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The dynamics of public investment under persistent electoral advantage ☆

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ABSTRACT

This paper studies the effects of asymmetries in re-election probabilities across parties on public policy and their subsequent propagation to the economy. The struggle between groups that disagree on targeted public spending (e.g., pork) results in governments being endogenously short-sighted: Systematic underinvestment in infrastructure and overspending on targeted goods arise, above and beyond what is observed in symmetric environments. Because the party enjoying an electoral advantage is less short-sighted, it devotes a larger proportion of revenues to productive investment. Hence, political turnover induces economic fluctuations in an otherwise deterministic environment. I characterize analytically the long-run distribution of allocations and show that output increases with electoral advantage, despite the fact that governments expand. Volatility is non-monotonic in electoral advantage and is an additional source of inefficiency. Using panel data from US states I confirm these findings.

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1. Introduction

A central issue in dynamic political economy is to understand how political frictions affect fiscal policy and economic performance over time. The political process of fiscal choice determines a game for the allocation of a 'common pool' resource: current and future taxable income (Inman and Fitts, 1990). Legislators demand projects that benefit a particular geographic area or an identifiable group of constituents, the cost of which are borne by the entire population. As a result of the fiscal wedge between social and local marginal costs, overutilization of the public resource and underinvestment in growth-enhancing projects arise.

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The recent literature on pork-barrel politics has focused almost exclusively on characterizing symmetric equilibria in which parties behave identically.[2] A main result is that re-election uncertainty introduces a wedge in intertemporal decisions when governments lack commitment. This wedge distorts economic allocations; thereby reducing long-run output and consumption. This paper contributes to the literature by considering the implications of asymmetries in political turnover between competing parties; that is, in an environment where one of the parties is politically stronger than the other. Additional distortions emerge when incumbents face different re-election prospects, since the politically disadvantaged party leans toward more short-sighted policies than it would if political turnover were symmetric. Even though parties have identical preferences over the size of the government, alternating power induces economic fluctuations via changes in taxation and spending (in an environment that is otherwise deterministic), furthering the inefficiencies. I find that the resulting volatilities are non-monotonic in the size of the political bias.

Persistent partisan advantage in democratic elections has been extensively documented by political scientists, in particular regarding the voting behavior across US states. Using a multi-component index that combines historical results in gubernatorial, House, and Senate elections, individual states are characterized as being under Democratic or Republican control. Brown and Bruce (2002) use a combination of the two most common indices of political competition, the Ranney index and the Holbrook Van Dunk index, to compute trends in political advantage. Their study shows that between 1968 and 2003, Massachusetts, Maryland, and New York exhibit a sizable and uninterrupted Democratic advantage (both at the state and national levels). New Hampshire, Wyoming, and Indiana, on the other hand, have been exclusively under Republican control. Using the results from state legislative elections I document that partisan advantage can be large and persistent at the state level. Evidence of systematic electoral biases in other countries is further illustrated by the recent experiences of Japan and Mexico. Understanding the implications of persistent partisan advantage on long-run outcomes is a main objective of this work.

Building on the work of Alesina and Tabellini (1990) and Besley and Coate (1998), I present a theoretical model in which partisan electoral advantage is explicitly considered. There are two groups of citizens in the economy that would like to target spending to themselves (through the provision of projects that benefit their geographical location) but have common interests regarding the accumulation of public capital, which enhances aggregate output. Groups are represented by parties that alternate in power via a democratic process. A key feature is that a representative of only one of the groups is in power at each point in time (e.g., the party has a majority in Congress) and suffers from limited commitment. I characterize time-consistent policies as Markov-perfect equilibria. Because election outcomes are uncertain, parties are endogenously short-sighted relative to the groups they represent. Thus, despite the fact that financing instruments are non-distortionary (i.e., taxes are lump-sum), an intertemporal wedge arises. As in the symmetric case, policymakers tend to overspend on pork and underinvest in productive public capital, which reduces output and private consumption relative to the efficient allocations.

The asymmetry arises because one of the parties is assumed to enjoy persistent political advantage, which is formalized as a higher probability of winning an election. Because the two decision-makers have different de facto discount factors, interesting strategic interactions arise. In particular, the disadvantaged party is endogenously more short-sighted and thus under-saves (relative to a world in which its rival had the same effective short-sightedness), while the advantaged party is less short-sighted and thus over-saves (relative to a world in which its rival had the same effective short-sightedness). Political uncertainty is propagated throughout the economy via volatility in policies, and economic cycles endogenously arise. This is the case even though there is no source of uncertainty other than the identity of the policymaker. Welfare is lower relative to the first best not only because of a dynamic inefficiency (investment is too low), but also because volatility in macroeconomic variables (output, employment, and consumption) is introduced.

Increases in political advantage widen the gap between the policies chosen by the two parties, as well as their probabilities of being elected. Despite the fact that the size of the government (total expenditures to output) increases with the political bias, long-run average output rises. The reason is that, on average, a larger proportion of revenues is devoted to productive public investment. I find that the size of the cycles induced by changes in political advantage is non-monotonic because it is affected by changes in policy and probabilities in opposite directions. Economies in which the political advantage is low exhibit rapid turnover but small fluctuations in policy, as the difference in investment shares is small. This happens because both parties have similar election prospects and are thus equally short-sighted. At the other extreme, when the biases are large, so are the differences in policy. But the most popular party is in power more often, and hence, fluctuations are small. Volatility is largest for intermediate values of the political bias.

I construct a proxy for partisan advantage for each state during the period 1970–2011 using election data in state legislatures. I document that partisan advantage is generally sizable and persistent within a given state over the sample period. I then test the main predictions of the model combining these series with the state economic and fiscal policy data from the US Census. First, and in line with the theory, I find that targeted spending as a share of total state government expenditure is significantly higher than average when a historically disadvantaged party gains a majority of seats in a state legislature. The share of public investment (total capital outlays) to total state government expenditures, on the other hand, is significantly lower than average when this party is in power. This holds even after state and year fixed effects are controlled for and provides some evidence of the short-sightedness of parties that hold power infrequently. Second,

[2] Recent examples are Amador (2008), Azzimonti (2011), Battaglini (2014), Battaglini and Coate (2007), and Debortoli and Nunes (2010).

I find that the average share of investment to total spending in a state increases with electoral advantage. This is consistent with Fiva and Natvik's (2009) finding that higher re-election probabilities are associated with higher public investment in Norwegian local governments. In addition, I show that states where parties enjoy a larger electoral advantage exhibit a lower share of targeted public spending (intergovernmental transfers to local governments) to total spending. Finally, I confirm that there is an inverted U-shaped relationship between the long-run volatility of linearly detrended data (output, public investment, and targeted spending) and electoral advantage.

The organization of the paper is as follows. A discussion of the existing literature is presented next. The benchmark model is described in Section 2. The Markov-perfect equilibrium is defined in Section 3 and characterized in Section 4. Section 5 provides empirical support for several implications of the theory. Section 6 concludes.

1.1. Related literature

This paper contributes to the literature that analyzes the dynamic efficiency of policy choices in representative democracies. It builds on the work by Besley and Coate (1998) and Alesina and Tabellini (1990), who present the first theories of political failure. In Alesina and Tabellini (1990), parties choose to overspend on public goods and to create an excessive level of debt when the outcome of elections is uncertain. In Besley and Coate (1998) parties fail to undertake public investments that are Pareto improving due to lack of commitment in a two-period model. My work extends some of their insights to a dynamic infinite-horizon political economy model, particularly relevant for assessing the long-run effects of government policy.

Amador (2008) and Azzimonti (2011) also analyze the inefficiencies generated by a common pool problem in a fully dynamic infinite-horizon model. Their basic mechanism, like the one in this paper, is based on the trade-offs described in Alesina and Tabellini (1990). Amador (2008) finds that politicians are too impatient, behaving as hyperbolic consumers, which results in inefficient overspending and excessive deficit creation.[3] In Azzimonti (2011), overspending results in equilibrium due to political turnover but in an environment in which the government distorts private investment in order to finance group-specific public goods. In both papers, taxation is deterministic, and so are output and consumption. Moreover, neither considers public investment. Battaglini and Coate (2007) introduce durable public goods financed by the government. Distortions arise due to the assumption of proportional taxation on labor income, while I assume those away by focusing on lump-sum taxes. In my paper distortions arise because public capital affects the productivity of labor. In contrast, durable goods and labor productivity are completely independent in Battaglini and Coate's setup.[4] Bassetto and McGranahan (2011) present an interesting alternative mechanism affecting voters' short-sightedness in a symmetric environment: population dynamics. Because future costs (and benefits) of public investment are shared with incomers and will not be borne by emigrating households, a dynamic common pool problem arises. As in my paper, this results in under-provision of infrastructure even when taxes are lump-sum.

The mechanism by which partisan advantage induces incumbents to choose growth-promoting policies (e.g., investment in infrastructure) in this paper is equivalent to the one that induces policymakers to choose less inefficient policies (e.g., lower debt) in Amador (2008) or (e.g., lower distortionary taxes) in Battaglini and Coate (2007) and Azzimonti (2011): Lower political instability increases the effective discount factor of policymakers in these dynamic models. This should not be interpreted as implying that lack of political competition is always good for economic growth. Besley et al. (2010) show that partisan advantage may be detrimental for economic development when a large proportion of the population is independent rather than partisan. In their environment, incumbents place more weight on pro-growth policies to attract swing voters when political competition is intense. A key assumption driving their result is that political candidates have commitment to platforms, while I consider an environment where promises are not credible unless they are ex-post optimal. In addition, by looking at a two-period model they ignore the positive effects of persistent partisan advantage on public policy, which is the focus of my paper. An interesting extension would incorporate swing voters and quantify which force dominates.

This paper also contributes to the literature on inefficiencies resulting from the government's lack of commitment. For example, Sleet and Yeltekin (2008) analyze how political frictions, through binding implementability constraints, affect the actual discount factor of the policymaker and deviate allocations away from the first best. Re-election uncertainty acts similarly here, but the asymmetry creates additional inefficiencies through optimal manipulation of public investment. While several existing models find strategic interactions between successive policymakers, most of them must rely on numerical methods to characterize the Markov-perfect equilibrium (e.g. Krusell and Rios-Rull, 1999 or Bachman and Bai, 2013a). I derive a closed-form solution instead.

A common feature of all the papers discussed above is that they restrict attention to symmetric environments, so there are no fluctuations in macroeconomic variables induced by changes in power. The analysis of cycles in policy and economic allocations generated by electoral advantage is a main contribution relative to their work.

[3] Caballero and Yared (2010), Debortoli and Nunes (2008, 2010), Devereux and Wen (1998), Kumhof and Yakadina (2007) and Ilzetzki (2011) also analyze environments in which exogenous political turnover introduces inefficiencies in debt accumulation and the level of taxation in Markov-switching models. See Lagunoff and Bai (2011) for an interesting case in which the probabilities of re-election are exogenous but depend on the aggregate state of the economy.

[4] Besley et al. (2013) study the effects of exogenous political instability on fiscal capacity (a durable public good) in a similar environment.

There exists a body of research where economic cycles can result from political frictions, but through alternative mechanisms to the one presented in my paper. One strand of the literature, the 'political budget cycles' (or political business cycles), argues that policymakers can engage in rent-seeking activities and may choose inefficient policies in order to increase their probability of re-election, so as to get continued access to these office rents. Incumbents' incentives to induce good economic outcomes just before an election produces fluctuations in fiscal policies, and these create volatility in economic variables (see, for example, Rogoff and Sibert, 1988, or Drazen, 2000b for a survey). Informational asymmetries between voters and policymakers are at the core of their results. In my paper, there is no disagreement between politicians' objectives and their constituency's. In that sense, my work is more related to the second strand of the literature, the 'partisan cycles,' in which political turnover between groups gives rise to economic fluctuations. The main difference with previous models in this literature (such as Milesi-Ferretti and Spolaore, 1994; Persson and Svensson, 1989 or more recently Azzimonti and Talbert, 2014; Song, 2012; and Bachman and Bai, 2013b) is that heterogeneity does not arise from differences in preferences over the size of public expenditures. Parties have the same ex-ante utility over the size of spending on public goods and on the level of investment. In equilibrium, one of the parties spends more and invests less just because it loses more often as a result of an electoral disadvantage. The advantage of this approach is that it can be tested since we do observe asymmetries in electoral advantage. In addition, the paper presents a full characterization of long-run outcomes. Many existing papers abstract from it by focusing on two-period models. An important exception is Acemoglu et al. (2011). The authors find that—as long as the discount factor is small enough—power alternation results in inefficient allocations where distortions (and hence labor) fluctuate over time. Because they abstract from any form of capital, the dynamic strategic link between current and future governments is abstracted from in their analysis. The dynamics of public investment is instead the main focus of my paper. In addition, since I restrict equilibria to be Markov-perfect (while they characterize sustainable equilibria), distortions do not disappear when the discount factor increases, while they vanish in their environment. My results are thus highlighting the detrimental effects of institutional failures under re-election asymmetries.

2. The benchmark model

In this section I describe the economic environment and define a competitive equilibrium given policy. Conditions satisfied by Pareto optimal allocations are presented to be used as a benchmark when discussing inefficiencies arising from political uncertainty in the following sections.

