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Distributive Politics and Electoral Incentives: Evidence from Seven US State Legislatures

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Abstract

We study the effect of electoral incentives on the allocation of public services across legislative districts. We develop a model in which elections encourage individual legislators to cater to parochial interests and thus aggravate the common pool problem. Using unique data from seven US states, we study how the amount of funding that a legislator channels to his district changes when he faces a term limit. We find that legislators bring less state funds to their district when they cannot run for re-election. Consistent with the Law of 1/N, this tendency is less pronounced in states with many legislative districts.

JEL-Code: D720.

Keywords: term limits, electoral incentives, distributive politics, the Law of 1/N, US state legislatures.

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1 Introduction

Elections are widely perceived to serve a number of complementary functions. They aggregate preferences, help select better public officials, and provide incentives for politicians to act in the interest of the voters they represent (e.g., Persson and Tabellini (2000)). Elections can serve the latter function when the threat of not being re-elected serves as a motivation for politicians. How this works, both in theory and in practice, is fairly well understood in the context of a single politician, such as a state governor or a head of state with executive power. Here, policy decisions can be analyzed as if they were made unilaterally by one policy maker and elections and the incentives they provide mitigate the conflict of interest between voters and their elected representative. Sometimes when voters are mistaken about what the right policy is, re-election incentives may force a politician who knows better to pander to voters instead of pursuing the socially optimal policy (Maskin and Tirole (2004)), but in most other cases, electoral incentives increase voter welfare (Besley (2006)).

Much less is known about how these incentives operate at the level of individual legislators elected to serve along side many other legislators in a legislative chamber. Do they matter and if so, do they help promote socially desirable outcomes? This paper provides some answers to these questions. We study the effect of electoral incentives on the allocation of district-specific public services when policy decisions are made by a group of legislators, each of whom is able to exert some influence on the final policy choice and each of whom is elected to represent the interest of a particular legislative district. We argue that the nature of the incentive effect of elections is very different in a world of collective decision making and distributive politics. The fundamental reason is that distributive politics is associated with a conflict, which is, typically, not present when a (single) politician is elected by all voters of a state, between what is desired by the voters of each district and what is optimal for the state as a whole. The source of this conflict is that the benefits of government spending can be concentrated to a particular group of voters while the tax costs are spread more widely across the entire polity. This encourages individual legislators to bring too much pork-barrel spending home to their district and creates a common pool problem. The combined consequence is that total government spending tends to be too high (Weingast et al. (1981)). The central message of our paper is that elections may acquire a more sinister role in a world of distributive politics: they may create additional incentives for legislators to cater to parochial interests in a way that magnifies rather than resolves the underlying common pool problem.

We develop this idea in two steps. First, we study it theoretically in a model of distributive politics, asymmetric information, and elections. Second, we gather and analyze data from seven US states on the amount of pork-barrel spending individual legislative districts receive from the state budget. Our evidence supports the central message of the paper and shows that re-election incentives magnify the overspending tendency associated with the common pool problem, but that this effect is smaller in states with a larger legislature.

We focus on US state legislatures for two reasons. Firstly, many observers argue that distributive politics plays a prominent role at the state level, where individual legislators represent geographically defined constituencies (e.g., Chen and Malhotra (2007), Thompson

(1986), and the survey by Goodman (2007)). Gosling (1985) provides a particularly insightful study of the budget process in Wisconsin that clearly demonstrates that state legislators are both willing and able to influence the spatial allocation of state spending. By tracking the state budget from the initial draft through to the final version, he quantifies the relative influence of the major political players (various state agencies, the executive's state budget office, and the state legislature) on the final budget allocation. The analysis shows that state legislators play a critical role in determining the allocation of transfers to local government units (municipalities, school districts, counties etc.) through relevant legislation drafted in committees and amended on the floor. In contrast, their influence on other, less geographically targeted spending items, is less pronounced. He summarizes his finding as follows:

> 'Local assistance items are 'bread and butter' of legislators' most informed and politically active constituents. And since each legislator represents at least one municipality, county, or school district, each has an interest in how local assistance proposals affect his jurisdiction. ... Bureaucrats are permitted to contribute a good proportion of the budget, but when the budgetary decisions involve the 'big ticket items', especially those affecting local governments back home, the legislative actors disproportionately shape the final outcome'. (Gosling, 1985: p. 477)

The second reason for focusing on US state legislatures is the institution of legislative term limits which exists in some of them. These limits generate the exogenous variation in the electoral incentives that we use to identify the incentive effect of elections.

This paper is related to two strands of the literature on the political economy of public spending. The first strand is the political agency literature on incentive effects of elections alluded to above. We relate our theoretical work to this literature in section 2. Empirically, a series of papers have looked for evidence of shirking among US congressmen when re-election incentives are weak, with somewhat contradictory results (see the survey by Lott and Davis (1992) and a more recent contribution by Parker and Powers (2002)). The major challenge in this line of research is to find variation in re-election incentives that can be taken as exogenous to the legislator's behavior. In their seminal paper, Besley and Case (1995) propose to use gubernatorial term limits in the US states to identify the impact of electoral incentives. When a governor enters his last allowed term, his policy choices no longer affect the re-election probability. This is in contrast to terms after which he can run for re-election. Using a within-state comparison of governors, Besley and Case show that governors who can no longer run for re-election allow state taxes to increase and state spending to drift up. List and Sturm (2006) also use gubernatorial term limits to demonstrate that state spending on more specific policies, such as environmental regulation, diverge more from the interests of voters when the governor can no longer run for re-election. Exploiting a unique dataset on local government corruption in Brazil, Ferraz and Finan (2011) show that mayors who cannot stand for re-election due to a term limit tend to be more corrupt.

These empirical papers, as do most of the theoretical literature, assume that policy is set unilaterally by a governor or a mayor. Taken together they provide evidence of a disciplining effect of elections, consistent with the suggestion of the agency literature that elections improve voter welfare. The major difference between our analysis and these earlier studies is our focus on collective policy-making by a group of legislators and on electoral incentives in operation at the level of individual legislators. This demands that we estimate the flow of money from the state budget to individual legislative districts within a state, rather than studying aggregate state spending and taxes or corruption. Moreover, the variation in electoral incentives in our work comes from legislative rather than executive (either gubernatorial or mayoral) term limits.[1]

The second strand of literature that this paper contributes to is the literature on distributive politics, started by Weingast et al. (1981). They demonstrate theoretically how the common pool problem emerges when the legislators' objective function ignores the cost of the tax imposed on other constituencies. We complement this theory by explicitly modelling the interaction between legislators and their voters. This allows us to show how elections provide incentives for overspending and magnify the underlying common pool problem.

Our study also adds to previous empirical applications of the theory of distributive politics to US state legislatures, e.g., Crain (1999), Gilligan and Matsusaka (1995; 2001), Primo (2006) and Chen and Malhorta (2007). These papers analyze *aggregate* state spending in order to test the Law of 1/N: the observation made in Weingast et al. (1981) that the extent of overspending is greater when there are more districts.[2] In contrast, we study transfers from the state budget to individual legislative districts. In this way, we attempt to measure pork-barrel spending directly and to show that these transfers are affected by the electoral incentives facing individual legislators in a way that is consistent with the wide-spread presumption that state legislators actively seek to attract state funds to their districts and that they are successful in that endeavor. Although our research design does not allow for a direct test of the Law of 1/N, we explore the fact that the number of districts is systematically related to the incentive effect of elections to bring new evidence to bear on it.

We now preview our study and its main results in more detail. We begin by building a theoretical model that embeds a political agency model with repeated elections, asymmetric information, and term limits within a canonical model of distributive politics. The purpose of the model is to illustrate the interaction between electoral incentives and distributive politics and thus guide our empirical investigation.

At the core of the model lies the common pool problem: the voters of each geographically defined constituency want more spending allocated to their district than what is socially optimal for the state as a whole. The reason is that the benefits of spending are concentrated geographically while the costs are borne by the population of the entire state. Legislators differ in their ability to bring back spending to the district that they represent and can serve for at most two terms in office.

[1] Ansolabehere and Snyder (2004) also use these term limits to estimate the effect of incumbency on reelection chances.

[2] The Law of 1/N has been subject to empirical study in other settings as well (Bradbury and Crain (2001), Baqir (2002), Bradbury and Stephenson (2003), Pettersson-Lidbom (2008), and Brooks et al (2011)). For a critical evaluation of the evidence on the Law of 1/N, see Primo and Snyder (2008).

The model delivers two predictions that guide our empirical investigation. Firstly, it predicts that spending to a particular legislative district should *fall* when the legislator representing it is up against the term limit relative to when this is not the case. We refer to this as the 'last-term effect'. This is the direct result of the incentives generated by elections to cater to parochial interests. In this way, elections may exacerbate the common pool problem and reduce welfare compared to the scenario without elections. While the incentives of the governor of a (US) state whose constituency is the entire state may be such that total spending drifts up in the absence of electoral incentives (as shown by Besley and Case (1995)), our model suggests that these incentives may work in the opposite direction in the context of distributive politics.

