \bar{K}_{FB}) + \log(1-\rho)^{1-\rho} + \rho\bar{v} - \log(1-\rho+\rho\lambda^J)\right]$. When λ^J is low $g^J > 0, g^I = 0$, then $U_J^{FB} = \frac{1}{1-\beta}\left[\log(\bar{K}_{FB}^{\alpha} - \bar{K}_{FB}) + \log\left((1-\rho)^{1-\rho}\rho^{\rho}\right) + \rho\log\frac{\lambda^J}{1-\rho+\rho\lambda^J}\right]$. Finally, for some parameters it could be the case that $g^J = g^I = 0$, so $U_J^{FB} = \frac{1}{1-\beta}\left[(1-\rho)\log(\bar{K}_{FB}^{\alpha} - \bar{K}_{FB} - G) + \rho\bar{v}\right]$.

[24]There could be corner solutions here as well. When $g^J = 0, g^I > 0$, $U_J^{SB} = \frac{1}{1-\beta}[(1-\rho)\log[(1-\alpha\beta)\bar{K}_{SB}^{\alpha}] + \rho\bar{v}]$ and when $g^J > 0, g^I = 0$ welfare is defined as in the main text. What changes is the steady state value of capital, which satisfies $\bar{K}_{SB} = \left(\frac{(\alpha\beta)^2}{(\alpha\beta(1-\rho)+\rho)}\right)^{1/(1-\alpha)}$ in both cases.

[25]This results from the functional form assumptions and it is not true in general.

PE^S). As we move from right to left, p increases. Notice that when $p = 1$ the benevolent Dictator's solution coincides with that of a BP that puts no weight on group S. This implies that if there is no political uncertainty, the PE does not exhibit more distortions relative to the FB than those arising from distortionary taxation. When $p < 1$, PE^N is strictly below SB capturing the extra inefficiencies caused by political instability (the lower is p, the smaller the PE set). The political equilibrium then exhibits *political failures.*

Unconditional long-run welfare

We could also compute 'unconditional' expected welfare. Because groups are symmetric, they will on average be in power half of the time, so $\bar{U}^{PE} = 0.5\bar{V} + 0.5\bar{W}$ is an alternative measure of long run welfare. Notice that as p decreases, steady state capital goes down, so both $\bar{V}$ and $\bar{W}$ decrease. The values of $\bar{U}^{PE}$ are represented by circles in Figure 2, where points closer to the origin correspond to lower values of p. They are aligned on the 45^o line because of symmetry. As before, when $p = 1$ we achieve the SB. When $p < 1$, in addition to the inefficiency created by distortionary taxation, further distortions are introduced by socio-political variables when the economy lacks a BP. An incumbent in power ignores the welfare effects of policy on members belonging to the opposition. When choosing spending, the marginal benefit is larger than that of a BP since all agents pay taxes, while only its own group receives the benefits (in the form of local public goods). This is a static distortion, with dynamic consequences, resulting from a common pool problem. The problem becomes more severe the less likely it is to remain in power. An incumbent who believes that he will be replaced with high probability does not have strong incentives to abstain from public consumption today in order to reduce the price of investment (i.e. set lower taxes). Knowing that it is very likely that tomorrow's policymaker would prefer a different composition of spending, the incumbent tries to manipulate next period's policy through the choice of the state variable.

There is yet another source of inefficiency in the political equilibrium. The uncertainty over the identity of tomorrow's policymaker introduces volatility in the consumption of the public good that was absent in the BP's solution. Long run welfare is lower not only because the amount of resources is smaller, but also because individuals suffer from artificial fluctuations in the consumption of public goods (keep in mind that there are no productivity shocks in this economy).

3.4 Quantitatively implications of an example economy

The objective of this section is to provide a robustness check to the correlations found in the analytical example between the price of investment and our two socio-political variables (polarization and political instability). We assume that the utility of public and private consumption is CES, $u(x) = \frac{x^{1-\sigma_i}}{1-\sigma_i}$ for $i = \{c, g\}$, the technology is Cobb-Douglas, $f(k, l) = k^\alpha l^{1-\alpha}$, and there are no fixed costs of providing public goods, $x(g) = g$. The parameters in the baseline economy will be calibrated to the US post-war period, a period corresponding to 4 years (the approximate time between elections). The capital share is set to 36%, the investment-to-output ratio to 3 and the yearly depreciation rate to 0.08. These imply $\alpha = 0.36$, $\beta = 0.8847$ (or 0.96 yearly), and $\delta = 0.22$. As standard in the macroeconomics literature, we will set $\sigma_c = 2$ (implying an inter-temporal elasticity of substitution $IES = 0.5$). There is less consensus on the value of the IES of public consumption, $1/\sigma_g$, but some studies indicate that this elasticity is larger than that of private consumption, so we will set $\sigma_g = 0.9$. As a benchmark, assume that polarization is equal to $\rho = 0.13$ (as in KKRR, and close to the average value of 0.138 in our sample).

The equilibrium is computed using a Perturbation Method, as described in Azzimonti, Sarte and Soares (2009) or in KKRR. We can see that the negative relationship between the price of investment and the probability of re-election for the calibrated economy holds, by looking at

Figure 3.4. The broken line (left-axis) represents the benchmark economy with low polarization, while the solid line (rigth-axis) is a country twice as polarized as the US. Notice that larger polarization implies larger distortions, so the negative correlation between these two variables found in Section 3.3 is robust to the change in parameters.