2.1. Economic environment

Consider a discrete-time infinite-horizon economy populated by agents of equal measure who live in one of two regions, A and B (normalizing total population to 1). While they have identical income and identical preferences over private consumption, they disagree on the composition of public expenditures, since public projects can be targeted to particular geographical areas. The instantaneous utility of agent j in region J is

$$u(c_j, n_j) + v\left(g^J\right) \tag{1}$$

where c_j denotes the consumption of private goods, n_j denotes labor, and g^J is the level of discretionary spending on local goods in region J. Notice that an agent living in region A derives no utility from the provision of a good in region B (and vice versa). In principle there will be disagreement in the population over 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. Following Greenwood et al. (1988), I will assume that preferences over consumption and leisure satisfy

$$u(c, n) = \log\left(c - \frac{n^{1+\frac{1}{\epsilon}}}{1+\epsilon}\right)$$

also referred to as the 'GHH form', where ϵ is the elasticity of labor, and preferences over the provision of public goods are logarithmic

$$v\left(g^J\right) = \log\left(g^J + G\right).$$

The constant G is interpreted as the minimum amount of the local public good that must be provided to each constituency. Hence, g^J represents discretionary spending directed to region J. From now on, we will refer to discretionary spending simply as 'public goods'. As long as $G > 0$ utility is bounded when a party chooses $g^J = 0$. Agents discount the future at rate $\beta \in (0, 1)$.

There are infinitely many competitive firms that produce a single consumption good and hire labor each period so as to maximize profits, which are distributed back to consumers who own shares of these firms. Firms have access to a Cobb–Douglas technology

$$F(K_g, n) = AK_g^{\theta} n^{1-\theta},$$

where n is the aggregate labor supply and K_g is the stock of public capital. Its level is determined by government investments and acts as an externality in production. The idea behind this specification is that the better the infrastructure (roads, harbors, bridges, etc.), the healthier and more educated the population, and the stronger the protection of property rights, the higher the productivity of the private sector. We assume that K_g depreciates fully after being used in production. In equilibrium, workers are paid the wage w and firms distribute profits

$$\Pi = F(K_g, n) - wn$$

as dividends to individual shareholders.

The government raises revenues via lump-sum taxes τ that are chosen every period, so private consumption is

$$c_j = wn_j + \Pi - \tau.$$

Taxes are used to finance the provision of consumable public goods (g^A and g^B) and investments in productive public capital ($I = K_g'$). The cost of producing local public goods is linear, so $x(g) = g + G$, where g is discretionary spending. Assuming that there is no debt, the government must balance its budget every period. Its budget constraint is

$$x\big(g^A\big) + x\big(g^B\big) + K_g' = \tau,$$

where primes denote next period variables. The assumption of lump-sum taxes is made in order to highlight the fact that inefficiencies in production may arise due to political frictions even when the government has access to non-distortionary financing instruments.

2.2. Competitive equilibrium given policy

Firms decide how much labor to hire given wages and distribute profits back in the form of dividends to agents, who own shares of these firms. Agents choose consumption and leisure, taking wages and government policy (public spending and investment) as given. A competitive equilibrium given policy is defined below (I omit the stock of public capital K_g from all functions to simplify notation).

Definition 2.1. A competitive equilibrium given government policy $\Upsilon = \{g^A, g^B, K_g'\}$ is a set of allocations, $\{c_j(\Upsilon), n_j(\Upsilon), \Pi(\Upsilon)\}$, prices $w(\Upsilon)$, and taxes $\tau(\Upsilon)$ such that:

(i) Agents maximize utility subject to their budget constraint. Agent j's labor supply satisfies

$$u_1\big(c_j(\Upsilon), n_j(\Upsilon)\big)w(\Upsilon) + u_2\big(c_j(\Upsilon), n_j(\Upsilon)\big) = 0,$$

where

$$c_j(\Upsilon) = w(\Upsilon)n_j(\Upsilon) + \Pi(\Upsilon) - \tau(\Upsilon).$$

(ii) Firms maximize profits, so $w(\Upsilon) = F_2(K_g, n(\Upsilon))$ and $\Pi(\Upsilon) = F(K_g, n(\Upsilon)) - w(\Upsilon)n(\Upsilon)$.
(iii) Markets clear $n(\Upsilon) = \int_j n_j(\Upsilon)$.
(iv) The government budget constraint is satisfied.

$$\tau(\Upsilon) = x\big(g^A\big) + x\big(g^B\big) + K_g'.$$

The static nature of firms' and workers' economic decisions simplifies the characterization of the competitive equilibrium to a great extent. Moreover, from condition (i) we can see that agents' decisions are independent of their type j, which results from the additive separability of the utility derived from the provision of public goods. Hence, there is aggregation and we can think of the competitive equilibrium as characterized by the decisions of a representative agent with $n_j(\Upsilon) = n(\Upsilon)$ and $c_j(\Upsilon) = c(\Upsilon)$.[5]

Replacing the firm's optimal decisions and the government budget constraint into the agent's budget constraint we obtain consumption as a function of policy,

$$c(\Upsilon) = F\big(K_g, n(\Upsilon)\big) - x\big(g^A\big) - x\big(g^B\big) - K_g', \tag{2}$$

with aggregate labor $n(\Upsilon)$ satisfying

$$u_1\big(c(\Upsilon), n(\Upsilon)\big)F_2\big(K_g, n(\Upsilon)\big) + u_2\big(c(\Upsilon), n(\Upsilon)\big) = 0. \tag{3}$$

[5] This result holds for any pair of concave functions $u(c, n)$ and $v(g)$, not just the particular ones assumed in the text.

2.3. Planning solutions

Before describing the outcome under political competition (where different parties alternate in power), it is useful to characterize the optimal allocation chosen by a benevolent social planner. The planner chooses $\{c, n, K'_g, g^A, g^B\}$ so as to maximize a weighted sum of utilities, where the weight on type J agents is $\lambda^J \in [0,1]$ (with $\lambda^A + \lambda^B = 1$). The planner's maximization problem is

$$V^*(K_g) = \max \sum_{J=A,B} \lambda^J \left[u(c,n) + v\left(g^J\right)\right] + \beta V^*\left(K'_g\right),$$

subject to the resource constraint:

$$c + x\left(g^A\right) + x\left(g^B\right) + K'_g = F(K_g, n).$$

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.[6]

$$-u_1(c,n)x_g\left(g^J\right) + \lambda^J v_g\left(g^J\right) = 0. \tag{4}$$

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 v implies that if type A agents have a higher weight in the social welfare function, more of their desired public good will be provided (at the expense of type B agents).

The second optimality condition refers to the optimal labor supply. Under this condition, the planner equates the marginal disutility of working to the marginal increase in the utility of consumption generated by additional production.

$$u_1(c,n)F_2(K_g,n) - u_2(c,n) = 0. \tag{5}$$

Finally, the planner chooses the level of public capital that equates the marginal costs in terms of forgone consumption to the discounted marginal benefits of investment.

$$-u_1(c,n) + \beta u_1\left(c', n'\right)F_1\left(K'_g, n'\right) = 0. \tag{6}$$

The planner's Euler equation is completely independent of the choice of the social welfare function: Changes in λ^J do not affect this margin. The result follows from assuming that both agents have the same trade-off between private and public consumption (i.e., u and v are equal for all agents).[7]

Departures from these conditions from zero represent gaps or wedges relative to the first best. For future reference, we will define the *public goods' provision wedge* with Δ_g, the *labor wedge* with Δ_n, and the *investment wedge* with Δ_k, respectively.

3. Politico-economic equilibrium

The role of the government in this economy is to provide public goods and productive public capital. 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 in which there are two parties, A and B, representing each group in the population and competing for office every period. They alternate in power according to an exogenous election probability p_i, $i \in \{A, B\}$. The asymmetry arises because one of the groups has greater political power than the other. In particular, I assume that type-B candidates are more likely to be elected

$$p_B = 0.5 + \xi, \quad \text{with } \xi \in \left[0, \frac{1}{2}\right],$$

and $p_A = 0.5 - \xi$. We can interpret ξ as measuring B's *electoral advantage*. This specification can be micro-founded using a traditional Lindbeck–Weibull probabilistic voting model augmented to allow for an ideology bias in the population toward party B and assuming no commitment to platforms (this is shown formally in the Online Appendix, Section 1). I abstract from incumbency advantage in this paper to ease notation, but the results hold for the case where p_i represents the probability of re-election with $p_i > 0.5$ $\forall i$ as long as $p_B > p_A$. Details are available upon request.

The elected party chooses the tax rate and the allocation of government resources between the different types of spending and investment so as to maximize the utility of its own type.[8]

[6] If the planner only cares about the well-being of, say, agent A, it will set $g_t^B = 0$ $\forall t$ and g_t^A so as to equate the marginal rate of substitution between private and public goods to the marginal cost of providing the goods $x_g(g)$.

[7] It is important to note that the planner is constrained to offer all households the same consumption allocation (that is, $c^A = c^B$). This condition is imposed in order to capture the constraint faced by the government in the political equilibrium (where parties cannot tax agents at different rates).

[8] In that sense this is a *partisan model*. A politician from party j is just like any other agent in that group, so he wants to maximize his type's utility. 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 Drazen (2000a) or Persson and Tabellini (2000) for a discussion of *opportunistic models*.

3.1. Markov-perfect equilibrium

There is no commitment technology, so promises made by any party before elections are not credible unless they are optimal ex-post. 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 rule out such mechanisms by focusing on Markov-perfect equilibria (MPE) instead, defined as a set of strategies that depend only on the current, payoff-relevant state of the economy. Given the sequence of events the only payoff-relevant state variable—besides the identity of the party in power—is the stock of public capital. In a Markov-perfect equilibrium, policy rules are functions of this state.

The equilibrium objects we are interested in are policy functions, allocations, and value functions. There are three policy functions: The investment rule of incumbent i, $h_i(K_g)$, and expenditures in each region-specific good $g_i^A(K_g)$ and $g_i^B(K_g)$. The labor supply $n_i(K_g)$ and consumption $c_i(K_g)$ under incumbent i's policies summarize the allocations. The value function of agent type J when his group is in power will be denoted by $V_J(K_g)$ and when his group is out of power by $W_J(K_g)$.

The incumbent must decide on the optimal policy, knowing that he will be replaced by a different policymaker with probability p_i. Suppose that B is the elected party. Given the stock of public capital K_g, his objective function today is:

$$\max_{g^A, g^B, K_g' \geq 0} u(c,n) + v\left(g^B\right) + \beta\left\{p_B V_B\left(K_g'\right) + p_A W_B\left(K_g'\right)\right\} \tag{7}$$

where consumption and labor satisfy Eqs. (2) and (3).

Since g^A and g^B affect only today's utility, tomorrow's decisions are independent of the composition of expenditures. If party i is in power, it will choose $g_i^J = 0$, for $J \neq i$, which further simplifies the problem. Slightly abusing notation, we use $g_i(K_g)$ 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 $V_B(K_g)$ and $W_B(K_g)$:

$$V_B(K_g) = u\left(c_B(K_g), n_B(K_g)\right) + v\left(g_B(K_g)\right) + \beta\left\{p_B V_B\left(h_B(K_g)\right) + p_A W_B\left(h_B(K_g)\right)\right\} \tag{8}$$

and

$$W_B(K_g) = u\left(c_A(K_g), n_A(K_g)\right) + \beta\left\{p_B V_B\left(h_A(K_g)\right) + p_A W_B\left(h_A(K_g)\right)\right\}, \tag{9}$$

where $c_i(K_g) = c(\Upsilon_i(K_g))$ and $n_i(K_g) = n(\Upsilon_i(K_g))$ are the competitive equilibrium values of consumption and labor under the political equilibrium policy functions $\Upsilon_i(K_g) = \{g_i^A(K_g), g_i^B(K_g), h_i(K_g)\}$ chosen by incumbent type i.

We can now define a Markov-perfect equilibrium, which just imposes consistency between private agents and the government's decisions.

Definition 3.1. A Markov-perfect equilibrium with exogenous political turnover is a set of value and policy functions such that:

i. Given the re-election probabilities and CE allocations and prices, the functions $h_i(K_g)$, $g_i^B(K_g)$, $g_i^A(K_g)$, $V_i(K_g)$, and $W_i(K_g)$ solve incumbent i's maximization problem, (7), (8), and (9).
ii. Given the re-election probabilities and government policy, the functions $c_i(K_g)$ and $n_i(K_g)$ satisfy Eqs. (2) and (3).

3.2. Differentiable Markov-perfect equilibrium (DMPE)

In order to further characterize incumbent i's optimal choices I will focus on *differentiable* policy functions. Klein et al. (2008) made this assumption (in a different context), arguing that there could be in principle an infinitely large number of Markov equilibria. Differentiability acts as a selection device, and allows us to derive the government optimality condition even though the envelope theorem doesn't hold.

The choice of expenditures is a static one, affecting only the *intratemporal* margin. At the optimum, the government chooses g so that the marginal cost of providing the good in terms of consumption equals its marginal benefit:

$$u_1\left(c_B(K_g), n_B(K_g)\right) x_g(g) = v_g(g). \tag{10}$$

We can see that government spending in the MPE is sub-optimal from the standpoint of a social planner—which gave positive weight to both types—since $\Delta_g \neq 0$ (see Eq. (4)). Sub-optimality arises for two reasons. First, the group out of power gets no provision of its preferred good. Second, there is over-spending in the sense that the marginal rate of private consumption is too low when compared to that of the utilitarian optimum (or any level associated with positive weights $\lambda^J > 0$). Even the group in power would prefer a *lower* level of g if the difference was invested in productive capital and subsequently used in the provision of its preferred good instead.

The investment decision affects the *intertemporal* margin; the costs of increasing public capital are paid today, while the benefits are received in the future. The government chooses K_g' so that the marginal cost in terms of forgone consumption equals *expected* marginal benefits:

$$u_1\big(c_B(K_g), n_B(K_g)\big) = \beta\big\{p_B V_{B1}\big(K_g'\big) + p_A W_{B1}\big(K_g'\big)\big\}. \tag{11}$$

As in the planner's first-order condition, the cost of an extra unit of investment in public capital is given by a reduction in current utility via a decrease in consumption $-u_1(c,n)$. The benefits, on the other hand, depend on the identity of the party that wins the next election. When K_g' increases, expected future utility rises from the expansion of resources. Type B agents enjoy an increase of $V_{B1}(K_g') = \frac{\partial V_B(K_g')}{\partial K_g'}$ utils if they win the next election (which occurs with probability p_B) and $W_{B1}(K_g') = \frac{\partial W_B(K_g')}{\partial K_g'}$ otherwise (which occurs with probability $p_A = 1 - p_B$).