Secondly, the model predicts that the absolute size of the fall in spending during the last term is (under a mild sufficient condition) smaller in states with a larger number of districts. Hence, a larger legislature dampens rather than magnifies the effect of the term limit. This implies that although electoral incentives aggravate the common pool problem, they do so to a lesser degree in legislatures with many districts where the common pool problem is already large. Our test of this prediction can be interpreted as a new test of the Law of 1/N because the prediction is a direct consequence of the fact that the overspending bias is larger in a larger legislature.

The main contribution of the paper is to take these predictions to the data and thus provide new empirical evidence on the incentive effect of elections and the Law of 1/N. To do this, we have collected a new dataset covering the period from 1992 to 2005 in seven US states (Arizona, Colorado, Louisiana, Missouri, Ohio, Oklahoma and South Dakota). The dataset contains information on the legislators elected to a state's lower chamber from each legislative district, and on the transfers from the state budget to these districts. The data on district-specific transfers (loosely referred to as pork-barrel spending) are unique and constructing these data can be seen as a major contribution of the paper.

Whilst we, as noted above, build on earlier work that use gubernatorial term limits in the US to study the effect of electoral incentives, we identify the 'last-term effect' differently. Previous studies estimated the 'last-term effect' by comparing a US state governor in his last term to himself in earlier terms *and* to other governors within the same state who were not in the last term. The latter group contains governors who never reach the term limit. If voters use elections to select particular types of governors, then governors who are repeatedly re-elected will differ systematically from those who are not. Consequently, within such a research design, one cannot identify the 'last-term effect' separately from the selection effect of elections. The richness of our data enables us to address this issue and to isolate the selection effect of elections from the incentive effect. We identify the 'last-term effect' by comparing how the transfers to a particular legislative district change when its legislator is up against the term limit relative to previous terms served by that *same* legislator. In other words, we identify the 'last-term effect' from within-legislator variation as opposed to within-district (-state, or -municipality) variation.[3] This reduces significantly the possibility that selection effects or other unobserved factors contaminate the estimate.

[3]This is to say we identify the incentive effect of elections from regressions with legislator fixed effects.

We find strong evidence that transfers fall when legislators no longer face electoral incentives or put the other way around that spending is inflated when legislators are subject to electoral incentives. On average, total transfers fall by $14 per capita in a legislator's last term relative to transfers secured by the same legislator in earlier terms. This corresponds to a 3.5 percent fall in spending. This finding – that pork-barrel spending is higher under the pressure from voters – is consistent with the conjecture that elections aggravate the common pool problem of distributive politics. Therefore, this finding is in the spirit of Maskin and Tirole (2004) who show that accountability to voters can reduce welfare. Further decomposition of the data reveals that the incentive effect is associated with Democrats only. We also find that the last term fall is smaller in states with a larger legislature and interpret this as indirect evidence of the Law of 1/N in operation.

The rest of the paper in organized as follows. In section 2, we develop the model and summarize the features that guide our empirical investigation. In section 3, we discuss the construction of the dataset and present some stylized facts. In section 4, we lay out our estimation strategy and present the empirical results related to the 'last-term effect'. In section 5, we present our test of the Law of 1/N. In section 6, we conclude. The appendices at the end of the paper contain proofs and a detailed description of the dataset.

2 The Model

Most of the existing theoretical literature on the incentive effect of elections and term limits focuses on situations with a single politician with executive power, such as a governor or a head of state, rather than on collective decision making.[4] The spotlight in this literature is on how and to what extent elections can resolve the conflict of interest between voters at large and their elected representative. Yet, virtually all fiscal decisions are made collectively by many legislators and often is an environment where distributive politics is important because the benefits of policy decisions can be targeted at voters living in particular legislative districts while the costs are disbursed more widely over the entire polity. In particular, this is true for the sample of US state legislatures that we shall study empirically. This creates an additional conflict of interest between what is optimal for the state as whole and what is optimal for voters in each district.

We build a model of collective decision making in which electoral incentives, term limits, and distributive politics all play major roles and interact. Our approach stresses three salient

[4]See, e.g., Ferejohn (1986), Reed (1994), Besley and Case (1995), List and Sturm (2006) or the overview in Persson and Tabellini (2000). An exception, however, is Bernhardt et al. (2004). They study the effect of term limits on the reelection rule in a political agency model with many legislators and distributive politics. Distributive politics is modeled as a zero sum game where more senior legislators can bring more pork-barrel home to their district at the expense of more junior legislators. While this formulation captures experience effects, it does not address the common pool problem underlying the standard conception of distributive politics and which forms the core of our model. Persson and Tabellini (2000: chapter 10) in their comparison of presidential and parliamentarian forms of government also combine elements of electoral accountability with distributive politics but do not consider asymmetric information which is an indispensable component of our approach.

features of collective decision making in a stylized state legislature. We follow the literature on distributive politics, initiated by the seminal work of Weingast et al. (1981), and assume that state spending is geographically targeted while the tax cost is shared amongst all districts. Since legislators are elected in particular legislative districts, this creates an incentive for them to cater to district-specific interests and to ignore the wider fiscal implications of their choices. This creates the common pool problem and the tendency for overspending that is at the core of our model. We add to this a conflict of interest between voters in a district and the legislator who represents them. Specifically, we assume that legislators differ in their ability to 'bring back the pork'. One interpretation of this is that legislators must exert effort in the legislative bargaining process to bias spending decisions in favor of their district. Voters would like to be represented by 'effective' legislators who know how to work the legislature to secure services for them, but they cannot observe these attributes directly before the fact. The second central feature of the model, then, is that voters use elections as an *ex post* selection device in their attempt to distinguish between different types of legislators. Term limits hamper this endeavor simply because elections cannot provide incentives for legislators who cannot seek re-election. This creates the 'last-term effect' that encapsulates the electoral incentive effect on the allocation of state funds.

The third feature of the model is the organization of collective decision making within the legislature. There are two main theoretical approaches to modeling this: The norm of universalism (e.g., Weingast et al. 1981; Primo and Snyder, 2006; Brooks et al. 2011) and legislative bargaining (e.g., Baron and Ferejohn, 1989; Baron, 1991; Battaglini and Coate, 2007). Under the norm of universalism, each legislator decides directly on the level of spending for his district, expecting that all legislators will support the omnibus bill needed to finance the overall spending package. Legislative bargaining, on the other hand, is based on the notion that particular legislators are granted agenda setting powers and that spending allocations take place within an environment of minimum winning coalitions. Although Shepsle and Weingast (1981) argue that the expected utility of a legislator running for re-election is higher when the legislature follows the norm of universalism than if politics is based on minimum winning coalitions, the norm can only be sustained if legislators can somehow commit to it and promise to vote for the omnibus bill that approves the overall spending level. The legislative bargaining model avoids this commitment problem and is, therefore, game theoretically more satisfactory. This, however, comes at the cost that the outcome of the legislative process is sensitive to the specific assumptions one makes about the bargaining process. Since these details – the identity of the agenda setter, the legislators in the minimum winning coalition etc. – at least in our setting, are hard to quantify empirically and thus to build into our empirical specification, this makes the legislative bargaining model less useful for our purposes.[5] For this reason, but also for reasons of tractability and to make the results directly comparable to those in the literature on distributive politics, we maintain

[5]Experimental evidence suggest that the effect of agenda setter power is weaker than suggested by the legislative bargaining model and that proposals often pass with a super-majority (Frechette et al., 2005). We have looked in detail at the number of votes cast in support of budget bills in one of the states (Missouri) in our sample. We find that most pass with a much larger majority than the 50% needed to form a minimum winning coalition.

the notion that legislators can influence the spending allocation to their district, but only if they exert (costly) effort. We interpret this as a reduced form representation of a more complex legislative process where effort is required to get into the right committees, to build coalitions with other legislators, to influence the leadership of the House etc. all of which eventually will affect how successful a legislator is at bringing the pork home.

2.1 The Economic and Political Structure

We consider a state with N legislative districts, indexed $k = 1, ..., N$. The time horizon of the polity is infinity and indexed by $t = 0, 1, 2, ...$ Each district is populated by a continuum of citizens with measure 1. All citizens live for ever, and, for simplicity, they do not discount the future.[6] They receive the same per-period income y. This is spent within the period on a private good or on paying taxes. Public services can be targeted at the district level and are denoted p_k. For simplicity, we shall refer to p_k as pork-barrel spending in district k. Pork-barrel spending is financed by a uniform lump sum tax τ collected from all districts to balance the state budget:

$$\tau = \frac{1}{N} \sum_{k=1}^{N} p_k. \tag{1}$$

We require that $\tau \leq y$ and assume that there is a cap on district spending set at $p_k \leq y$.[7] The utility function of a voter living in district k is

$$u(p_k) = y + v(p_k) - \tau, \tag{2}$$

where $v(.)$ is strictly concave and increasing in p_k. Voters value pork-barrel spending in their district but fail to internalize the full tax implications of such spending. As a consequence, their most-preferred spending level is

$$p^V = \arg\max_{p_k} y + v(p_k) - \frac{p_k}{N} - \frac{\sum_{j \neq k} p_j}{N}. \tag{3}$$

From a state welfare perspective, the optimal level of spending in a given district reflects the tax externality and is determined by maximizing a utilitarian social welfare function:

$$p^E = \arg\max_{p_k} y + v(p_k) - p_k + \sum_{j \neq k} (y + v(p_j) - p_j). \tag{4}$$

[6] This assumption can be relaxed but simplifies the characterization of the political equilibrium.