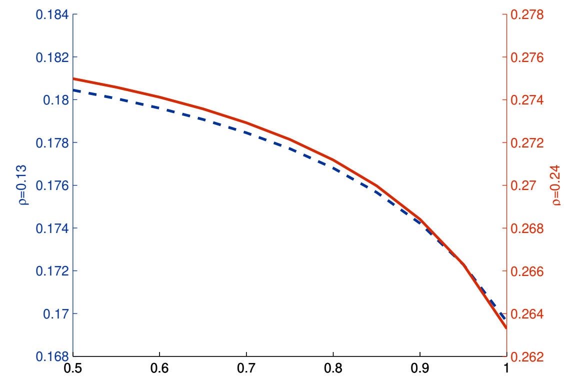

Figure 3: Price of investment and political instability.

This model inherits a commonly known sensitivity to σ and δ from the Markov-perfect, time-consistent solution under distortionary taxation. When δ is very low and σ is high, the tax rate is actually inefficiently smaller than that in commitment case (i.e. than in the second best). Political instability and polarization exacerbate such inefficiency. In this case, the correlation between these socio-political variables and the tax rate has the opposite sign to the one in the data. While these cases exist, for standard values of δ and σ the correlations are consistent with the empirical evidence, as shown in the figure.

4 Concluding Remarks

I present a model where disagreements about the composition of spending in a polarized and politically unstable society result in implementation of short-sighted policies by the government. As a consequence, investment rates are too low, which slows down growth during the transition. In the long run, this results in output, consumption, and welfare being inefficiently low. The larger the degree of polarization, the greater is the inefficiency. Political stability mitigates the effects of polarization by making the incumbent internalize the dynamic inefficiencies introduced by the choice of growth-retarding policies. The model provides a formal micro-foundation for the empirical findings of Easterly and Levine (1997) and Barro (1991) within a dynamic neoclassical framework with rational agents.

The mechanism driving our results is intuitive. Groups with conflicting interests try to gain power in order to implement their preferred fiscal plan. Since there is a chance of being replaced by the opposition, over-spending is optimal. Because this is financed by distortionary taxes on investment, choosing a large public sector reduces investment: the relative price of investment goes up as taxes increase, and this deters private savings. The greater the disagreement, captured by the degree of polarization, the larger the losses of being replaced by the opposition are. Hence, the stronger is the short-sightedness in policy choices.

The forces that drive short-sightedness are the disagreement of consecutive governments, the political uncertainty, and the induced lack of commitment. Therefore, a way to improve the performance of democratic institutions would be to try to reduce the effect of either of these factors. Consider for example an independent Congress where both groups had representation. Depending on each group's bargaining power, positive amounts of both public goods could be provided every period, thus reducing the 'disagreement effect'.

5 Appendix

The FOC with respect to g is:

$$(1-\rho)u_c[-x_g - H_g] + \rho v_g + \beta H_g \left\{pV'_K + (1-p)W'_K\right\} = 0, \tag{17}$$

where primes denote variables evaluated next period and $H_g = \frac{\partial H(K,g)}{\partial g}$. Denote the by $\mathcal{G}(K)$ the function that solves this equation.

We can obtain V_K by differentiating equation (11), and use the eq.(17) to cancel terms involving changes in $\mathcal{G}(K)$. We obtain

$$V_K = (1-\rho)u_c[f_K + (1-\delta) - H_K] + \beta H_K\{pV'_K + (1-p)W'_K\}.$$

Given the definition of Δ_g and using eq.(17) we can write

$$V_K = (1-\rho)u_c[f_K + 1 - \delta - H_K] - \frac{H_K}{H_g}[\Delta_g + \rho(1-\mu)v_g]. \tag{18}$$

Let $\bar{H}_K = H_K + H_g\mathcal{G}_K$. To find W_K differentiate eq.(12):

$$W_K = (1-\rho)u_c[f_K + 1 - \delta - x_g\mathcal{G}_K - \bar{H}_K] + \beta\bar{H}_K\{(1-p)V'_K + pW'_K\},, \tag{19}$$

We can use eq.(17) to solve for W'_K:

$$W'_K = \frac{1}{1-p}\left\{\frac{(1-\rho)u_c[x_g + H_g] - \rho v_g}{\beta H_g} - pV'_K\right\}. \tag{20}$$

Replacing this equation into eq.(19), using the definition of Δ_g, and simplifying it results in:

$$W_K = (1-\rho)u_c[f_K+1-\delta-x_g\mathcal{G}_K-\bar{H}_K]+\beta\bar{H}_k\frac{1-2p}{1-p}V'_K+\frac{p}{1-p}\frac{\bar{H}_k}{H_g}[(1-\rho)u_cH_g-\Delta_g-\rho(1-\mu)v_g]. \tag{21}$$

Replacing eq. (18) in the expression above and updating one period we obtain an expression for W'_K that is independent of the value functions and their derivatives. Finally, we can update eq. (18) one period and replace it, together with W'_K, to obtain the GEE:

$$\tilde{\Delta}_g + H_g\left\{\Delta_K - \beta\frac{H'_K}{H'_g}\tilde{\Delta}'_g + \beta\left[-(1-p)\rho v'_g\mathcal{G}'_K + (1-2p)\frac{\bar{H}'_K}{H'_g}\left(\tilde{\Delta}'_g + \Delta'_k H'_g - \beta H'_g\frac{\bar{H}''_K}{H''_g}\tilde{\Delta}''_g\right)\right]\right\},$$

where $\tilde{\Delta}_g = \Delta_g + \rho(1-\mu)v_g$. Re-arranging this expression, we obtain eq.(15).

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