4. Characterization

It is instructive to analyze the Pareto optimal allocations first, obtained by solving the planner's problem presented in Section 2.3. Under the assumptions above, the economy collapses to a traditional neoclassical economy and thus the standard results apply. The labor supply takes a simple form,

$$n(K_g) = \big[\epsilon A(1-\theta)K_g^{\theta}\big]^{\frac{\epsilon}{1+\epsilon\theta}}, \tag{12}$$

and the level of production is given by

$$F\big(K_g, n(K_g)\big) = \bar{A}K_g^{\bar{\theta}} \quad \text{where } \bar{A} = A\big[\epsilon A(1-\theta)\big]^{\frac{\epsilon(1-\theta)}{1+\epsilon\theta}} \text{ and } \bar{\theta} = \frac{\theta(1+\epsilon)}{1+\epsilon\theta}.$$

Public capital evolves according to

$$K_g' = h^*(K_g) = s^*\tilde{A}K_g^{\bar{\theta}}, \quad \text{with } s^* = \beta\bar{\theta} \text{ and } \tilde{A} = \bar{A} - \frac{[\epsilon A(1-\theta)]^{\frac{1+\epsilon}{1+\epsilon\theta}}}{1+\epsilon}, \tag{13}$$

where $\tilde{A}K_g^{\bar{\theta}}$ equals the total amount of resources net of the disutility of labor, and we can think of it as 'labor-adjusted' production. A benevolent planner invests a constant proportion $s^* = \beta\bar{\theta}$ of labor-adjusted resources, independently of the Pareto weights attached to each group (these weights affect the composition of region-specific public goods but not the total amount of resources devoted to them). Since $\bar{\theta} < 1$, public capital converges *deterministically* to a steady-state level $K_g^* = [\beta\bar{\theta}\tilde{A}]^{\frac{1}{1-\bar{\theta}}}$. Therefore, there are no fluctuations in aggregate allocations in the first best.

Under a utilitarian planner ($\lambda^J = 1/2$) targeted goods are equally provided to both types,

$$g_A^*(K_g) = g_B^*(K_g) = \frac{1}{2}g^*(K_g) \quad \text{with } g^*(K_g) = \frac{1}{2}\big(1-s^*\big)\tilde{A}K_g^{\bar{\theta}} - G,$$

where $g^*(K_g)$ denotes the total provision of targeted goods in the first best, as a function of the capital stock.

The competitive equilibrium given policy determines consumption and labor as functions of government spending and investment. Because taxes are lump sum and there are no income effects under the GHH formulation, the labor supply follows Eq. (12). Consumption satisfies

$$c_i(K_g) = \bar{A}K_g^{\bar{\theta}} - g_i(K_g) - G - h_i(K_g).$$

Proposition 4.1 fully characterizes government policy.

Proposition 4.1. *There exists a differentiable Markov equilibrium where incumbent i chooses:*

$$g_i(K_g) = \frac{1}{2}(1-s_i)\tilde{A}K_g^{\bar{\theta}} - G, \qquad h_i(K_g) = s_i\tilde{A}K_g^{\bar{\theta}}, \quad \textit{and} \quad \tau_i = \frac{1}{2}(1+s_i)\tilde{A}K_g^{\bar{\theta}}$$

and the propensity s_i satisfies

$$s_i = \bar{\theta}\beta\left[\frac{1+p_i}{2-\bar{\theta}\beta(1-p_i)}\right]. \tag{14}$$

Proof. See Appendix A.1. □

An incumbent of type i invests a constant proportion of labor-adjusted resources, with the propensity to invest being a function of the probability of winning the election.

4.1. Dynamic inefficiencies in the MPE

When $p_i \to 1$, the economy has no political turnover, so we can think of the planner as a benevolent dictator since $s_i = s^*$, implying that investment is efficient. However, as long as the outcome of elections is uncertain, public investment will be distorted relative to the first best, as the optimal propensity to invest is lower than optimal $s^* = \bar{\theta}\beta > s_i$.

Corollary 4.1. *When $p_i < 1$, there is underinvestment in public capital $h_i(K_g) < h^*(K_g)$ and overspending in targeted goods, $g_i(K_g) > g^*(K_g)$.*

Proof. Let $p_i < 1$, since $\frac{\partial s_i}{\partial p_i} > 0$, then $s_i < s^*$ implying $g_i(K_g) > g^*(K_g) = \frac{1}{2}(1-s^*)\tilde{A}K_g^{\bar{\theta}} - G$ and $K_g' < K_g'^*$. □

Political uncertainty induces dynamic inefficiencies, generating under-investment in infrastructure and over-spending in targeted transfers. The intuition behind this result is well understood in the literature, and follows from the disagreement regarding the composition of targeted spending between the two groups. When choosing whether to invest an extra unit of revenues, incumbent B understands that part of the benefits of this investment will be spent on the opposition's constituency next period with some probability. Because election outcomes are uncertain, parties are endogenously short-sighted relative to the groups they represent. Notice that the rationale of this holds even in the symmetric case, $p_A = p_B$, where the center of the conflict is *what* to spend the budget on, instead of *how much* to spend (as analyzed in detail in Azzimonti, 2011).

When $p_A \neq p_B$ there are additional distortions generated by asymmetric election prospects, which cause not only short-sightedness, but also politico-economic fluctuations. These result from endogenous disagreement on the *levels* of spending and investment between the two groups that arise, as described in the next section, because their de-facto discount factors are different.

4.2. Politico-driven economic fluctuations

To understand how asymmetries in the probability of winning an election affect the investment wedge, it is useful to re-write the government first order condition as follows (see Appendix A.1 for details).[9]

$$\Delta_k = \beta p_A\{DE + MB + ID\} \tag{15}$$

where

$$DE = -x_g\big(g_A(K_g')\big)g_{A1}(K_g')u_1\big(c_A(K_g'), n_A(K_g')\big),$$
$$MB = u_1\big(c_A(K_g'), n_A(K_g')\big)F_1\big(K_g', n_A(K_g')\big) - u_1\big(c_B(K_g'), n_B(K_g')\big)F_1\big(K_g', n_B(K_g')\big)$$
$$ID = h_{A1}(K_g')\big[-u_1\big(c_A(K_g'), n_A(K_g')\big) + u_1\big(c_A(\tilde{K}_g'), n_A(\tilde{K}_g')\big)\big], \quad \text{where } \tilde{K}_g' = h_B^{-1}\big(h_A(K_g')\big).$$

The first term, *DE* (disagreement effect), captures the cost of disagreement in terms of the provision of targeted transfers described in the previous section. When the incumbent is not re-elected (which happens with probability p_A), a marginal increase on public capital today changes the opposition's spending in public goods tomorrow by $g_{A1}(K_g')$. This results in a cost in terms of forgone consumption next period with no utility benefit, since the incumbent derives no utility from that public good. From today's perspective it is optimal, then, to decrease investment with respect to the certainty case. Notice that by choosing a low level of investment today, the current policymaker can 'tie the hands of its successor' by leaving him with a small tax base next period. Disagreement over the composition of public goods, together with the political uncertainty, deters public investment.[10]

If parties had the same political power ($p_A = p_B$), the composition of expenditures would be the only source of disagreement, as the other two terms in Eq. (15) would cancel out. When $p_A \neq p_B$ two additional distortions arise. The marginal benefit of investing an extra dollar is different for members of group B when party B is in power than when party A is in power. This happens because taxation is different under the two parties, and so are equilibrium allocations. This affects not only the marginal utility of consumption, $u_1(c_i(K_g'), n_i(K_g'))$, but also the aggregate labor supply—and hence the marginal productivity of capital $F_1(K_g', n_i(K_g'))$—under an incumbent type i. The *MB* term captures the difference between the marginal benefits of investment under the two incumbent types. The *ID* (investment disagreement) term highlights another form of strategic manipulation, since investment today affects investment tomorrow. Because B's likelihood of staying in power is larger, the expected marginal benefits of investing one more dollar in public capital next period are higher than

[9] Since specific functional forms for utility and production were not used to derive Eq. (15), this equation describes more generally the optimal behavior of an incumbent in a political equilibrium with re-election uncertainty.

[10] 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-Ferretti and Spolaore (1994) also obtain strategic manipulation but for an alternative environment. For an infinite-horizon economy with symmetric shocks that also exhibits a disagreement effect, see Azzimonti (2011).

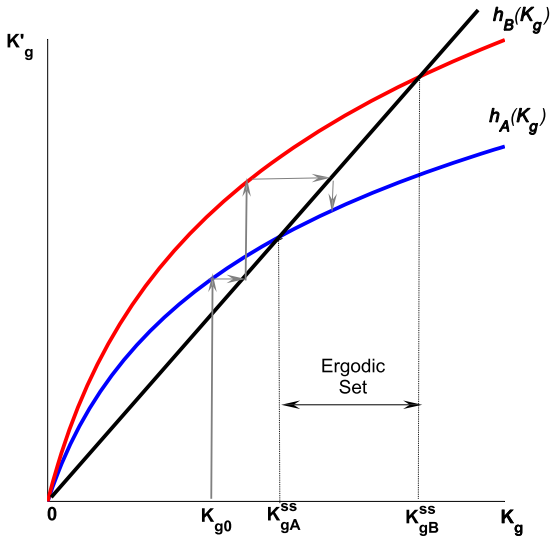

Fig. 1. Evolution of capital: policy functions.

for party A, which would increase investment tomorrow by only $h_{Ak}(K'_g)$. By choosing K'_g appropriately, incumbent B can induce party A to invest an amount closer to B's desired level $h_B(K'_g)$.

The combination of these three effects affects the marginal propensity to invest of the two parties, as seen in Eq. (14). Since $p_B > 0.5$, then $s_A < s_B$. The evolution of public capital, which follows

$$K'_g = s_i \tilde{A} K_g^{\bar{\theta}} \tag{16}$$

then depends on the identity of the incumbent and fluctuates with political alternation.

Consider an economy with $0 < K_{g0} < K_{gA}^{ss}$. If party i were in power long enough, capital would converge to the steady-state value K_{gi}^{ss}, as shown in the following lemma.

Lemma 4.1. *Fix i and $K_{g0} > 0 \Rightarrow \exists$ a unique stationary point $h_i(K_{gi}^{ss}) = K_{gi}^{ss}$ given by $K_{gi}^{ss} = (s_i \tilde{A})^{\frac{1}{1-\bar{\theta}}}$.*

Proof. Existence is trivial from $h_i(K_g) = s_i \tilde{A} K_g^{\bar{\theta}}$. Uniqueness follows from the properties of the policy function: (i) it is strictly increasing, $h'_i(K_g) = s_i \tilde{A} \bar{\theta} K_g^{\bar{\theta}-1} > 0$ since $s_i \in [0, 1]$ and $\bar{\theta} < 1$, (ii) strictly concave $h''_i(K_g) = s_i(\bar{\theta} - 1)\tilde{A}\bar{\theta} K_g^{\bar{\theta}-2} < 0$, and (iii) it crosses the 45° line from above $h'_i(K_{gi}^{ss}) = \bar{\theta} < 1$. □

Suppose that the government always followed B's optimal investment rule. Then K_g would evolve according to the upper line in Fig. 1, converging eventually to K_{gB}^{ss} (where B's policy function intersects the 45° line).

If A's rule was followed instead, not only would the steady state be lower ($K_{gA}^{ss} < K_{gB}^{ss}$) but convergence would take place at a slower pace. This follows from the fact that the speed of convergence under B is larger, $h'_B(K_g) > h'_A(K_g)$. When parties alternate in power, public investment fluctuates following the political cycle and the evolution of capital is stochastic. A possible path is represented by the arrows in Fig. 1.

Eventually, the economy reaches an 'ergodic set' in which public capital only takes values belonging to the interval $[K_{gA}^{ss}, K_{gB}^{ss}]$. Since public capital affects the productivity of the private sector, other macroeconomic variables (such as labor, output, and consumption) also fluctuate, with political shocks propagating into the real economy. The following proposition formally characterizes the evolution of capital over time.

Proposition 4.2. *Let $0 < K_{g0} < K_{gA}^{ss}$. Then $\exists T < \infty$ such that $\{K_{gt}\}_{t=0}^{T}$ is an increasing sequence and $\{K_{gt}\}_{t=T}^{\infty} \in [K_{gA}^{ss}, K_{gB}^{ss}]$.*

Proof. See Appendix A.2. □

The proposition states that starting from a value of capital outside of the ergodic set, the sequence of K_{gt} is increasing and reaches the set in finite time.

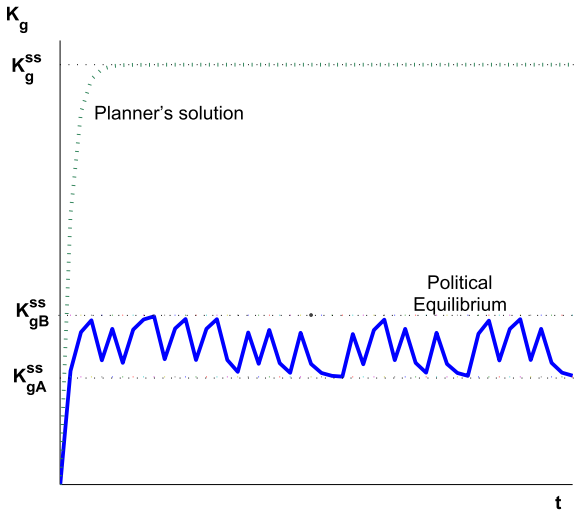

Fig. 2. Evolution of capital: simulation.