[7] This assumption can be relaxed but maintaining it simplifies the presentation of certain non-essential features of the political equilibrium.

It is clear that $p^V > p^E$. This is the underlying common pool problem associated with distributive politics: voters in each district want more pork-barrel spending for their district than what is efficient for the state as a whole because they only pay the fraction $\frac{1}{N}$ of the tax cost.

Every period the voters of each district elect one representative to the state legislature. The legislator representing district k is recruited from among the voters of that district and elected by the simple majority rule. The objective of the legislator is to serve his district and thus to bring pork back to it.[8] His capacity to do this, however, depends on how the legislative process is organized in the state legislature and on his personal ability to 'bring home the pork'. To capture this, we assume that each legislator must exert costly effort, e_k, to bring services back to his district. The amount of pork, p_k, that legislator k can bring back to his district is an increasing, concave function of his effort and is denoted by $f(e_k)$. The (personal and socially wasteful) cost of effort is an increasing and convex function of effort. The fundamental assumption of the model is that legislators have different abilities and, for some it is easier to secure pork for their district than for others. In particular, we assume that there are two types of legislators, $T \in \{L, H\}$. We refer to these as effective (L) and ineffective (H) legislators and specify the type-specific (effort) cost function as

$$C^T(e_k) = a^T C(e_k), \tag{5}$$

where $C' > 0$, $C'' \geq 0$ and $a^H > a^L$. Type is private information to each legislator and is a fixed and unchanging attribute. The probability that a randomly chosen citizen from a given district, once installed in office, is of type L (H) is δ $(1 - \delta)$.[9] Citizens get ego-rents from being in office. The ego-rent may vary with the number of terms served and we denote the rent associated with term τ as $M_\tau > 0$.[10] A legislator who is out of office gets utility as any other citizen-voter. Combining these assumptions, we can write the per-period payoff of a legislator of type T elected to serve district k for term τ as

$$U^T(p_k) = u(p_k) + M_\tau - a^T c(p_k), \tag{6}$$

where we define $c(p_k) \equiv C(f^{-1}(p_k))$ with $c' > 0$ and $c'' \geq 0$. This formulation of the objective function allows us to study the behavior of a legislator *as if* he picks district level spending (pork-barrel) directly rather than indirectly through his effort choice. We shall, therefore, talk about the pork-barrel delivered to a district and the effort that went into bringing this outcome about as being synonymous.

[8] For simplicity, we refer to legislators as males. In reality, of course, many of them are women.

[9] These probabilities are common knowledge and also represent the population shares of potential legislators in each district.

[10] Besides being realistic – it is likely that the ego-rent from being elected the first time is bigger than that of being re-elected – this assumption allows us, as we discuss below, to state the sufficient condition under which all voters are willing to run for a first term in office as a function of the size of the first-term ego-rent alone.

The state has a term limit policy. It stipulates that a given legislator can at most serve two consecutive terms in office and that he can only serve once. It is useful to refer to legislators serving their first term as *first-term* legislators and legislators who serve their second term as *last-term* legislators. The timing of events within a given period t is:

1. At the beginning of the period, all newly elected first-term legislators learn their type and the legislature meets to decide on the spending allocation and the overall level of taxation. Each legislator decides how much effort to exert in order to secure services for his district. This is done simultaneously. The lump sum tax is determined by the collective choices of the N legislators to balance the budget. The voters in district k observe the pork-barrel delivered to their district, but not that delivered to other districts.[11]

2. At the end of the period, an election is held in each district using the majority rule. If the legislator of district k is a first-term legislator, then he may run again against a randomly chosen challenger and the candidate who gets the support of the majority of voters in the district gets elected to serve for the next period. If the legislator of district k is a last-term legislator, he cannot run again and the voters of district k elect a new legislator at random.[12]

2.2 Analysis and Results

We begin the analysis by characterizing the outcome of the collective decision making process within a given period in the absence of any electoral concerns. In this case, a legislator of type $T \in \{L, H\}$ takes the effort levels of the other legislators as given and chooses:

$$p^T = \arg\max_{p_k} y + v(p_k) - \frac{p_k}{N} - \frac{\sum_{j \neq k} p_j}{N} - a^T c(p_k). \tag{7}$$

We refer to p^L and p^H as the most-preferred pork-barrel spending of each type and the effort levels required to induce these as the minimum amounts of effort that a legislator of that type is always willing to exert. Irrespective of his type, the minimum amount of effort for one legislator does not depend on the choices made by the $N-1$ other legislators (and hence on the composition of the legislature).[13] The independence greatly simplifies the analysis of

[11] From this, they can deduce the amount of effort exerted by their legislator.

[12] We can think of this as an election in which two challengers selected randomly from the district population compete. Since voters have no information about their types, they are indifferent between them. Citizens chosen at random to run can, in principle, decline to do so. We discuss this issue in more detail below.

[13] This would not be the case if we allow the spending production function $f(e_k)$ or the effort cost functions $a_T C(e_k)$ to depend on the effort of other legislators. In that case, the composition of the legislature would matter. We looked at this empirically and cannot find any evidence that such inter-dependencies are important [results are available upon request] and so, we decided not to complicate the model in this direction.

political equilibria with electoral incentives, although we do need to take into account that realized payoffs are interdependent.[14]

All legislators are willing to work for their district even if electoral incentives are absent. The reason is that they care directly about the public services delivered to their district. How hard a given legislator will work depends, however, on his ability. More effective legislators put in more effort and, as a consequence, $p^L > p^H$. Since effort is costly, even p^L is less than what the voters of the district really want ($p^L < p^V$). However, precisely because the effort is costly, if legislators happen to be very ineffective at securing pork, it is possible that the most-preferred spending level of individual legislators is less than the efficient level of spending p^E.[15] In order to focus on the (relevant) case where distributive politics is associated with a common pool problem (i.e., $p^H > p^E$), we assume throughout that

$$a^H < \frac{N-1}{Nc'(p^E)}. \tag{8}$$

With this assumption in place, we can rank the spending levels as follows: $p^E < p^H < p^L < p^V$.

The voters of each particular district prefer more pork-barrel spending to less (up to p^V) and know that $p^L > p^H$. They will, therefore, try to use the power of the ballot box to get rid of first-term legislators of type H and aim at re-electing legislators of type L only. Since legislators must exert effort to bring pork-barrel spending back to their district, a randomly selected citizen may, unless the ego-rent is sufficiently large, prefer not to stand for election and let someone else do the heavy lifting. To ensure a ready supply of legislators of both types, we assume that the first-term ego-rent M_1 satisfies the following sufficient condition:

$$M_1 > \delta a^L c(y) + (1-\delta) a^H c(p^H). \tag{9}$$

This assumption, which says that the first-term ego-rent is larger than the maximum expected cost of effort for a first-term legislator, ensures that any voter even if he does not anticipate to get re-elected will be willing to serve for one term *and* do (at least) what is required of his type in equilibrium.[16]

We use Perfect Bayesian Equilibrium (PBE) to characterize outcomes of the legislative process in the presence of electoral incentives. Last-term legislators cannot run again due to the term limit and face no electoral incentives. They will, therefore, exert the minimum effort needed to bring home p^L or p^H and the voters of those districts elect a new legislator at random. The situation is more complex in a district k represented by a first-term legislator.

[14] The reason is that the tax bill payable by citizens in a particular district depends on how much pork other districts get.

[15] Our efficiency benchmark (p^E) does not take the effort cost into account for two reasons. Firstly, the effort represents socially wasteful activities, and, secondly, these activities can be avoided by a utilitarian social planner.

[16] It is a sufficient condition because it assumes that legislators of type L will have to exert effort to bring back the maximum possible amount of pork ($p_k = y$) and because it ignores the value of re-election.

In those districts, a PBE consists of an effort choice (and an associated amount of pork-barrel spending) – one for each type of legislator – a re-election rule, and a set of Bayes-consistent beliefs held by voters in the district, such that

1. first-term legislators of each type exert an optimal amount of effort (thus securing an optimal amount of pork-barrel spending to their district) given the re-election rule in their district and the choices of the other legislators;

2. the re-election rule is optimal given the voters' beliefs about the type of the district's incumbent and the incumbent's strategy;

3. voters' beliefs are whenever possible updated according to Bayes rule.