This is illustrated in Fig. 2, which plots a series of investment for a simulation of this economy. It also shows the evolution of capital that would be followed by a benevolent planner. We can see that a planner reaches a significantly higher steady state as described in Corollary 4.1.[11]

Public capital exhibits an increasing trend until it reaches the ergodic set at which point it fluctuates around a constant mean. It is possible to show theoretically that this process is in general stationary. In order to do so, it is useful to work with the logarithm of our variables of interest. Letting $\hat{x} \equiv \log(x)$, we can show:

Lemma 4.2. *Define* $\bar{\epsilon} = p_A \hat{s}_A + p_B \hat{s}_B$. *Then* $\hat{K}_{gt+1}$ *follows an AR(1) process,*

$$\hat{K}_{gt+1} = q + \bar{\theta} \hat{K}_{gt} + \epsilon_t$$

where $\epsilon_t = \hat{s}_t - \bar{\epsilon}$ *and* $q = \log(\tilde{A}) + \bar{\epsilon}$. *The shocks* ϵ_t *are i.i.d. and white noise with zero mean and variance*

$$\sigma^2 = p_A p_B (\hat{s}_A - \hat{s}_B)^2.$$

The long-run distribution of $\hat{K}_{gt+1}$ *has the following properties.*

i. *The mean is* $E(\hat{K}_{gt+1}) = \frac{q}{1-\bar{\theta}} \equiv \mu$.
ii. *The variance is* $Var(\hat{K}_{gt+1}) = \frac{\sigma^2}{1-\bar{\theta}^2} \equiv \gamma_0$.
iii. *The auto-covariances and auto-correlations satisfy*

$$Cov(\hat{K}_{gt+1}, \hat{K}_{gt+1-j}) = \frac{\bar{\theta}^j}{1-\bar{\theta}^2}\sigma^2 \equiv \gamma_j \quad \text{and} \quad \rho_j = \frac{\gamma_j}{\gamma_0}.$$

Proof. Take logs in Eq. (16) to obtain $\hat{K}_{gt+1} = \log \tilde{A} + \bar{\theta} \hat{K}_{gt} + \hat{s}_t$. Since $\hat{s}_t$ is a two-state i.i.d. stochastic process that equals $\hat{s}_i$ with probability p_i, its expected value is $E(\hat{s}_t) = p_A \hat{s}_A + p_B \hat{s}_B = \bar{\epsilon}$. By adding and subtracting $\bar{\epsilon}$ from the equation, its transformed error term ϵ_t has a zero mean. The variance is obtained by computing $Var(\epsilon_t) = E(\epsilon_t^2) - [E(\epsilon_t)]^2$ and using the fact that $p_A = 1 - p_B$. Stationarity follows from the fact that $\bar{\theta} < 1$. For the computation of long-run moments, see Hamilton (1994). □

Fig. 3 depicts the evolution of investment and spending in region-specific goods for a period of time, once the economy has reached its ergodic set. The economy experiences booms when B is in office and short periods of recession after party A wins an election. For example, consider what happens at $t = 8$, when group B takes office. There is an immediate jump in investment and a contraction of spending on public goods. This results in larger levels of public capital and hence more

[11] The parameters θ, G, and ξ are chosen to jointly match the ratio of federal public investment to GDP of 2.56, the ratio of federal public consumption to output of 13.12, and the average Democratic advantage in US federal congressional elections of 0.131. This implies $\theta = 0.034$, $G = 0.085$, $\xi = 0.062$. Additionally, $\beta = 0.95$ and $\epsilon = 2$ are standard in the literature. Even though the theory abstracts from productivity shocks, the model explains about 50% of the volatility in public investment to output ratios under this calibration. See Online Appendix 2 for further details.

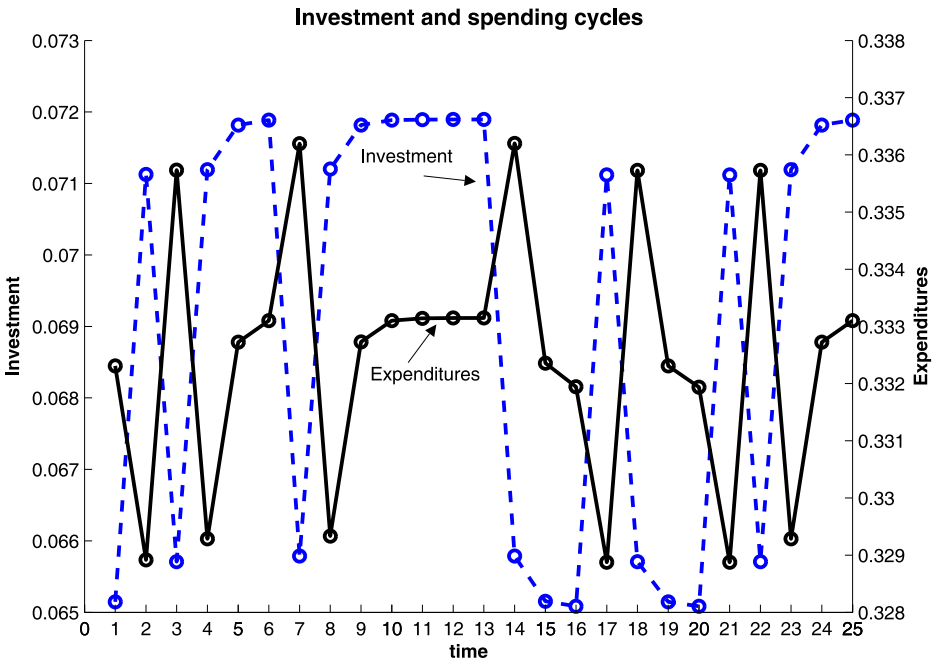

Fig. 3. Understanding the cycle.

production (i.e., a 'boom' in the economy). Government investment grows over time (periods 8 to 13), and as public capital becomes larger, the amount provided of the public good also increases. Group A gets into power in period 14, at which time expenditures on public goods have a boost accompanied by a contraction in investment.

Total expenditures increase when the party enjoying an electoral advantage is in office, since

$$e_{it} = x(g_{it}) + h_i(K_{gt}) = \frac{1}{2}(1+s_i)\tilde{A}K_{gt}^{\bar{\theta}}$$

rises right after B takes control of the government.

Notice that the nature of the economic cycle is intrinsically different from the one found in traditional partisan cycle models, in which one of the parties is assumed to derive higher utility from public goods than the other. In such models, switches in power that are associated with increases in total expenditures should also result in higher public consumption. In this model, however, increases in total spending right after a switch in government would be associated with *decreases* in public consumption.

Finally, an empirical implication from this analysis is that the share of investment to total spending (or to output) decreases right after there is a switch in power to a historically disadvantaged party (e.g., when party A wins an election in our example). The share of targeted spending on total spending (or output), on the other hand, increases right after a switch. This implication will be tested using data for US states in Section 5.1.

Because output, consumption, and expenditures are proportional to capital, their processes are also stationary. The following lemma provides some insights into the propagation mechanism of political shocks.

Lemma 4.3.

$$Var(\hat{n}_t) < Var(\hat{y}_t) < Var(\hat{K}_{gt+1}) \quad \textit{and}$$
$$Var(\hat{c}_t) = Var\big(\hat{x}(g_t)\big) > Var(\hat{y}_t).$$

Proof. See Appendix A.3. □

Private consumption reacts immediately to the change in taxes that occurs after a political switch. The labor supply, on the other hand, is unaffected by the resulting income effects due to the GHH preference assumption. Since the current stock of capital is fixed, output does not change either. This implies that consumption variability is larger than output variability in this model. Public consumption reacts in the same way to shocks as private consumption as a result of separability and the fact that both are assumed to have the same intertemporal elasticity of substitution. Power switches also affect investment, and this creates changes in output and labor, but with a lag. Hence, investment is more volatile than these two variables, as shown in the lemma above. It is worth mentioning at this point that since we are abstracting from productivity

shocks, these implications are not to be taken as general results regarding relative volatilities at business cycle frequencies, but instead as illustrating how economic variables react to medium-term political shocks associated with switches in the ideology of the policymaker.

4.3. The effect of party advantage

The probability of party B's re-election increases when its electoral advantage ξ rises, $\partial p_B/\partial \xi > 0$. Since B belongs to the advantaged group, he is more likely to be succeeded by a candidate of his own type, which creates incentives to invest even more resources in productive activities, $\partial s_B/\partial \xi > 0$. If A was in power instead, a higher value of ξ would decrease this party's probability of staying in power, $\partial p_A/\partial \xi < 0$. So the short-sightedness would be strengthened, $\partial s_A/\partial \xi < 0$, resulting in a propensity to invest even lower relative to the first best. Despite the decrease in A's propensity to invest, long-run capital increases as B's electoral advantage goes up, as shown in Lemma 4.4.

Lemma 4.4. *The long-run average of the capital stock increases with political advantage*

$$\frac{\partial E(\hat{K}_g)}{\partial \xi} > 0.$$

Proof. See Appendix A.4. □

Because $\hat{y}$ and $\hat{n}$ are increasing functions of $\hat{K}_g$, output and the labor supply will also increase in the long run as ξ increases.

This model also provides implications for the relationship between political stability, the size of governments, and the composition of public spending. The degree of political stability is closely related to the variable ξ. Political turnover is highest when $\xi = 0$, since each party's probability of winning an election equals 0.5. As B's advantage increases, power switches become more infrequent, and political stability goes up. The size of governments is usually measured as the ratio of total government expenditures to GDP in the empirical literature, which given our assumptions equals

$$\frac{e_i}{y} = \frac{1}{2}(1 + s_i).$$

The long-run average of this variable is just $E(e/y) = p_A e_A + p_B e_B$, and can be shown to be increasing in ξ following steps similar to those in Appendix A.4 (proof available upon request). Hence, the model predicts that states (or countries) with larger political advantage—and low political turnover—should exhibit overall larger governments. Finally, long-run public consumption as a fraction of output is decreasing in this variable, since $E(\frac{x(g)}{y}) = \frac{1}{2} - E(e/y)$. More concisely, as the advantage of B increases, a larger percentage of expenditures is devoted to productive investment and away from public consumption. This implies the following:

Lemma 4.5. *The long-run share of public investment to output increases with political advantage, while the share of public consumption decreases with it*

$$\frac{\partial E(\frac{K_g}{Y})}{\partial \xi} > 0 \quad \textit{and} \quad \frac{\partial E(\frac{x(g)}{Y})}{\partial \xi} < 0.$$

Additionally, the long-run share of public investment to total spending also increases with political advantage, while the share of public consumption decreases with it.

The volatility of political and economic variables can be shown to be non-monotonic in the electoral advantage ξ.

Proposition 4.3. *There exists a unique value ξ^* such that $\forall \xi < \xi^*$ we have $\frac{\partial Var(\hat{K}_g)}{\partial \xi} > 0$ and $\forall \xi > \xi^*$ we have $\frac{\partial Var(\hat{K}_g)}{\partial \xi} < 0$.*

Proof. See Appendix A.5. □

The reason is that there are two opposing forces driving these volatilities. One is given by the gap between each party's propensities to save, which increases the volatility of policy and allocations. The other force is political stability, which reduces it. When $\xi = 0$, both parties are completely symmetric. Even though political turnover reaches its maximum value (with $p_A = p_B = 0.5$), the gap is zero (since $s_A = s_B$). So there are no fluctuations in policy or economic variables, and $\sigma^2(\xi) = 0$, implying $Var(\hat{K}_g) = 0$. As ξ increases, the marginal propensity to invest of type A falls below the symmetric level, while that of type B lies above that value. Hence, the gap in the marginal propensities to invest is widened and volatility rises. For small deviations from symmetry, this effect dominates that of political stability. Eventually, ξ becomes large enough that even though the gap between s_A and s_B is large, political turnover is very infrequent. Since B is in power

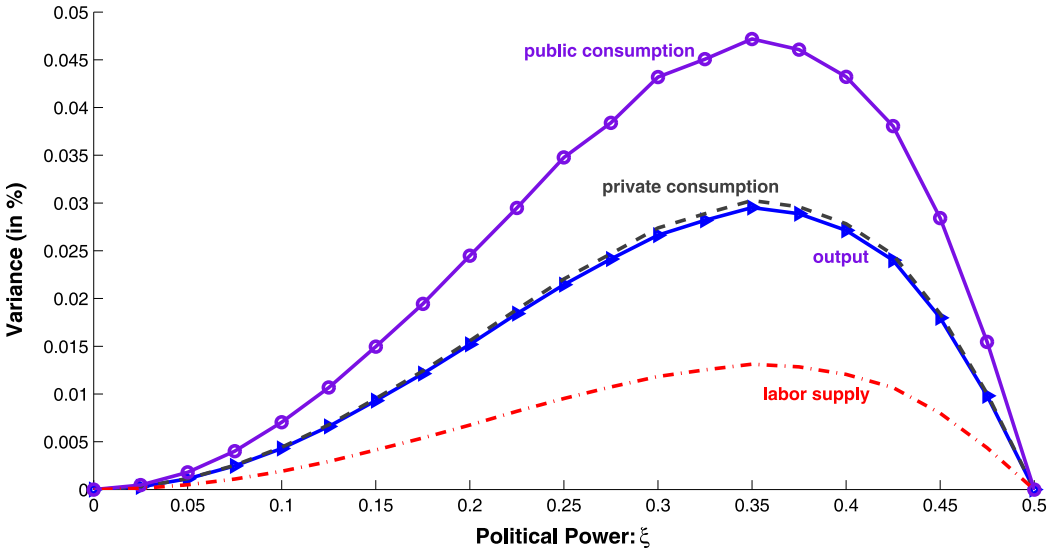

Fig. 4. Volatility of policy and allocations, measured by the variance of log-variables.

most of the time, policy remains stable and volatility goes down. At an extreme, when $\xi = 0.5$ party B wins elections with probability one. So there is no variability in policy or allocations. We can see this graphically in Fig. 4.

As shown in Lemma 4.3, output is more volatile than labor but exhibits less volatility than public and private consumption. The variance of public investment is much larger than that of all other variables because the estimated elasticity of public capital is quite small in this example ($\theta = 0.039$). Therefore, it has been omitted to make the figure more readable.

This result provides a testable implication of the model. States (or countries) in which parties are very symmetric (i.e., where electoral advantage is negligible) should exhibit frequent turnover but low volatility in policy variables. We should also expect low variability in states (or countries) where turnover is infrequent due to large values of ξ. Fluctuations should be greatest for states with intermediate levels of electoral advantage.

5. Application: electoral advantage in US states

The objective of this section is to contrast relevant implications of the model with their empirical counterparts. We want to assess whether the effects of partisan advantage on fiscal policy and allocations are consistent with the theory developed in previous sections.

The unit of analysis is a state. US states provide an ideal sample, since they share the same institutional features (as well as aggregate economic conditions), but are heterogeneous in terms of their citizens' political preferences. In addition, most states are subject to balanced budget rules, as assumed in the theoretical analysis.[12] The analysis proceeds in two ways. One takes advantage of the variation in electoral outcomes over time and the composition of spending within US states, using panel data analysis. The other one emphasizes how the cross-sectional variation in electoral advantage across states affects first and second moments of government policy in the long-run. The sample consists of 47 states (Alaska, Hawaii, and DC are excluded due to data unavailability. Nebraska has a nonpartisan unicameral legislature). Even though state finance data are consistently available since 1950, the sample is restricted to the period 1970–2011. The reason is that the pool of voters changed significantly following the 1965 Voting Rights Act. Prior to this act, otherwise qualified voters were required to pass a literacy test, which had prevented African Americans from exercising the franchise in southern states. Measures of incumbency advantage changed significantly in these states, and so did the mix of policies implemented. Because we are interested in analyzing the effects of partisan advantage on policy variables in the steady state (e.g., given a fixed constituency), our sample excludes this period.

Political data Electoral advantage ξ is proxied by the average margin of victory of the winning party in state legislatures, also referred to as 'party strength'. It measures the degree to which a given party dominates electoral politics in a particular state.[13] Let $sh_{jt}(i) = \frac{i_{jt}}{D_{jt}+R_{jt}}$ denote the share of seats obtained by party $i \in \{R, D\}$ in the upper and lower houses of the

[12] Some states do have 'rainy day funds' and/or special capital accounts used to finance certain investment projects, which we have abstracted from in the theoretical analysis. See Bassetto and McGranahan (2011) for a description.

[13] See Brown and Bruce (2002) for a measure that also includes results from national and gubernatorial elections. Ansolabehere and Snyder (2002) construct a measure similar to ours, but using election results for a broader set of state and locally elected executive officers. We will also use their measure as a robustness check in the analysis.

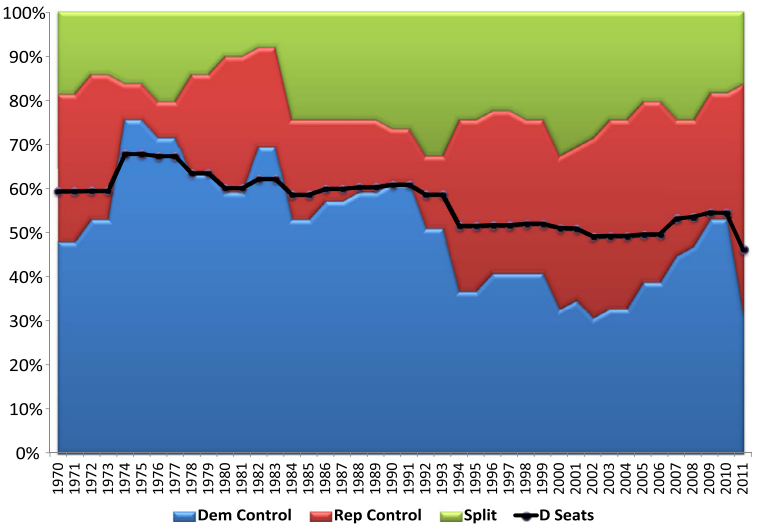

Fig. 5. The persistence of partisan advantage. (For interpretation of the references to color in this figure, the reader is referred to the web version of this article.)

legislature of state j in year t. While state budgets are decided upon every year, elections are held every other year, so the share of seats held by each party is only available on a bi-annual frequency. Appendix A.6.1 provides a detailed description of how annual observations are generated, together with the data sources.

The solid line in Fig. 5 represents the share of seats controlled by the Democratic party in both houses in the state legislature over time. Clearly, Democrats enjoyed a persistent political advantage over the Republican party, since they controlled more than 50% of the seats for most of our sample. The surface closer to the figure's origin (i.e., the blue shaded area) measures the percentage of states under D control in both houses (i.e., those where the share is larger than 0.5), while the medium surface (red area) is the equivalent measure for party R.

'Split' denotes the percentage of states under a divided government (i.e., where each party controls only one house, represented by the green upper surface in the graph). While the number of states under a divided government has increased between 1980 and 2000, its proportion is relatively small for most of the sample. Therefore, I will focus on the average share of seats in both houses for the reminder of the analysis.

Following the political science literature, party strength PS in state j at year t is defined as

$$PS_{jt} = \left|sh_{jt}(D) - sh_{jt}(R)\right|,$$

that is, as the margin of victory of the winning party in state elections. The average value of this variable over the sample period, PS_j, is the empirical counterpart of $|p_A - p_B|$ in the model. Using the definition of p_i derived in the theoretical section of the paper, electoral advantage ξ_j can thus be proxied by $\frac{1}{2}PS_j$.

Electoral advantage per state is depicted in Fig. 6. Blue states denote parties where Democrats enjoyed an electoral advantage (i.e., $sh_j(D) > sh_j(R)$), and red states correspond to Republican ones (i.e., $sh_j(D) < sh_j(R)$, numbers in parenthesis). Clearly, some states exhibited a large electoral advantage over our sample period, such as Arkansas where ξ averaged 0.36 (recall that the maximum value ξ can take is 0.5). We can also observe a large degree of heterogeneity in the sample, since the standard deviation of ξ_j is 0.09, while its mean is 0.16. This evidence suggests that electoral advantage—in a given state—is sizable and persistent, as assumed in the theoretical model.

Economic data Gross state product (GSP) is obtained from the National Economic Accounts at the Bureau of Economic Analysis (BEA). Fiscal data and population per state come from the Bureau of the Census (BOC), historical series. Public investment corresponds to 'total capital outlays' in the Census data. There is no readily available measure of pork-barrel spending in the data, but the previous literature has proxied it using inter-governmental transfers (Primo and Snyder, 2008). The idea is the following: the legislature is composed of a group of representatives who belong to one of the two dominant parties and would like to target transfers to their own localities. Assuming that pork-barrel expenditures are distributed evenly among members of the incumbent party, the predictions of the benchmark model apply even if there are more than two regions in a given state (as long as certain localities identify with one of the two parties, so they are the recipients of targeted transfers). To the extent that parties are less short-sighted (due to persistent electoral advantage), they substitute away from targeted spending into growth-promoting investment. At the state level, this should lead to lower levels of aid to local governments (targeted transfers) used to finance local goods. 'State inter-governmental transfers to local governments' is therefore our proxy for targeted spending. Finally, total government spending corresponds to 'total state government expenditure.' Personal income is used as a control variable in some specifications. All variables are per-capita and measured in 2000 constant dollars (using the GDP deflator).

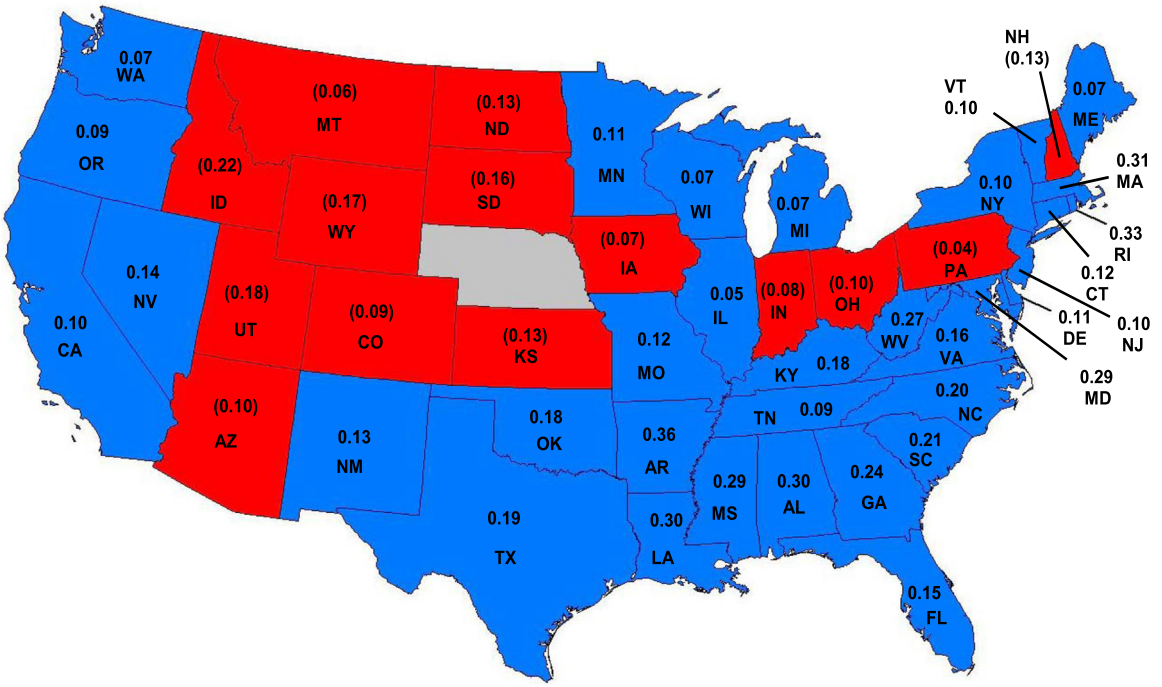

Fig. 6. Electoral advantage (Republican in parenthesis). (For interpretation of the references to color in this figure, the reader is referred to the web version of this article.)

Table 1
Targeted spending and public investment shares.

Variable	Average	St. dev.	Min	Max
As percentage of state output:				
Total spending/GSP	11.33	2.73	5.26	23.34
Investment/GSP	1.04	0.44	0.30	3.71
Targeted/GSP	2.98	0.91	0.62	6.34
As percentage of total spending:				
Investment/Total spend.	9.44	3.94	2.75	29.92
Targeted/Total spend.	26.72	6.84	6.86	54.02

Notes: Sample period 1970–2011 for all variables.

State governments spend on average 11% of GSP on consumption, operations, and investment per year, as seen in Table 1 (Total Spending/GSP). Around 9% of this amount corresponds to public investment, whose share of GSP is approximately 1%. Targeted spending represents almost 27% of total spending, and in some states as much as 54%. This proxy for pork-barrel spending includes several items that are not susceptible to political shifts (such as welfare programs, which are determined by well-defined formulas or spending that would affect investment at the local level). Unfortunately it is not possible to perfectly separate these from politically driven targeted transfers in the Census data set. The effects of electoral advantage on targeted spending are therefore going to represent a lower bound.[14]

5.1. Power switches and short-sighted behavior: event analysis

An empirical implication of the theoretical model is that parties that do not enjoy an electoral advantage will behave more short-sightedly when they win an election. As a result, we should observe an immediate increase in the targeted spending share of total state government spending, together with a decrease in the public investment share of total spending when a historically disadvantaged party gains control of the legislature. I will test this hypothesis next.

A power switch is defined as an event where a majority of seats in both houses of a state legislature is gained by a party with a historical electoral disadvantage. That is, when the *average* share of seats obtained by the disadvantaged party

[14] It would be possible to subtract some intergovernmental transfers which are specific to welfare programs or directed to school districts. This reduces the average ratio of targeted spending to total spending by about half. The qualitative results are similar to the ones presented in the paper, but we do lose observations, as the available series is shorter. Details available upon request.

becomes greater than 50% in both houses. Alternatively, we could define a switch as an event where a party gains full control in both houses. This is a stricter criterion than the one we use because it implies that a share of seats greater than 50% in *each* house would be required to record an event. Unfortunately, under this alternative definition there would be too few events to conduct the analysis. Hence, we restrict attention to events where the party wins a majority of seats on average, if: (i) it has a historical disadvantage and (ii) it held less than 50% of the seats in the previous year. For example, an event is recorded if, after a particular election, the Republican party wins a majority of seats in both houses in Arkansas, a historically Democratic state (recall that $\xi_{AK} = 0.36$, from Fig. 6). The dummy variable *Switch* takes a value of 1 when such an event occurs, and 0 otherwise. We have identified 51 events in our sample where a switch occurs.[15]

Our event study documents the behavior of targeted spending and investment, as percentages of total state government expenditures, in a six-year window around an event (two periods before the switch and four periods after the event, to account for potential implementation delays). The timing is important for this analysis, because elections are held in a particular year but elected legislators only decide on the budget in the subsequent calendar year. To take this into account, we have shifted political election data one year forward in time to match the actual legislative terms served by state legislators (see Appendix A.6.1 for more details on this). Because states are heterogeneous in size, development, and preferences, we normalize each policy measure by the average value per state. In other words, we define

$$\Delta P_{j,t} = \frac{P_{j,t} - \bar{P}_j}{\bar{P}_j},$$

where t denotes the year and j the state, P refers to government policy: either targeted spending as a share of total state government expenditures or investment as a share of total state government expenditures, and $\bar{P}_j$ denotes the average value of the policy variable in state j over the sample period 1970–2011.