The voters of a district represented by a first-term legislator vote for the incumbent if the expected utility with him in the seat for a second term is larger than the expected utility of electing a randomly chosen challenger.[17]

Within the class of pure strategy perfect Bayesian equilibrium, two types of political equilibria can potentially emerge: pooling equilibria in which all types of first-term legislators select the same effort level and separating equilibria in which the two types exert different level of effort in their first term. We can, however, rule pooling equilibria out.[18] To see how, consider a candidate pooling equilibrium in which all types of first-term legislators deliver p^L and expect to be re-elected. First-term legislators of type H cater to voters by pretending to be more effective in producing pork than they really are, and voters reward first-term legislators with re-election for doing so. In their second and final term, ineffective legislators would, however, reveal their true ability and deliver p^H. Voters foresee this and it is optimal for them to deviate from the proposed equilibrium strategy and not to re-elect first-term legislators who delivered p^L. The reason simply is that irrespective of the type, the next first-term legislator will, by assumption, play the pooling equilibrium strategy and deliver p^L. Getting p^L for sure is better for voters than getting p^L with probability δ and p^H with probability $1 - \delta$. Thus, pooling on p^L cannot be an equilibrium. A similar argument rules out pooling equilibria involving pooling on some other p. The intuition behind this is that if all first-term legislators can be trusted to secure more pork than p^H, then voters prefer to have a first-term legislator in the seat each period and will never re-elect anyone. This eliminates the incentive of first-term legislators of type H to do anything but putting in the minimum effort and deliver p^H to their district.

In any separating equilibrium, it must be in the interest of first-term legislators of different types to differentiate their pork-barrel spending to such an extent that voters can deduce their type from observing how much pork they bring home and then only re-elect those whose type is revealed to be L. Thus, in equilibrium, first-term legislators of type H will not be re-elected and so they put in the minimum effort needed to deliver p^H during their first (and only) term in office. To get re-elected, first-term legislators of type L may, on the other

[17] In case of indifference between re-electing or not, we assume that voters re-elect, as in Maskin and Tirole (2004).

[18] We thank a referee for pointing this out.

hand, have to exert extra effort to bring home pork-barrel spending beyond p^L. We denote the equilibrium amount of spending delivered by a first-term legislator of type L serving in district k by $\widetilde{p}_k^L$. To enable voters to distinguish between the two types of legislators, it must be the case that a first-term legislator of type H is not willing to mimic a legislator of type L by delivering $\widetilde{p}_k^L$. This requires that $\widetilde{p}_k^L$ satisfies:[19]

$$v(\widetilde{p}_k^L) - \frac{\widetilde{p}_k^L}{N} - a^H c(\widetilde{p}_k^L) \leq (1-\delta)\left(v(p^H) - \frac{p^H}{N}\right) + \delta\left(v(\widetilde{p}_k^L) - \frac{\widetilde{p}_k^L}{N}\right) - M_2. \tag{10}$$

At the same time, it must be in the interest of legislators of type L to put in the extra effort needed to bring the extra pork back to their district ($\widetilde{p}_k^L$) in order to get re-elected rather than to forgo re-election and simply put in the minimum amount of effort and deliver p^L. This requires that $\widetilde{p}_k^L$ satisfies:

$$v(\widetilde{p}_k^L) - \frac{\widetilde{p}_k^L}{N} - a^L c(\widetilde{p}_k^L) \geq (1-\delta)\left(v(p^H) - \frac{p^H}{N}\right) + \delta\left(v(p^L) - \frac{p^L}{N}\right) - M_2. \tag{11}$$

We denote the (largest) spending levels that solve equations (10) and (11) with equality by $\widehat{p}^H$ and $\widehat{p}^L$, respectively.[20] Effort is costly to legislators. Consequently, in the quest for re-election, legislators of either type are only willing to exert more than the minimum amount of effort if the second-term ego-rent, M_2, is sufficiently large. To make sure that legislators have an incentive to put in more effort than the minimum, we assume that $M_2 > \max\{M_L, M_H\}$ where $M_H = a^H c(p^H)$ and[21]

$$M_L \equiv a^L c(p^L) + (1-\delta)\left[(v(p^H) - \frac{p^H}{N}) - (v\left(p^L\right) - \frac{p^L}{N})\right]. \tag{12}$$

This guarantees that $\widehat{p}^L > p^L$ and that $\widehat{p}^H > p^H$, i.e., that the two types are, indeed, willing to exert extra effort if that can get them re-elected. A comparison of equations (10) and (11) shows that $\widehat{p}^L > \widehat{p}^H$. That is, legislators of type L are willing to put in more effort to get re-elected than legislators of type H. Intuitively, this is because exerting effort is cheaper for legislators of type L than for type H ($a^H > a^L$). As a consequence, any $\widetilde{p}_k^L \in \left[\widehat{p}^H, \widehat{p}^L\right]$ is a candidate strategy for legislators of type L in a separating equilibrium. On the one hand, first-term legislators of type L are willing to exert the effort needed to bring that much pork home and get re-elected. On the other hand, legislators of type H are not willing to do so. They prefer to exert the minimum effort (and deliver p^H) to putting in the extra effort

[19] Details of this and subsequent derivations are collected in Appendix A which also contains the proofs of the propositions stated below.

[20] We have omitted subscript k to highlight that the cut-off values are the same across districts. This follows from the fact that the p^L and p^H are independent of the district in which a legislator is elected.

[21] To derive these thresholds, we evaluate equation (10) at $\widetilde{p}_k^L = p^H$ and equation (11) at $\widetilde{p}_k^L = p^L$.

needed to bring home any amount of pork in this interval, even if doing so could get them re-elected for a second term. The intuition, again, is that it is cheaper for effective legislators to deliver 'extra' pork to their district than it is for ineffective legislators to do so.

We can reduce the set of separating equilibria to a singleton by eliminating weakly dominated strategies and imposing some additional, but reasonable, restrictions on the out-of-equilibrium beliefs of voters (discussed in appendix A). This allows us to focus on the signalling equilibrium that is least costly to legislators of type L, i.e., the one that requires such legislators to put in the least extra effort to signal their type. The following proposition characterizes this particular separating equilibrium.[22]

Proposition 1 *(Signalling equilibrium) Define*

$$M_S \equiv a^H c(p^L) + (1-\delta)\left[(v(p^H) - \frac{p^H}{N}) - (v\left(p^L\right) - \frac{p^L}{N})\right]. \quad (13)$$

For $M_2 > M_S$, a unique undominated separating equilibrium in pure strategies exists and is supported by the following strategies and beliefs:

1. *First-term legislators of type L exert the effort level that delivers $\widehat{p}^H > p^L$ in their first term. First-term legislators of type H exert the effort level that delivers p^H in their first term.*

2. *Voters of district k re-elect their first-term legislator if and only if $p_k = \widehat{p}^H$.*

3. *The posterior belief of voters of district k that the first-term legislator of their district is of type L is 1 if they observe $\widehat{p}^H$ and 0 if they observe p^H.*

4. *Last-term legislators of type L exert the effort level that delivers p^L while last-term legislators of type H exert the effort level that delivers p^H.*

Corollary 2 *(Screening equilibrium). If $max\{M_L, M_H\} \leq M_2 \leq M_S$, then first-term legislators of type L can reveal their type by exerting the minimum amount of effort and deliver p^L.*

The proposition characterizes two types of separating equilibria. The most interesting of these is the *signalling equilibrium.* In this equilibrium, first-term legislators of type L put in extra effort to bring home additional pork to their district and in that way to signal their commitment to the district they represent. Voters, in turn, reward them for doing so with re-election. The other type is a *screening equilibrium* in which first-term legislators of type L are able to reveal their type and get re-elected without having to put in extra effort during their first term. The signalling equilibrium is applicable when the second-term ego-rent is larger than the critical value M_S defined in equation (13). Intuitively, the size of the ego-rent controls whether first-term legislators of type H have a strong or a weak incentive to

[22] All proofs are in appendix A.

mimic type L in their bid for re-election. The larger is the ego-rent for the second term, the stronger the incentive. First-term legislators of type L will, therefore, have to 'over-exert' effort to convince voters that they are really effective at getting services delivered to their district.[23] If, on the other hand, the ego-rent is relatively low ($M \leq M_S$), then the incentive to mimic is weak, and first-term legislators of type L can reveal themselves without having to exert extra effort. They simply put in the minimum amount of effort to deliver p^L and get re-elected for doing so because voters know that even such a modest amount of pork is beyond what an ineffective legislator would ever be willing to deliver.

The main empirical prediction of the model concerns the impact of electoral incentives on district-level spending over the life-cycle of the legislator elected to represent it. Last-term legislators face no electoral incentives, as they, by definition, have to step down, but first-term legislators do. The difference between what a legislator does in his first and last term, therefore, captures the effect of electoral incentives. We refer to this difference as the 'last-term effect'. Since only legislators of type L get re-elected to the term limit, the 'last-term effect' is

$$\Phi_k = \max\left\{\widehat{p}^H, p^L\right\} - p^L. \tag{14}$$

We can summarize the main prediction of the model as follows.

Proposition 3 *(The 'last-term effect') The amount of spending allocated to a particular legislative district is (weakly) smaller when the legislator representing that district is in his last term compared to when he is not, i.e.,* $\Phi_k \geq 0$.