To account for these possibilities, I estimated a fixed effects regression where the dependent variable is $\Delta P_{j,t}$, and the independent variables are six dichotomic variables defining the event window. As before, $Switch_{jt}$ takes a value of 1 if a historically disadvantaged party in state j takes power in period t and zero otherwise. The past lags $Switch_{jt} - 1$ and $Switch_{jt} - 2$ take a value of 1 if the event occurred 1 and 2 years before, respectively, and zero otherwise. The forward lags $Switch_{jt} + 1$, $Switch_{jt} + 2$, $Switch_{jt} + 3$, and $Switch_{jt} + 4$ are defined analogously. Year and state fixed effects are included as additional controls. These variables' estimated coefficients capture the average response of policy to a switch before or after the event occurs for policy variable P. Therefore, they represent the counterpart to the values presented in Fig. 6, but after controlling for the year effects and state characteristics.

Table 2 summarizes the main findings. In the first three models, P corresponds to the share of investment to total spending, while the last three models are computed using targeted spending instead. Models (1) and (4) only include two periods after a switch, and the remaining ones consider the whole six-year window. Consistent with the theoretical predictions, a historically disadvantaged party chooses a lower share of investment to total state expenditure—between 4% and 6% below the state average—during its first year in power. These values are significant at the 5% level, even after fixed effects are considered. Notice that standard errors are robust to heteroskedasticity and clustered at the state level in all specifications. Past and future lags are statistically insignificant, indicating that the largest effect on investment is produced upon impact. Specification (3) also considers the Divided dummy variable, which takes a value of 1 if houses are Split (as defined previously). While this variable is statistically insignificant, including it increases the effect of a switch on investment shares.

The behavior of targeted spending is also consistent with the model: a disadvantaged party chooses to increase the share of targeted spending in total expenditures when it enjoys a majority in the legislature. The average impact of a switch results in a 3% to 5% increase above the average share for that state. This result is still significant, but only at the 10% level. Forward lags are statistically significant in this case, indicating that targeted spending is larger than average throughout the term, but as the coefficients indicate, at a decreasing rate. As in the case of investment, the Divided dummy has the expected sign: it attenuates the incumbent's myopia. The coefficient is, however, statistically insignificant.

Finally notice that the explanatory power for investment shares is much larger than for targeted spending shares. This could result from the fact that the latter measure includes not only pork-barrel spending but also some automatic stabilizers.

5.2. Composition of fiscal policy and electoral advantage

Lemma 4.5 is one of the most important results for cross-state comparisons. While the ranking of volatilities could be caused by other factors (such as productivity shocks), the long-run relationship between fiscal variables and persistent electoral advantage is a distinctive prediction of this model. According to Lemma 4.5, the long-run share of public investment to total spending is increasing in party advantage, while the share of targeted spending is decreasing in it. The intuition is that as the advantage of a party increases, its likelihood of staying in power goes up. This reduces the short-sightedness induced by re-election uncertainty, shifting expenditures away from targeted spending and into investment.

[15] This is conditional on having enough observations to construct a window around the event. Hence, events that occur very early in the sample (in 1970 or 1971) or near the end of it (post-2008) are excluded by construction.

Table 2
Power switches and the composition of spending.

	Δ Investment share			Δ Targeted share		
	(1)	(2)	(3)	(4)	(5)	(6)
Switch −2		−2.523	−2.991		0.773	1.288
		(2.571)	(2.682)		(2.005)	(2.080)
Switch −1		−2.551	−3.077		2.002	2.581
		(2.918)	(2.995)		(2.344)	(2.386)
Switch	−4.437**	−4.751**	−5.623**	3.464*	3.729*	4.690*
	(2.100)	(2.266)	(2.416)	(1.963)	(2.206)	(2.441)
Switch +1	−2.904	−3.283	−3.999	3.368*	3.762*	4.551*
	(2.740)	(2.857)	(2.947)	(1.946)	(2.230)	(2.412)
Switch +2	0.285	−0.0467	−0.499	2.775	3.148	3.647*
	(2.465)	(2.564)	(2.634)	(1.706)	(1.928)	(2.010)
Switch +3		−1.197	−1.687		2.541	3.081
		(2.408)	(2.415)		(1.928)	(1.999)
Switch +4		−2.979	−3.217		3.382	3.645*
		(2.442)	(2.443)		(2.091)	(2.145)
Divided			1.990			−2.192
			(1.806)			(1.860)
Observations	1958	1958	1958	1958	1958	1958
R-squared	0.716	0.717	0.717	0.177	0.180	0.183

Notes: All regressions include year and state fixed effects as additional control variables. The dependent variables and the Switch independent variables are described in the main text. Switch $\pm t$ is a dummy variable that takes a value of 1 t periods after (or before) the Switch event. Divided is a dummy variable equal to 1 in periods where the legislature is Split (that is, no party has an absolute majority in each state legislature's house).

Standard errors are robust against heteroskedasticity and clustered at the state level. They are reported in parentheses.

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

To examine this empirically, I estimate regressions of the form

$$\ln \bar{R}_j = \alpha + \beta \xi_j + X_j + \epsilon_j$$

where $\bar{R}_j$ is a measure of policy in state j, ξ_j is the per state average electoral advantage, and X_j is a set of controls. I consider two different measures for R: (i) public investment as a percentage of total state government expenditures and (ii) the share of targeted spending on total state government expenditures. Recall that investment corresponds to total capital outlays and pork is proxied by state inter-governmental transfers to local governments. Because the theoretical predictions refer to long-run outcomes, the dependent variable is averaged out over time for each state in the sample. The results under different specifications are summarized in Table 3.[16]

The first column of Table 3 presents the estimated coefficient of a simple linear regression of the (natural logarithm of) average public investment as a share of total spending on average electoral advantage ξ_j, ignoring other control variables. Consistent with the lemma, the coefficient of ξ_j is positive and significant at the 5% level (using robust standard errors).

The model in column (2) controls for regional effects, average state's personal income, and political preferences. Intuitively, we would expect a lower percentage of total expenditures to be devoted, on average, to public infrastructure in more developed (e.g., richer) states. The coefficient of *income*, the natural logarithm of average state per capita personal income, is indeed negative, but statistically insignificant. Political preferences are captured by a dummy variable, *democrats*, which equals 1 if the state has been, on average, under democratic control in both houses. We find that states that have been under Democratic control exhibit lower ratios of investment to total public spending than those under Republican control (or under divided governments). The variable is significant at the 1% level. The theoretical model assumed away any differences in preferences over public investment (other than those endogenously derived from differences in electoral advantage). The results from this empirical exercise suggest that an interesting extension to the theoretical model should include both types of heterogeneity: in electoral advantage and political preferences. Finally, changes observed in the political arena in southern states could also be related to other socio-economic changes in the region, which could affect the interaction between partisan advantage and investment shares. To account for this, I included an interaction between the *South* indicator and partisan advantage ξ_j. The coefficient is negative and statistically significant, indicating that the effect of partisan advantage is weaker in southern states relative to the rest of the country.

Besley et al. (2010) find that the share of public investment on government expenditures decreases with partisan advantage for a panel of US states. There are two reasons why our results differ. The first one is that I am focusing on long-run

[16] I could alternatively use $\bar{R}_j$ as a dependent variable instead of the natural logarithm of the ratio. The results are qualitatively the same in terms of the coefficient signs and significance. Details are available upon request.

Table 3
Electoral advantage and government policy, benchmark model.

Averages	Share of total spending				Share of GSP		
	Investment			Targeted	Investment		Targeted
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ξ_j	0.819**	1.381**		−1.119*	1.455**		−1.098**
	(0.399)	(0.634)		(0.556)	(0.616)		(0.536)
Income		−0.257	−0.230	0.502*	−1.067***	−0.999***	−0.360
		(0.256)	(0.280)	(0.273)	(0.317)	(0.337)	(0.293)
Democrats		−0.215***	−0.261***	0.0465	−0.210**	−0.238***	0.0469
		(0.0741)	(0.0737)	(0.0838)	(0.0799)	(0.0787)	(0.102)
South x ξ_j		−1.782**		1.717**	−1.289		2.285***
		(0.723)		(0.789)	(0.844)		(0.717)
ξ_j-AS			3.668**			4.869**	
			(1.695)			(2.164)	
South x ξ_j-AS			−3.474*			−4.044	
			(1.873)			(2.620)	
Observations	47	47	47	47	47	47	47
R-squared	0.076	0.403	0.457	0.379	0.474	0.520	0.267

Notes: All regressions include regional dummies (following the Census definition). Each observation represents a simple average per state over the sample period 1970–2011. The measure of infrastructure spending is the natural logarithm of 'total capital outlays' as a percentage of total state government spending. The measure for targeted spending in specifications (4) and (8) is the natural logarithm of 'state inter-governmental transfers to local governments' as a percentage of total state government spending and GSP, respectively. Personal income is also measured in logs. Democrats represent a majority in the House and Senate, on average, over the sample period. ξ_j represents the benchmark measure, and ξ_j-AS the Ansolabehere and Snyder (2002) measure of electoral advantage.

Standard errors are robust against heteroskedasticity and reported in parentheses.

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

outcomes by using average values per state in the regressions, rather than period-by-period observations. This makes sense because partisan advantage is constant in my model and I do not have a theoretical implication regarding the relationship between policy and partisan advantage, when the latter changes over time. The second, and most important reason, is that their sample starts in 1950 rather than in 1970. Measures of partisan advantage changed significantly in southern states following the 1965 Voting Rights Act, and so did the mix of policies implemented. The identification in Besley et al. (2010) comes mostly from changes observed between 1965 and 1972, since political competition remains fairly stable afterwards. Re-computing their fixed-effects regression (Table 2, p. 1341, column 4 of their paper) for the sample period 1970–2001 delivers a statistically insignificant relationship between public investment (as a percentage of government spending) and current political competition (e.g., the negative of partisan advantage). This can be seen in Table 5, Appendix A.6.2, which first replicates their original computations and then presents regression outcomes for alternative sample periods.[17]

This is not inconsistent with my model, since all the predictions arise from *expected* long-run electoral advantage. Because I am interested in analyzing the effects of partisan advantage on political instability in the steady state (e.g., given a fixed constituency), my sample excludes the period 1950–1969 and considers average values to proxy long-run outcomes.

One can ask whether the results of specification (2) are robust to using alternative measures of partisan advantage. Column (3) of Table 3 re-estimates the model using the measure constructed by Ansolabehere and Snyder (2002, AS). Their measure, used by Besley et al. (2010) and Bassetto and McGranahan (2011), includes election results for a broader set of state and locally elected executive officers (like governor, secretary of state, attorney general, etc.). The variable is also measured between 0 and 0.5, and higher values of ξ_j-AS represent a larger electoral advantage. The sample period is shorter due to data availability, 1970–2001, but the results are qualitatively similar to the ones in our benchmark case (column 2).

Specification (4) tests whether the average percentage of targeted spending on total public spending decreases with electoral advantage. We see that the coefficient of ξ_j is indeed negative and statistically significant, but at the 10% level. Interestingly, the introduction of the Democrat variable does not improve the fit of the model: we cannot reject the hypothesis that its coefficient is zero. This implies that the choice of targeted transfers is, beyond electoral advantage, independent of the identity of the party in power. For robustness, the same regressions were computed using as dependent variables the natural logarithm of the shares of public investment and targeted spending to GSP. The results are quantitatively larger for public investment, columns (5) and (6), and basically the same for targeted transfers.[18]

[17] Bassetto and McGranahan (2011) also find, for yet a different specification and sample starting in 1970, that the coefficient of political competition on public investment is statistically insignificant using state-level data.

[18] Using Ansolabehere and Snyder's (2002, AS) measure in specifications (4) and (7) delivers a statistically insignificant relationship between our measure of targeted spending and their measure of electoral advantage. This could be due to the fact that the sample period is shorter, since the AS-measure is only available until 2001.

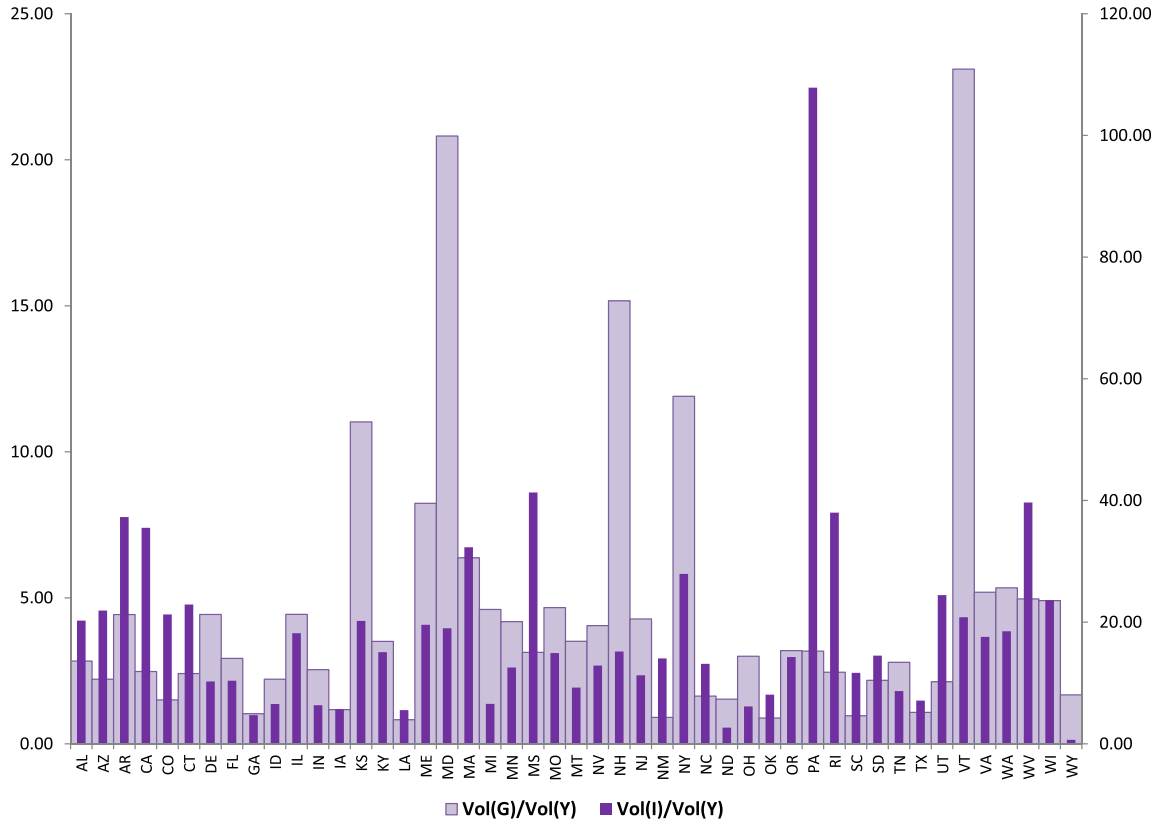

Fig. 7. Standard deviation of GSP and G during the medium term cycle, per state.

5.3. Variance and electoral advantage

According to the model, the volatility of government policy and economic outcomes is also affected by partisan advantage. In this section, we want to study this second moment for our variables of interest and relate it to our empirical measure of electoral advantage. Because most of the individual series are non-stationary, the logged data will be linearly de-trended, allowing for states to have different trends.[19]

Fig. 7 depicts the ratio between the volatility of targeted spending and the volatility of GSP for each state in our sample (lighter bars) together with the relative volatility of public investment to output volatility. Consistent with Lemma 4.3, the volatility of targeted spending is larger than the volatility of output for most states in our sample (exceptions are New Mexico, Oklahoma, and South Carolina). Public investment is more volatile than output for every state with the exception of Wyoming.

The non-monotonicity in the volatility of variables as electoral advantage increases, shown in Lemma 4.3, is another distinctive prediction of this model. To examine this empirically, I estimate regressions of the form

$$Var(\bar{Y}_j) = \alpha + \beta\xi_j + \gamma\xi_j^2 + X_j + \epsilon_j$$

where j denotes the state, and $Var(\bar{Y}_j)$ refers to the variance of either the natural logarithm of detrended public investment or targeted spending per state, averaged out over the sample period 1970–2011. The variable ξ_j stands for electoral advantage and ξ_j^2 represents a quadratic term. Political preferences, as in the previous section are proxied by *Democrats*, and the *South* dummy variable is included to account for regional differences.

The regression outcomes for each dependent variable in the benchmark specification are summarized in Table 4. Reported standard errors are robust to control for heteroskedasticity. The coefficients of the linear and quadratic terms of electoral advantage are significant at the 1% level, implying an inverted U-shaped relation with public investment (second column) and targeted transfers (third column). The average value of the variance of targeted transfers in the sample is 0.013, implying that the variance doubles at peak (e.g., when electoral advantage is about 0.22). The average value of the variance of investment in the sample is 0.048, indicating that the effect of electoral advantage on the volatility of investment is slightly

[19] In the previous section this step was unnecessary because we were mostly working with ratios, which are stationary under a balanced growth path.

Table 4
Non-monotonicity of variances.

Dependent variables in Ln and detrended	Var(Investment) (1)	Var(Targeted) (2)
ξ_j	0.471***	0.235***
	(0.0932)	(0.0685)
ξ_j^2	−0.800***	−0.530***
	(0.268)	(0.169)
Democrats	0.0124	−0.00740
	(0.00898)	(0.00530)
South	−0.0284***	−0.00691**
	(0.00932)	(0.00329)
Observations	47	47
R-squared	0.693	0.483

Notes: All specifications include a South dummy as an additional control variable. The dependent variables are the per state variances over the sample period of the natural logarithm of public investment and targeted spending (linearly detrended), respectively. Electoral advantage is the simple average per state of the benchmark variable. The sample period is 1970–2011.

Standard errors, reported in parentheses, are robust against heteroskedasticity.

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

smaller but still important. This simple model explains around 69% of the variability public investment and about 48% of the variability of pork spending.[20]

6. Concluding remarks

I presented a model in which disagreements about the composition of spending results in implementation of endogenous short-sighted policies by the government: Investment in infrastructure is too low, while spending on public goods is too high. 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, strategic manipulation of the level of investment is optimal.

I considered a case in which one of the groups enjoys an advantage in the political arena, captured by a higher probability of being in power. As a result, the politico-economic equilibrium is asymmetric and public investment is not only inefficiently low but it also fluctuates. The group with the advantage wins elections more often, becoming less impatient. Therefore, it chooses a share of investment to output closer to the first best. Even though both groups have symmetric preferences over the size of spending and investment, in equilibrium the group with the disadvantage tends to spend more and invest less. Since different policies are implemented as parties alternate in power, the political cycle is propagated throughout the real economy. In equilibrium, macroeconomic variables fluctuate even in the absence of economic shocks. Moreover, consumption, employment, and output are distorted despite the fact that the government has access to lump-sum taxation. Increases in electoral advantage induce increases in the share of public investment to total expenditures by the advantaged party. Finally, volatility is non-monotonic in the degree of electoral advantage. Economies with intermediate values of this variable are expected to exhibit the largest volatility in fiscal and economic variables.

I test the main hypotheses of this model using data from US states over the period 1970–2011. I document persistent electoral advantage in US state legislatures. I find evidence of a larger than average share of target spending to total state government expenditures, and a lower-than-average share of public investment to total state government expenditures when a historically disadvantaged party gains a majority of seats in state elections. I also show that there is a negative relationship between long-run targeted spending shares and party advantage, and a positive relationship between long-run public investment shares and the political bias. Finally, I present evidence of an inverted U-shaped relationship between electoral advantage and the volatility of (detrended) GSP, public investment, and government consumption.

This paper abstracts from several important dimensions related to public investment that would be interesting to incorporate in future research. One of them is private savings. By distorting production through public capital, the government would introduce a wedge in private investment decisions. This would act similarly to distortionary taxation on capital income. Another interesting extension would be to relax the balanced budget assumption. States are unable to issue debt to finance discretionary expenditures, but they are allowed to borrow to finance some public investment projects. Debt would make these investments cheaper from the standpoint of an incumbent and could potentially decrease the inefficiencies highlighted in this paper. Finally, analyzing the case where agents disagree on public investment rather than on public spending could complement the analysis.

[20] These results do not depend on the introduction of the regional dummy. The R-squared in specification (1) is 0.66 when South is excluded, while it is 0.46 when South is excluded from specification (2).

Table 5
Dependent variable: investment/total spending.

Sample	1950–2001 (1)	1966–2001 (2)	1970–2001 (3)
Political competition	4.975***	1.085	1.050
	(1.651)	(1.606)	(1.340)
Observations	2496	1728	1536
R-squared	0.836	0.860	0.803

Note: All regressions include state and year fixed-effects as additional control variables. The measure of public investment is total capital outlays as a percentage of total state government expenditures. Standard errors are in parenthesis, are robust against heteroskedasticity, and are adjusted for clustering at the state level. Significance:
* $p < 0.1$,
** $p < 0.05$,
*** $p < 0.01$.

Appendix A

A.1. Proof of Proposition 4.1

Lemma A.1. *The government Euler equation (GEE) can be written as*

$$u_1\big(c_B(K_g), n_B(K_g)\big) = \beta\Bigg\{\sum_{i=A,B} p_i u_1\big(c_i(K'_g), n_i(K'_g)\big) F_1\big(K'_g, n_i(K'_g)\big) - p_A x_g\big(g_A(K'_g)\big) g_{A1}(K'_g) u_1\big(c_A(K'_g), n_A(K'_g)\big) - h_{A1}(K'_g) p_A\big[u_1\big(c_A(K'_g), n_A(K'_g)\big) - u_c\big(c_B(\tilde{K'_g}), n_B(\tilde{K'_g})\big)\big]\Bigg\}. \tag{17}$$

Proof. The FOC with respect to K'_g satisfies Eq. (11). Denote the rule that solves this functional equation by $h_B(K_g) \equiv K_B$. Define $h_A(K_g) \equiv K_A$ analogously.

Focus on the problem of party B (and abstract from the subindexes in its value function). Obtain $V_1(K_g)$ by differentiating Eq. (8) and simplifying:

$$V_1(K_g) = u_1\big(c_B(K_g), n_B(K_g)\big) F_1\big(K_g, n_B(K_g)\big). \tag{18}$$

To find $W_1(K_g)$ differentiate Eq. (9):

$$W_1(K_g) = u_1\big(c_A(K_g), n_A(K_g)\big) c_{A1}(K_g) + \beta h_{A1}(K_g)\big\{p_B V_1(K_A) + p_A W_1(K_A)\big\}, \tag{19}$$

where $c_{A1}(K_g) = F_1(K_g, n_A(K_g)) - x_g(g_A(K_g)) g_{A1}(K_g) - h_{A1}(K_g)$. Notice that allocations are evaluated given party A's policy, because we are considering the value function of a type B agent when his group is out of power.

Use Eq. (11) to solve for $W_1(h_B(K_g))$:

$$W_1(K_B) = \frac{1}{p_A}\left\{\frac{1}{\beta} u_1\big(c_B(K_g), n_B(K_g)\big) - p_B V_1(K_B)\right\} \tag{20}$$

In order to replace the equation above in Eq. (19) we need the value function to be evaluated in the investment choice of government A, $W_1(K_A)$. Assuming that the functions h_i are invertible, we can achieve this by evaluating Eq. (20) at $\tilde{K_g} = h_B^{-1}(h_A(K_g))$,

$$W_1(K_A) = \frac{1}{p_A}\left\{\frac{1}{\beta} u_c\big(c_B(\tilde{K}_g), n_B(\tilde{K}_g)\big) - p_B V_1(K_A)\right\} \tag{21}$$

Replace Eq. (21) into Eq. (19) and simplify:

$$W_1(K_g) = u_1\big(c_A(K_g), n_A(K_g)\big)\big[F_1\big(K_g, n_A(K_g)\big) - x_g\big(g_A(K_g)\big) g_{A1}(K_g)\big] - h_{A1}(K_g)\big[u_1\big(c_A(K_g), n_A(K_g)\big) - u_1\big(c_B(\tilde{K}_g), n_B(\tilde{K}_g)\big)\big]. \tag{22}$$

Update Eq. (22) by substituting K_g with $K'_g = h_B(K_g)$ and replace in Eq. (11). After some manipulations, we obtain Eq. (17). □

Guess a constant investment share $h_i(K_g) = s_i\tilde{A}K_g^{\bar{\theta}}$. Eq. (10) implies:

$$g_B(K_g) = \hat{c}_B(K_g) = \frac{1}{2}(1-s_B)\tilde{A}K_g^{\bar{\theta}},$$

with $\hat{c}_B(K_g) = c_B(K_g) - \frac{n_B(K_g)^{1+\epsilon}}{1+\epsilon}$. Eq. (17) simplifies to:

$$\frac{1}{\hat{c}_B(K_g)} = \beta\Bigg\{p_B\frac{f_K(K_g')}{\hat{c}_B(K_g')} + (1-p_B)\frac{[f_K(K_g') - g_{AK}(K_g)]}{\hat{c}_A(K_g')} + (1-p_B)h_{AK}(K_g')\left[-\frac{1}{\hat{c}_A(K_g')} + \frac{1}{\tilde{c}_B(K_g')}\right]\Bigg\},$$

where $K_g' = h_B(K_g) = s_B\tilde{A}K_g^{\bar{\theta}}$ and $\tilde{c}_B(K_g') = \frac{1}{2}\frac{1-s_B}{s_B}s_A\tilde{A}K_g'^{\bar{\theta}}$.

Replacing the guess into the equation above and simplifying,

$$s_B = \frac{\beta\bar{\theta}(1+p_B)}{2-\beta\bar{\theta}(1-p_B)}. \tag{23}$$

A.2. Proof of Proposition 4.2

Let $N = [K_{gA}^{ss}, K_{gB}^{ss}]$ define the ergodic set. We will prove the proposition in two steps: first, by showing that any sequence starting outside of the set necessarily converges to a point inside the set; second, by showing that any sequence starting inside N necessarily stays in N.

Step 1. Let $0 < K_{g0} < K_{gA}^{ss}$. Define the sets $M_i = [0, K_{gi}^{ss}]$ and $Q_i = [K_{gi}^{ss}, \infty) \Rightarrow \forall K_g \in int(M_i)$, $h_i'(K_g) > 1$ and $\forall K_g \in int(Q_i)$, $h_i'(K_g) < 1$. Let $K_g \in M_A \cap M_B \equiv M$, then we know that $K_g' > h_i(K_g)$ from Lemma 4.1 for $i \in \{A, B\}$. Hence, if $K_{g0} \in M$ the sequence $\{K_{gt}\}_t$ is increasing. Moreover, $\exists T < \infty$ such that $K_{gT} > K_{gA}^{ss}$. Suppose not. Since M is bounded and $\{K_{gt}\}_t$ is increasing, then the series must converge to the upper bound K_{gA}^{ss}. But $h_B(K_{gA}^{ss}) > K_{gA}^{ss}$ from Lemma 4.1 and the fact that $s_B > s_A$. Contradiction.