This proposition provides a reason why the pork-barrel spending allocated to a given legislative district falls immediately before the term limit becomes binding for the legislator representing it compared to the spending allocation to that same district in previous periods during which the *same* legislator represents it. This 'last-term effect' arises because a binding term limit eliminates the need for effective legislators to put in extra effort to show commitment to their voters. This 'last-term effect' is most pronounced in societies in which legislators enjoy a large (second-term) ego-rent and may be entirely absent in societies in which the ego-rent is modest (below the threshold M_S such that the screening equilibrium is played). It is important to stress that the 'last-term effect' isolates the incentive effect of elections from any selection effects. It does so because it is based on a comparison between what happens over the life-cycle of a particular legislator of fixed type.

As noted above, pooling equilibria in which legislators of type H cater to voters during their first term do not exist in our model. However, if legislators gain experience during their first term[24], as in Bernhardt et al. (2004), voters may be willing to keep legislators for a second term rather than selecting a novice at each election. In this case, pooling equilibria may emerge and provide another reason why spending falls in the last term that a legislator serves.

[23] The second-term ego-rent cannot, however, be too large. This is because it would then be infeasible, given the constraint that $p_k \leq y$, for first-term legislators of type L to bring back an amount of pork that would never be matched by type H. The exact condition is provided in appendix A.

[24] One could imagine that it requires less effort for all types of legislators to bring pork back to their district in their second than in their first term.

In the absence of electoral incentives, all legislators exert the minimum amount of effort to deliver, depending on their type, p^L or p^H to their district. This is, in general, inefficient from the point of view of the state because each legislator fails to internalize the tax cost falling on other districts. We refer to this as the *underlying* common pool problem. As suggested by the Law of 1/N, this underlying problem becomes more serious, in the sense that the overspending bias is larger, when the number of districts (N) increases, i.e., $\frac{\partial p^T}{\partial N} = -\frac{1}{(v''(p^T)-a^T c''(p^T))N^2} > 0$ for $T \in \{H, L\}$. This is well-known. What is new and interesting is the fact that electoral incentives also serve to magnify the tendency for overspending and thus add to the underlying common pool problem. This is because the desire to gain re-election, in the signalling equilibrium, forces first-term legislators of type L to exert extra effort so as to bring more pork back to their district than they otherwise would have brought ($\widehat{p}^H > p^L$). For a given number of legislative districts, the underlying common pool problem is, therefore, exaggerated by first-term legislators of type L vowing to get re-elected.

An important question is how the Law of 1/N and the 'last-term effect' interact. In particular, does an increase in the number of districts magnify or dampen the 'last-term effect' associated with the signalling equilibrium, i.e., is $\Phi_k(N) = \widehat{p}^H(N) - p^L(N)$ larger when there are more districts and, *ceteris paribus*, a more serious underlying common pool problem? The answer is not straight forward. This is because an increase in N affects both the amount of pork-barrel spending that last-term legislators bring to their district ($p^L(N)$) and the need to inflate first-term spending to get re-elected ($\widehat{p}^H(N)$). The former effect unambiguously dampens the 'last-term effect' because $p^L(N)$ is increasing in N. The latter effect is ambiguous. To see why, recall that the *least* extra pork a legislator of type L must bring home to get re-elected is defined by the *most* extra pork ($\widehat{p}^H$) a legislator of type H would ever be willing to bring home to get re-elected. $\widehat{p}^H$ is defined by

$$v(\widehat{p}^H) - \frac{\widehat{p}^H}{N} - a^H c(\widehat{p}^H) = (1-\delta)\left(v(p^H) - \frac{p^H}{N}\right) + \delta\left(v(\widehat{p}^H) - \frac{\widehat{p}^H}{N}\right) - M_2. \quad (15)$$

An increase in N has two effects on $\widehat{p}^H$ which work in opposite directions. On the one hand, an increase in N reduces the cost for legislators of type H to pretend to be of type L. This is because there are more districts to share the tax cost of the extra spending required and, as a consequence, the left-hand side of equation (15) is larger for a given $\widehat{p}^H$. This, *ceteris paribus*, makes legislators of type H more eager to mimic and thus $\widehat{p}^H$ increases. On the other hand, the expected payoff as an ordinary voter, represented by the right hand side of equation (15), also increases in N and for the same reason: there are more districts to share the tax cost of any given spending level. This reduces the incentive to mimic and thus $\widehat{p}^H$ decreases. The next proposition provides a mild sufficient condition that ensures that the 'last-term effect' is smaller in a larger legislature.

Proposition 4 *(Interaction between the Law of 1/N and the 'last-term effect'). Assume that $v''' = c''' = 0$. The 'last-term effect' is smaller when there are more legislative districts,* *i.e.,*

$$\frac{\partial \Phi_k}{\partial N} < 0 \tag{16}$$

for $M > M_S$.

An increase in the number of districts tends to moderate the 'last-term effect'. Although, electoral incentives magnify the underlying common pool problem in general, they do so less in societies where the common pool problem is already large, i.e. where the number of districts is large.

A sufficient condition for this to be true is that the *rate* at which the marginal benefit of spending falls and the *rate* at which the marginal effort cost increases do not vary with the level of spending, i.e., the second derivatives of $v(.)$ and $c(.)$ are constant over the relevant range from p^H to $\widehat{p}^H$. This guarantees that the direct effect of the Law of 1/N on the 'last-term effect' coming from the increase in p^L dominates any indirect effects coming from the effect of N on $\widehat{p}^H$. We stress that the condition is a sufficient condition; that is, $\frac{\partial \Phi_k}{\partial N} < 0$ holds even if v''' and c''' are different from zero, as long as they are not extremely large in absolute value.

Proposition 4 delivers the second testable prediction of that model that we take to the data. In fact, one way to look at the proposition is that it suggests a new, indirect test of the Law of 1/N.

3 Data

Our empirical evidence comes from seven US state Houses of Representatives. We study the effect of electoral incentives faced by state legislators on the allocation of state funding to their districts using the variation in incentives generated by term limits. To do this, we join together three types of data:

1. Data on individual state legislators elected to the state House of Representatives in each state.

2. Data on the term limit policies of each state House.

3. Data on the allocation of state spending across legislative districts within each state.

In this section, we discuss these data in more detail.

During the 1990s, twenty one US states introduced limits on how long individual legislators can serve in their state legislatures.[25] We focus on seven of these states during the period 1993 to 2004.[26] The states are Arizona, Colorado, Louisiana, Missouri, Ohio, Oklahoma and

[25] Six of these subsequently repealed these term limits.

[26] For Louisiana the data cover 1992-2005.

South Dakota.[27,28] For each of the seven states, we gather data on the representatives who served in the state House during the sample period. These data are constructed from state legislative election results available in the State Elections Database by Carsey et al. (2008), and complemented with information from state legislative rosters, election records, and state government almanacs. The dataset covers 1,574 legislators, representing approximately 600 legislative districts. The length of service varies from 1 year to 35 years, with an average of just over 9 years. The legislators in the sample are equally split between Republicans and Democrats.

Table 1 reports the number of state legislators in the sample, broken down by state. The table also records when legislative term limits were adopted in the seven states, and when they became binding for the first time. Using this and the information on when each legislator was first elected into the House, we calculate the year in which the term limit becomes binding for each legislator. There are 328 legislators who served for the maximum number of terms and thus were forced to step down because of the term limit.

<Table 1: State Houses of Representatives and term limits in the seven states>

The major challenge is to estimate the amounts of money allocated from the state budget to individual legislative districts, i.e., to estimate pork-barrel spending within each state. We do so by tracing transfers from the state budgets to local government units (municipalities, counties, school districts etc.), and then by matching these local government units to the legislative districts in which they reside. In the remainder of this section, we explain in more detail how we do this, discuss the merits and limitations of our approach, and present some descriptive statistics. Appendix B contains a more detailed exposition of the method that we used to match state spending to legislative districts and lists all the sources we have drawn upon.

3.1 Matching Spending to Legislative Districts

The US Census Bureau collects annual data on the fiscal accounts of all local government units within each state. These data, which include transfers from the state budget to local government units, are reported in the State and Local Government Finance (SLGF) database and in the Public Elementary–Secondary Education Finance (PESEF) database. The local government units represent counties, municipalities, school districts and special districts (water districts, library districts, housing development agencies etc.).[29]

[27] These states represent three out of four regions of the USA: Midwest, South and West, and contain 12% of the US population.

[28] Of the fifteen states that currently have legislative term limits, the remaining eight are not in our sample because data on geographical boundaries of their legislative districts were not available (California, Florida, Maine, Montana, Michigan, and Arkansas), because the term limits were not binding during the period we consider (Nevada) or because they do not have a House of Representatives (Nebraska).

[29] The US Census Bureau operates with a fifth category: townships. Geographical boundary data are not available for townships. Therefore, we could not match them to legislative districts. For that reason, townships are not included in the analysis. The share of total state transfers allocated through townships is negligible.

The transfers from the state budget are, typically, allocated to these local government units to help fund specific categories of services. Using the SLGF database's disaggregation of items, we distinguish among nine categories of transfers. These categories are education, health and hospitals, highways, housing and community development, public welfare, utilities (water supply, gas supply, electric power, and sewerage), public mass transit systems, general local government support, and 'all other' (US Census Bureau, 2006). For state transfers to school districts, the PESEF database goes one step further and makes a very useful distinction between transfers governed by a pre-specified formula, typically based on enrollment numbers, and transfers that are not governed by such rules.

We match the geographical location of the local government units that receive transfers from the state budget to the geographical location of the state legislative districts. This is done by inputting the geographical boundary data provided by the US Census Bureau Topologically Integrated Geographic Encoding and Referencing System (TIGER) into custom-written software that calculates the area overlaps between each local government unit and legislative district pair. State legislative boundaries were redrawn following the decennial Census in year 2000. We account for this by generating two sets of matches, with old and new legislative boundaries, and then use the appropriate match.

Smaller local government units, such as most municipalities, are located within a single legislative district in their entirety. In these cases, we allocate the total transfer from the state budget to that local government unit to the legislative district within which it resides. On the other hand, larger local government units, e.g., school districts and counties, often straddle two or more legislative districts. In such cases, we attribute a share of the transfers to each legislative district. The share is equal to the percentage area overlap between the jurisdiction of each local government unit and the legislative district. Adding up all these shares provides an estimate of the total transfer from the state budget to each legislative district in each year. This is our estimate of pork-barrel spending.

3.2 Merits and Limitations

The main advantage of our matching approach is that it delivers an estimate of state budget transfers to each of about 600 legislative districts across seven states. We are not aware of other work that does this on a similar scale.[30] The closest predecessor is the work by Ansolabehere and Snyder (2006). They draw upon the same US Census Bureau data as us, but focus on spending allocated to counties and do not attempt to allocate these state transfers to individual legislative districts. Our approach, in contrast, generates information on the geographical allocation of spending across legislative districts and does so for a broader range of transfers, including significant transfers to school districts.

[30] Thompson (1986) and Thompson and Moncrief (1988) study allocation of pork-barrel spending across legislative districts in North Carolina. Their focus is on a narrow group of projects which flow through special appropriation bills and account for less than one percent of the total state budget. Although their analysis confirms that distributive politics is important, their sample is too small to make statistical inferences based on it.

At the same time, our approach clearly has limitations. The main limitation is that our estimate of district-specific pork-barrel spending is noisy. What we ideally would like to quantify is the pork-barrel that a legislator manages, through his effort and skill, to channel to his district from the state budget and which would not come to the district in the absence of the legislator's actions. This is inherently unobserved and can only be measured with error. There are two broad categories of errors and they go in opposite directions.

First, our estimate might not capture all of the pork-barrel that a legislator procures for his district. In our sample, the transfers from the state budget to local government units constitute just over a quarter of all state spending.[31,32] The rest is, then, spent on goods and services procured by the state government directly from the private sector or from non-governmental organizations and not channeled through local government units. Some of this spending is on items with geographically diffuse benefits, but a proportion must be on items that benefit particular legislative districts and, therefore, should be counted as pork-barrel. For example, if a state builds a state prison in one of the districts, then the local population benefits from more jobs even though this is not reflected in the accounts of any local government unit and thus not included in our estimate of pork-barrel. It is, therefore, clear that our estimate leaves out some types of pork and can, in this sense, be considered a lower bound on the amount of pork-barrel spending. At the same time, Gosling (1985) argues that state legislators predominately use spending that goes through local government units to 'bring back the pork', and, so we stress that the portion of pork that our estimate does capture is likely to be politically salient.

Second, our estimate might include some spending that would accrue to a district regardless of the effort exerted by the legislator representing it and which should, therefore, not be considered pork-barrel. It is notoriously difficult to obtain direct and systematic evidence on how much of a hand particular legislators have in securing funds for their districts. Here, we make two observations. Firstly, transfers that accrue to a district (through local government units) without the legislator's involvement will work against us finding evidence of a 'last-term effect'. In the limit, if legislators cannot influence the spending allocation at all, then there should not be any systematic patterns in our measure of district-specific spending over their legislative life-cycle. Secondly, we make a distinction between categories of transfers over which individual legislators are likely to have no or little influence, such as school formula spending, and categories of spending over which it is more plausible, *a priori*, that individual legislators can exert some influence. We expect to find a smaller effect of electoral incentives amongst items in the first category compared to the second. This provides a reality check on the reliability of our estimate of pork.

In addition to these general issues, the matching procedure itself rests on two particular assumptions. First, it presumes that the geographical boundaries of a local government unit

[31] This is net of spending on state government administration.

[32] To put this figure into perspective, we might notice that the transfers from the state budget account for approximately one third of all spending by local government units and is similar to the proportion accounted for by local taxes. Put differently, the transfers from the state budgets of the seven states to local government units are of a similar magnitude to the transfers that these state governments receive from the federal government.

(say, a county or a school district) define the citizens who benefit from the state spending channeled through that unit. In many instances (e.g., for spending on schools within a school district) this approximates reality closely, but in others (e.g., for spending on roads) the presumption is more doubtful. Second, our matching algorithm assumes that the benefits of the services funded by state transfers are spread evenly across the geographical area to which they are allocated. Violations of these two assumptions lead to errors similar to the ones discussed above: we may attribute either too much or too little to a particular legislative district, although now this is because we might mis-attribute the benefits across districts.

To summarize, our estimate of district-specific spending may over- or under-estimate the pork that particular legislators manage to bring back to their district. However, this noise is most unlikely to be a source of bias in our test of the 'last-term effect' and the Law of 1/N. As we discuss in more detail in section 4, we use term limits to generate variation in electoral incentives. When they become binding for a particular legislator is exogenous with respect to that legislator's past performance. It is, therefore, most unlikely that the error with which we measure pork-barrel spending is correlated with whether the legislator, who represents the receiving district and who serves the maximum allowed term, is in his last term or not.

3.3 Descriptive Statistics

Table 2 reports summary statistics for the estimates of the transfers to legislative districts in each of the seven states. On average, a district receives US$400 per capita (in 1984 dollars) from the state budget, but there is significant variation across states, and large variation within states across legislative districts.[33] The real value of the transfers, averaged across all districts and states, rose steadily over the course of the sample period, from $326 per capita in 1992 to $466 per capita in 2005.

<Table 2: Total transfers from the state budget to legislative districts>

Table 3 shows the breakdown of transfers from the state budget to legislative districts by the purpose for which they are intended. We make a distinction between two main categories of transfers. The first category, which we refer to as 'non-discretionary transfers', collects those transfers that are allocated according to some pre-specified formula or rule. This includes all transfers to the school districts that in the PESEF database are classified as following a formula[34], welfare payments, such as unemployment benefits, and transfers to utilities. The second category, which we refer to as 'discretionary transfers', collects the rest of the transfers, which are not, as far as we can tell, allocated according to fixed rules. This includes non-formula education spending, spending on highways, health, transport subsidies,

[33] We note that our geographical matching method overstates this variation relative to its true (unobserved) value.

[34] For more information on the use of school formula in the US states, see Verstegen and Jordan (2009).

housing, and local government support.[35] We believe that 'non-discretionary transfers' are more likely to be outside a legislator's control than 'discretionary transfers'.

<Table 3: Breakdown of transfers to legislative districts by transfer type>

From table 3, we notice that elementary and secondary education receive the largest per capita transfers, followed by local government support and spending on highways. Importantly, 87 percent of all state spending on elementary and secondary education is channelled through the school districts and can, therefore, be geographically attributed using our matching approach. For the other categories, such as spending on utilities, the share of direct state provision is much higher and the bulk of state spending in these categories cannot be attributed to particular legislative districts. There is a lot of variation within each type. The variation is highest for discretionary transfers, with a coefficient of variation that is twice that of non-discretionary transfers.

4 A Test of the 'Last-term Effect'

In this section, we discuss the evidence on the 'last-term effect' amongst state legislators in the seven US states. In section 5, we discuss the test of the Law of 1/N.

4.1 Identification

The main testable prediction of our model is that a representative who serves his last term allowed under the state's term limit rules will bring less transfers to his district than he did in previous terms when he could seek re-election. To examine this prediction, we estimate the following equation

$$y_{ijt} = \gamma(last\ term)_{ijt} + \boldsymbol{\alpha}'\mathbf{x}_{ijt} + \varepsilon_{ijt}, \tag{17}$$

where i denotes a legislator, j a state, and t a year. The variable y_{ijt} denotes the estimate of the (real) per capita transfer to the district of legislator i from the state budget in state j in year t. The variable *last term* is a dummy variable that takes on the value of one if a legislator is in his last allowed term under the state's term limit laws. The vector $\mathbf{x}$ collects various fixed effects and other controls that we discuss in more detail below, and ε_{ijt} is the error term. We are interested in the sign of γ. Our model predicts that $\gamma \leq 0$ and is rejected if $\gamma > 0$.