Now let $K_g \in Q_A \cap Q_B \equiv Q$, then we know that $K_g' < h_i(K_g)$ from Lemma 4.1 for $i \in \{A, B\}$. Hence, if $K_{g0} \in Q$ the sequence $\{K_{gt}\}_t$ is decreasing. Moreover, $\exists T' < \infty$ such that $K_{gT'} < K_{gB}^{ss}$. Suppose not. Since Q is bounded below and $\{K_{gt}\}_t$ is decreasing, then the series must converge to the lower bound K_{gB}^{ss}. But $h_A(K_{gB}^{ss}) > K_{gB}^{ss}$ from Lemma 4.1 and the fact that $s_B > s_A$. Contradiction.

Step 2. Let $K_{gt} \in N$, then there are two possibilities. Either $i = A$, in which case $K_{gt+1} = h_A(K_{gt}) \geq K_{gA}^{ss}$ from Lemma 4.1, so $K_{gt+1} \in N$. Alternatively, if $i = B$, then $K_{gt+1} = h_B(K_{gt}) \leq K_{gB}^{ss}$ from Lemma 4.1, so $K_{gt+1} \in N$.

A.3. Proof of Lemma 4.3

Since $\hat{y}_t = \log\tilde{A} + \bar{\theta}\hat{K}_{gt} \Rightarrow Var(\hat{y}_t) = \bar{\theta}^2 Var(\hat{K}_{gt}) < Var(\hat{K}_{gt})$. Take logarithms to Eq. (12), then $Var(\hat{n}_t) = (\bar{\theta} - \frac{\theta}{1+\theta\epsilon})^2 Var(\hat{K}_{gt}) < Var(\hat{y}_t)$. Showing that $Var(\hat{c}_t) = Var(\log(g+G))$ is trivial from $\hat{c}_t = \log(0.5\tilde{A}) + \log(1-s_t) + \bar{\theta}\hat{K}_{gt} = \log(g+G)$. To show that $Var(\hat{c}_t) > Var(\hat{y}_t)$ note that the variance of $\hat{c}_t$ is

$$Var(\hat{c}_t) = Var\big(\log(1-s_t)\big) + \bar{\theta}^2 Var(\hat{K}_{gt}) + 2\bar{\theta}Cov\big(\log(1-s_t), \log s_{t-1}\big),$$

from the expression for $\hat{c}_t$ and the definitions of $\hat{K}_{gt}$ and $\hat{\epsilon}_t$. Finally, $\bar{\theta}^2 Var(\hat{K}_{gt}) = Var(\hat{y}_t)$ and $Cov(\log(1-s_t), \log s_{t-1}) = 0$ because political shocks are *i.i.d.*

A.4. Proof of Lemma 4.4

Differentiating condition *i.* in Lemma 4.2 we obtain

$$\frac{\partial E(\hat{K}_g)}{\partial\xi} = \frac{1}{1-\bar{\theta}^2}\left(p_B\frac{\partial s_B}{\partial p_B}\frac{1}{s_B} - p_A\frac{\partial s_A}{\partial p_A}\frac{1}{s_A} + \hat{s}_B - \hat{s}_A\right) > p_B\frac{\partial s_B}{\partial p_B}\frac{1}{s_B} - p_A\frac{\partial s_A}{\partial p_A}\frac{1}{s_A}$$

since $\hat{s}_B > \hat{s}_A$. We can use the fact that $\frac{\partial s_A}{\partial p_A} = \frac{\partial s_B}{\partial p_B}(\frac{1+p_B}{s_B}\frac{s_A}{1+s_A})^2$ in the right-hand side of the equation and simplify it to

$$RHS = \frac{\partial s_B}{\partial p_B}\frac{1}{s_B^2(1+p_A)^2}\big[p_B s_B(1+p_A)^2 - p_A s_A(1+p_B)^2\big] > \frac{\partial s_B}{\partial p_B}\frac{1}{s_B^2(1+p_A)^2}\frac{s_A}{s_B^2(1+p_A)^2}(p_B - p_A)(1-p_A p_B) > 0.$$

A.5. Proof of Proposition 4.3

The proof is based on the properties of σ^2 since they determine the shape of $Var(\hat{K}_g)$, defined in condition *ii.* of Lemma 4.2. We will use the following results.

Lemma A.1. *The variance of $\bar{\epsilon}$ is non-negative, $\sigma^2(\xi) > 0\ \forall \xi \in [0, 0.5]$ and has only two zeroes: $\sigma^2 = 0$ at $\xi = 0$ and $\xi = 0.5$. At these points, its slope satisfies $\frac{\partial \sigma^2(\xi)}{\partial \xi}|_{\xi=0} = 0$ and $\frac{\partial \sigma^2(\xi)}{\partial \xi}|_{\xi=0.5} < 0$.*

Proof. The first property follows by definition: $\sigma^2 = p_A p_B(\hat{s}_A - \hat{s}_B)^2 \geq 0$. When $\xi = 0$, $\hat{s}_A = \hat{s}_B \Rightarrow \sigma^2 = 0$. When $\xi = 0.5$, $p_A = 0 \Rightarrow \sigma^2 = 0$. Let $z = \hat{s}_A - \hat{s}_B$ and note that $p_A p_B = 0.5^2 - \xi^2$. Then

$$\frac{\partial \sigma^2}{\partial \xi} = -2\xi z^2 + p_A p_B 2z \frac{\partial z}{\partial \xi} \tag{24}$$

where $\frac{\partial z}{\partial \xi} = 2(1 - \bar{\theta}\beta)[(1 + p_B)^{-1}(2 - \bar{\theta} p_A)^{-1} + (1 + p_A)^{-1}(2 - \bar{\theta} p_B)^{-1}]$. When $\xi = 0$, $z = 0 \Rightarrow \frac{\partial \sigma^2}{\partial \xi}|_{\xi=0} = 0$. Since $p_A = 0$ when $\xi = 0.5$, $\frac{\partial \sigma^2}{\partial \xi}|_{\xi=0.5} < 0$ follows. □

Lemma A.2. *Let $\Xi \equiv \{\xi \in (0, 0.5] : \frac{\partial \sigma^2(\xi)}{\partial \xi} = 0\} \Rightarrow$ for any $\xi \in \Xi$, we have $\frac{\partial^2 \sigma^2(\xi)}{\partial^2 \xi} < 0$.*

Proof. The second derivative of Eq. (24) is

$$\frac{\partial^2 \sigma^2}{\partial^2 \psi} = -2z^2 - 8z\xi \frac{\partial z}{\partial \xi} + 2p_A p_B \left(\frac{\partial z}{\partial \xi}\right)^2 + 2p_A p_B z \frac{\partial^2 z}{\partial^2 \xi}, \tag{25}$$

with

$$\frac{\partial^2 z}{\partial^2 \xi} = 4(1 - \bar{\theta}\beta)\left[\frac{1 + \bar{\theta}\beta p_A}{(1 + p_A)^2(2 - \bar{\theta}\beta p_B)^2} - \frac{1 + \bar{\theta}\beta p_B}{(1 + p_B)^2(2 - \bar{\theta}\beta p_A)^2}\right].$$

Take $\xi^* \in \Xi$. We know that: (i) $z > 0$, since $\xi > 0$ and $s_A = s_B \Leftrightarrow \xi = 0$ and (ii) ξ^* solves $z = \frac{p_A p_B}{\xi}\frac{\partial z}{\partial \xi}$. Evaluating Eq. (24) at ξ^* we obtain

$$\left.\frac{\partial^2 \sigma^2}{\partial^2 \xi}\right|_{\xi \in \Xi} = 2\frac{z}{\xi}\left[\xi\left(0.5^2 - \xi^2\right)\frac{\partial^2 z}{\partial^2 \xi} - \left(0.5^2 + \xi^2\right)\frac{\partial z}{\partial \xi}\right]. \tag{26}$$

Defining $\gamma_i = (1 + p_i)(2 - \bar{\theta}\beta p_j)$ for $j \neq i$, replacing the expression for $\frac{\partial^2 z}{\partial^2 \psi}$ into Eq. (26), and using condition (ii) we obtain

$$\begin{aligned}\left.\frac{\partial^2 \sigma^2}{\partial^2 \xi}\right|_{\xi \in \Xi} = 4\frac{z}{\xi}(1 - \bar{\theta}\beta)\big(&\gamma_A^{-2}\left[2\xi\left(0.5^2 - \xi^2\right)(1 + \bar{\theta}\beta p_A) - \left(0.5^2 + \xi^2\right)\gamma_A\right] \\ &- \gamma_B^{-2}\left[2\xi\left(0.5^2 - \xi^2\right)(1 + \bar{\theta}\beta p_B) + \left(0.5^2 + \xi^2\right)\gamma_B\right]\big)\end{aligned}$$

Since the second term is clearly positive (due to $\gamma_i > 0\ \forall i$),

$$\begin{aligned}\left.\frac{\partial^2 \sigma^2}{\partial^2 \xi}\right|_{\xi \in \Xi} &< 4\frac{z}{\xi}(1 - \bar{\theta}\beta)\gamma_A^{-2}\left[2\xi\left(0.5^2 - \xi^2\right)(1 + \bar{\theta}\beta p_A) - \left(0.5^2 + \xi^2\right)\gamma_A\right] \\ &< 4\frac{z}{\xi}(1 - \bar{\theta}\beta)\gamma_A^{-2}(1 + p_A)\left[2\xi\left(0.5^2 - \xi^2\right) - \left(0.5^2 + \xi^2\right)(2 - \bar{\theta}\beta p_A)\right]\end{aligned}$$

using the fact that $\bar{\theta}\beta < 1$. Simplifying, we obtain

$$< 4\frac{z}{\xi}(1 - \bar{\theta}\beta)\gamma_A^{-2}(1 + p_A)\left[0.5^2(-1.5 + \xi) + \xi^2(-2 + \bar{\theta}\beta/2) - \xi^3(2 + \bar{\theta}\beta)\right] < 0. \qquad \square$$

Claim A.5.1. *There exists a unique $\xi^* \in \Xi$.*

Proof. Existence by continuity of $\sigma^2(\xi)$ and Lemmas A.1 and A.2. The function $\sigma^2(\xi)$ is continuously differentiable and strictly positive in the interval $(0, 0.5)$ and equal to zero at $\xi = 0$ and $\xi = 0.5$. Hence a point in Ξ must exist.

Uniqueness by contradiction. Suppose $\exists$ at least one value $\tilde{\xi} \in \Xi$ such that $\frac{\partial^2 \sigma^2}{\partial^2 \xi} \geq 0$, because the function $\sigma^2(\xi)$ is continuous in ξ and $\sigma^2 = 0$ at the extremes, $\xi = 0.5$ and $\xi = 0$, as shown in Lemma A.1. But this contradicts Lemma A.2, which proved that $\sigma^2(\xi)$ is strictly concave around any point where the first derivative is zero. □

A.6. Empirical appendix

A.6.1. Data on electoral advantage

Data on partisan representation in state legislatures is taken from the Council of State Governments' "The Book of the States". During the time period from 1950–2000, election results are published on a biennial basis during even numbered years. Legislative sessions generally begin during the first quarter of the year following an election (representatives elected in 1970 will begin serving their term in 1971). Consequently, we shift political election data one year forward in time to match the actual legislative terms served by state legislators. This captures the crucial fact that legislators elected in 1970 are responsible for government spending decisions starting in 1971. Four states, Mississippi, Louisiana, New Jersey and Virginia, have odd year election dates. Since the Council of State Governments still publishes data for these states in even years, the political statistics for these states already matches the legislative terms served by the politicians. As a result, we do not shift the political data forward for these states.

Given that data are published on a biennial basis, we impute missing partisan composition values by taking the partisan composition values from the previous year. Since no state has regular elections more frequently than every other year, this imputation does not omit statewide election results, although it may omit small changes due to states occasionally needing to fill vacant seats in off-election years. Since 2000, the Council of State Governments has published data on party composition of state legislatures on an annual basis, with the exception of 2004. Party composition data for 2004 are taken from the 2003 levels. No further imputation is needed for the remaining years 2000–2011.

Throughout the time period studied, Nebraska has been characterized by a nonpartisan state legislature. Accordingly, the state is omitted from the empirical analysis in the paper. Similarly, Minnesota maintained a nonpartisan state legislature until 1972. Pre-1972 data for this state are omitted.

A.6.2. Robustness of Besley et al. (2010) results

In this section, we re-compute Besley et al.'s (2010) regression equation

$$\tau_{st} = \theta_s + \upsilon_t + \delta\kappa_{st} + \epsilon_{st},$$

where τ_{st} denotes the share of total capital outlays in total state government expenditure in state s at date t and θ_s and υ_t are state and year fixed-effects, respectively. Robust standard errors are adjusted for clustering at the state level. All variables are obtained from the online appendix of Besley et al. (2010) at the Review of Economic Studies.

The first column replicates Besley et al.'s (2010) results. Because their measure of political competition is the negative of incumbency advantage, they conclude that the two are negatively related. The second column re-estimates the model, but for a sample starting in 1966 (right after the 1965 Voting Rights Act had been passed). The standard error is basically the same, but the effect of political competition more than halves. As a result, the coefficient becomes statistically insignificant. The third column presents results for a sample that starts, like in our benchmark series, in 1970. The resulting coefficient is similar in magnitude to the one in column (2), and also statistically insignificant.

Appendix B. Supplementary material

Supplementary material related to this article can be found online at http://dx.doi.org/10.1016/j.red.2014.08.005.

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