We now elaborate on how we identify the effect of electoral incentives on pork-barrel spending and compare our identification strategy to that used in previous empirical work on the subject. To this end, it is useful to consider a simple example, illustrated in Figure 1, with two districts A and B in a state that allows a maximum of four two year terms. In

[35] We experimented with allocating utilities to either group, and our results remain unaffected by this. We report the results with utilities included as non-discretionary transfers.

the period between 1991 and 2003, district A first elects Stanley, who serves for two terms, and then looses to Blanche. Blanche is re-elected subsequently every time until she reaches the maximum of four two year terms and is forced to step down in 2003. In district B, representative Mitch is first elected in 1991 and is re-elected every time until he has served the maximum of four two year terms and is forced to step down in 1999. He is replaced by Stella in 1999, who is re-elected once, and then decides not to stand for election in 2003. In the example, our main independent variable *last term* is equal to one in district A in 2001 and 2002 (during Blanche's last two years in office) and in district B in 1997 and 1998 (during Mitch's last two years in office). It is equal to zero in all other cases.

The most naive approach to identification of the effect of electoral incentives on district-specific transfers from the state budget is to compare $E(y_{ijt}|last\ term = 1)$ to $E(y_{ijt}|last\ term = 0)$. This involves a comparison across districts A and B. Clearly, the demographic, economic, and political characteristics differ across districts and this may cause voters in different districts to prefer or need different levels of spending. Moreover, these characteristics are often correlated with the nature of politics in the district and may, therefore, affect the probability that a legislator 'survives' to the term limit. For this reason, it is difficult, if not impossible, to obtain an unbiased estimate of the 'last-term effect' from between-district comparisons of this sort. District fixed effects partly address this problem by limiting inference to within-district differences. This is the approach followed by Besley and Case (1995) in their work on gubernatorial term limits, electoral incentives and aggregate state spending.[36]

Basing inference solely on within-district variation eliminates some important sources of bias, but not all. To see this, let us return to the example in Figure 1. In this example, a within-district comparison includes the comparison of the state transfers that Stanley brings to those that Blanche brings. This contaminates the estimate of the 'last-term effect' because Blanche, who survives for the maximum allowed number of terms, and Stanley, who is voted out after the first term, are likely to be systematically different in their capacity to secure funds for the district. To illustrate, suppose that our model is the true data generating process. In equilibrium, the average transfer secured by legislators who survives till the last term is higher than that of the rest. This is because only 'effective' legislators of type L (in the example, Blanche) will ever reach the term limit, while 'ineffective' legislators of type H (in the example, Stanley) get systematically deselected. This mechanism biases the estimate of γ upwards and makes it impossible to identify the incentive effect of elections separately from the selection effect.

In their recent work on corruption in Brazil, Ferraz and Finan (2011) propose a way around this selection problem. Paraphrased within the context of our example, their proposal is to limit the sample to legislators like Blanche and Mitch who are re-elected for the maximum number of terms. This eliminates the selection problem (again, according to our theory, both would be of type L) and produces an unbiased estimate of the incentive effect *if* Blanche's first three terms are a good counterfactual for what Mitch's first three terms

[36]To be precise, Besley and Case (1995) study the behavior of state governors and use a design with state fixed effects to identify the 'last-term effect'. Their state fixed effects play the same role as district fixed effects in our context.

would have been like. This assumption is easier to defend in some contexts than in others. First, if the number of legislators per district is small (as is the case in our data), then district fixed effects cannot be used with this strategy. Therefore, this strategy necessitates not only comparison across legislators within a district but also across districts. We have already discussed the drawbacks of such comparisons above. Second, even if the approach deals with 'selection into survival', the legislators who get re-elected till the term limit binds may still differ systematically in ways that bias the estimate of the 'last-term effect'. For instance, if there are systematic cohort effects, then, even if Blanche and Mitch happened to have been elected in the same district, Blanche's first three terms would not be a good counterfactual for Mitch's. In the context of our sample of US state legislators, such cohort effects are likely to be important. Recall that we study the state legislatures during the period when legislative term limits are first introduced. One of the widely accepted rationales for term limits is that they induces a (desirable) change in the type of candidates willing to run for office (see, for instance, Cato Institute (1996)). Insofar as this actually happened, the pool of legislators would change systematically within our sample period. This implies that legislators from different cohorts cannot readily be compared to each other, and, within our setting, any attempt to estimate the incentive effect of elections by comparisons across legislators is likely to confound cohort effects with incentive effects.

The richness of our data, however, allows for a different and, we argue, more appropriate identification strategy. Since we have a decent number of observations for each term limited legislator (up to 12 years), we can identify the effect of electoral incentives by using only within-legislator variation. This is achieved by including legislator fixed effects into equation (17). By doing so, the last term served by a legislator is only compared to the earlier terms of that *same* legislator, i.e., returning to the example of Figure 1, the transfers that Blanche secured in 2001 and 2002 are compared to the transfers she herself secured district A between 1995 and 2000. This addresses the selection problem head on without inviting systematic biases from differences across districts, legislators, or cohorts. Moreover, the main prediction of our model regarding electoral incentives in proposition 3 concerns precisely such a comparison. This provides another rationale for our choice of identification strategy.

In addition to legislator fixed effects, we also take into account that all the districts in a state are affected by common (fiscal) shocks or trends. We do this by controlling for state-specific year effects in all our estimations.

To summarize our identification strategy, we estimate the effect of electoral incentives using term limits in a specification that includes legislator fixed effects and state-specific year effects. The latter implies that we compare the transfer that a particular legislator brings to his district to the amount received by an average district in that state in that year. The former implies that we identify the 'last-term effect' by comparing the amount of transfers that the legislator brought to his district (relative to what an average district got in that year in that state) in the legislator's last term to that he brought to the district in previous terms when electoral incentives were still operating.

There are two additional issues that deserve comment before we discuss the estimation results. Firstly, the analysis is predicated on the assumption that the term limit rules generate exogenous variation in electoral incentives. The fact that term limits were introduced during the sample period might raise concerns that the decision to adopt these limits could have been driven by the same unobserved factors that drove budget allocations. While this would clearly be a major concern in the context of cross-state comparisons, all we need to assume within our research design with legislator fixed and state-specific year effects is that the timing of when the term limit becomes binding for individual legislators is (conditionally) uncorrelated with the legislative choices made by those particular legislators. We think this is a very plausible assumption to make. Secondly, while our identification strategy effectively deals with state-specific over time fluctuations in spending and with the concern that those legislators who 'survive' to the term limit are systematically different from those who do not, the estimate of the 'last-term effect' could be biased if time varying unobserved factors for individual legislators are important. One particular concern is learning-by-doing or experience effects. Such effects would imply that the transfer that a particular legislator secures for his district may increase with years of service. Although we cannot rule experience effects out, we stress that they work against us finding a negative 'last-term effect'.

4.2 Evidence

We present the evidence on the incentive effect of elections in four sub-sections. The main results are presented in the next sub-section. The following sub-section investigates party differences while the third sub-section discusses some robustness checks. In the last sub-section, we present some additional evidence on the 'last-term effect' in the absence of term limits.

4.2.1 Main Results

Table 4 reports our headline estimates of the incentive effect of elections using the variation in electoral incentives due to legislative term limits in the specification with legislator fixed effects and state-specific time effects.[37] The first column reports the result for total per capita transfers to each legislative district. We see that the transfer falls during a legislator's last term relative to previous terms served by that same legislator, and that this effect is significant at the five percent level. On average, the total transfer falls by $14 per capita in a legislator's last term. This corresponds to a 3.5 percent fall in the average district.

In the second column, we report the results when we restrict attention to education spending. As noted in the discussion above, transfers for primary and secondary education are targeted at well-defined geographical areas (school districts) and constitute the largest component of total state transfers. It is, therefore, of special interest to look for a 'last-term effect' for this sub-category. We observe a statistically significant fall in education transfers in the last term of a legislator in the order of $10 per capita.

[37] Some districts are represented by more than one legislator. In these cases, we matched each legislator with the total transfer to the district. For this reason, we cluster at district-year level when estimating all standard errors.

In columns 3 and 4, we report the results for discretionary and non-discretionary transfers separately. Conceptually, we conjecture that the 'last-term effect' is present only for spending items over which we can reasonably assume that legislators have (some) discretion as opposed to items which are based on pre-specified formulas. In line with this conjecture, we find that discretionary transfers fall in a legislator's last term (column 3), while the effect is insignificant for non-discretionary transfers (column 4). The magnitude of the effect for discretionary transfers is about $10 per capita. Overall, these estimates are consistent with the main prediction of the model. They suggest that electoral incentives induce a tendency for overspending early in a legislator's career when re-election incentives are still important.

[Table 4: Test of the 'last-term effect': The main results]

4.2.2 The Role of Political Parties

Parties play an important role in US politics. At the heart of much existing analysis of party politics, at least in the political economics literature, is the conflict between the party that is interested in the total share of seats and individual legislators who are interested in their own seat only (see, e.g., Grossman and Helpman (2006)). The degree to which individual legislators will toe the party line depends on the party's internal system of incentives and governance, and is often referred to in the literature as 'party discipline' (see, e.g., Alesina and Spear (1988) or Dhami (2003)). Strong party discipline may mitigate the effect of electoral incentives for individual legislators (for instance, the incentive to acquire pork at the expense of other districts in situations where the party may want to strengthen its general support in the state). There is a body of empirical work documenting cross-party differences that suggests that the Republican Party tends to be more disciplined in this sense than the Democratic Party (see, e.g., McGillivray (1997), Besley and Case (1995), and Knight (2005)).

To investigate if a similar difference exists at the level of individual state legislators, we allow for the possibility that electoral incentives operate differently across Democrats and Republicans. Specifically, we introduce three dummy variables into specification (17): one dummy variable for whether a legislator is a Democrat or not (*Democrat*)[38] and two dummy variables that are equal to one if a Democrat or a Republican, respectively, is in his last term (*Last term, Democrat (Republican)*). The results are reported in Table 5.

[Table 5. Test of the 'last-term effect': Democrats versus Republicans]

We see that the 'last-term effect' is only significant among Democrats. According to the estimate reported in column 1, they bring about $17 per capita less back to their district when they serve their last term. For education transfers, the estimate is slightly smaller

[38] Since we include legislator fixed effects, the direct effect of party affiliation on the size of the average district transfer (captured by the coefficient on the *Democrat* dummy variable) is identified from legislators who change their party while in office. There are very few such cases, and the coefficient on this variable is insignificant.

(column 2). As before, the 'last-term effect' is associated with discretionary transfers only (columns 3 and 4). This is consistent with previous empirical research that suggests that the Republican Party is more effective at imposing party discipline then the Democrats. In particular, Besley and Case (1995) find among US state governors that the 'last-term effect' is associated only with Democrats, not with Republicans.

4.2.3 District Characteristics

The transfers that legislative districts receive from the state budget are likely to depend on district characteristics, as well as on the behavior of the district's representative. This is particularly clear for spending items which are governed by pre-specified rules based on demographic characteristics, such as the number of school-age children. Our estimations compare earlier and later terms of the same legislator, and so district characteristics that are fixed over time are not contributing to the identification of the 'last-term effect'.[39] Yet, it is possible that districts evolve over time. Omitting district characteristics that change over time and which affect the allocation of pork-barrel spending may bias our estimate of γ if they are also correlated with the timing of a legislator's last term. However, since the timing of a legislator's last term is determined by the year when the legislator was first elected into the House, it is not easy to think of reasons why such a relationship should exist.

Nevertheless, to address this potential concern, we have constructed three time-varying control variables: the proportion of the population over 65, the proportion of children of school-age, and income per capita. These data are not available at the legislative district level on a yearly basis, and so, we constructed them from county data using the same geographical overlap technique that we used to estimate the district-specific transfers. We add these control variables to equation (17). Although in this specification the 'last-term effect' on total spending is no longer significant, a statistically significant negative 'last-term effect' among Democrats persists in education spending. In particular, we observe a fall in education spending in the order of $12 per capita and this result continues to be driven by discretionary rather than formula-based transfers [not reported].[40]

4.2.4 The 'Last-term Effect' in the Absence of Term Limits

Our identification strategy builds on the fact that term limits force legislators to step down and thus create exogenous variation in electoral incentives. One may ask, however, if we could not simply study how the pattern of transfers change when a legislator enters his last term as revealed *ex post*, without making use of term limits. If our model is interpreted literally, then, without term limits, ineffective legislators of type H will be kicked out after their first (and only) term, while effective legislators of type L will be re-elected forever and, in the steady state they will be the only type in the legislature. Of course, in reality we do

[39] This statement is true since virtually no legislator change districts in our sample.

[40] The controls themselves are mostly significant. Districts with more school-age children and lower income per capita get more transfers.

see turnover even in legislatures that do not have term limits. This is so for at least two reasons. Firstly, voters may simply make mistakes and, within the context of our model, re-elect legislators of type H or kick legislators of type L out of office by accident. Secondly, some effective legislators of type L may leave office voluntarily, either because of age or for other private reasons. Turnover associated with random errors in voting will not induce a 'last-term effect'. This is because legislators do not anticipate the outcome of the election. Consequently, if all the turnover that we observe in a legislature without term limits were due to such random events, there should not be any systematic patterns in the flow of funds to a district across the life-cycle of the legislator who represents it. Any 'last-term effect' must, therefore, be due to voluntary retirement. In particular, within the context of our model, a legislator of type L who (privately) decides not to run again will behave as if he were a term-limited legislator. This will induce a fall in the pork flowing to his district during his last term in office compared to his earlier terms. Adding this up, we expect the 'last-term effect' to be weaker amongst legislators who do not face a binding term limit compared to those who do.

We take this to the data in two ways. First, we estimate how pork-barrel spending changes in the last term of legislators who serve in seven state Houses of Representatives that do not have term limits. To do that, we choose seven states without term limits that border the states in our sample (Alabama, Iowa, Illinois, Kansas, North Dakota, New Mexico, and Tennessee – see appendix B for more detail), and construct the same type of district-specific transfer data for these states as for our main sample. We then analyze what happens to the transfer when the legislators in these Houses reach their last term as revealed *ex post*. We use the same research design as above with legislator fixed effects and state-specific time fixed effects. The independent variable (*last term, ex post*) is an indicator variable that takes on the value of one during the last term served by a legislator. Table 6 reports the results. Although the point estimate both for total (column 1) and for discretionary (column 2) transfers are negative, neither are statistically significant. The same is true when we consider the two parties separately.

Second, we estimate the effect of the last term among the legislators who step down *before* they are forced to do so under the term limit laws in our main sample of the states that do have term limits. In this case, the independent variable (*last term, ex post*) takes the value of one during the last term served by a legislator but we limit the sample to the legislators who do not serve the maximum allowed number of terms (i.e., we exclude any legislators who step down because of the term limit). The results, reported in columns 3 and 4 of table 6, again, show that there is no statistically significant 'last-term effect' among these legislators. This conclusion does not change if we allow the effect to vary by party.

We believe that these (negative) results illustrate the importance of using an exogenous source of variation in electoral incentives, such as term limits, to estimate the impact of electoral incentives on the behavior of legislators. The point is not only that this variation is exogenous with respect of the legislative history of individual legislators, but also that incentives change steeply at the point in time when the term limit binds and the reason for stepping down is unambiguous.

[Table 6. A 'last-term effect' without term limits]

5 A New Test of the Law of 1/N

The Law of 1/N – stating that the tendency to overspend is more pronounced in larger legislatures – has been subject to intense empirical scrutiny. Most investigations center on a relationship between the number of districts (or the size of the decision making body more generally) and total spending. The evidence from across US states, US cities, and cross-national samples of countries is broadly supportive of the Law.[41] A major challenge with such tests is that the size of the legislature and government spending are likely to be jointly determined by third factors; put differently, it is often difficult to find sufficient exogenous variation in the size of the legislature to have confidence in the results (see the discussion in Pettersson-Lidbom (2008)). Another limitation of these tests is their focus on aggregate spending, despite the fact that the underlying theory of distributive politics is concerned with how pork-barrel is allocated to particular geographically designated constituencies. The implication of the Law of 1/N for aggregate spending is a by-product of this process. Thus, tests that look at aggregate spending do not shed much light on whether the underlying mechanism through which the total spending is inflated is, in fact, consistent with the distributive politics model. Doing so requires data on the amount of pork that flow to particular districts.

Our data allow us to study such flows and to conduct a new test of the Law of 1/N that explores the interaction between electoral incentives, the distribution of pork-barrel spending and the size of the legislature. The test is inspired by the theory developed in section 2. Recall that proposition 4 suggests that the 'last-term effect' is smaller in absolute magnitude in states with a large legislature and that this dampening effect is a direct consequence of the Law of 1/N.

To take this prediction to the data, we explore the variation in the size of Houses of Representatives in our sample, from Arizona with 30 districts to Missouri with 163 districts (see table 1). We augment the baseline specification from equation (17) with an interaction term between the indicator variable for the last term of the term limited legislators (*last term*) and the number of legislative districts (*number of districts*) and test if the coefficient on this interaction term is positive or not. This test is not plagued by the same problems of endogeneity as the tests that use cross-state variation in the number of districts to estimate the effect on total state spending.[42] The identification comes from the interaction between

[41] See e.g., Gilligan and Matsuska (1995), Bradbury and Cain (2001), Baqir (2002), Bradbury and Stephenson (2003) and Primo (2006). Chen and Malhotra (2007) demonstrate how the effect is conditional on the level at which spending can be targeted. Pettersson-Lidbom (2008) finds evidence that contradicts the Law. He uses a discontinuity design and data from Swedish and Finish municipalities to estimate the causal effect of an increase in council size on total spending and finds that it is negative.

[42] Brooks et al. (2011) also propose an indirect test of the Law of 1/N. They study a sample of US cities and make use of the fact that block grants from the federal government provide exogenous variation in city revenues. They use this to study the effect of council size on the responsiveness to extra revenues. They

a fixed number of districts within each state and individual legislatures being up against the term limit. As long as the (historical) choice of number of districts is not correlated with some unobservable variable that is also correlated with whether a particular legislator is up against the term limit, the estimate of the impact of the number of districts on the size of the 'last-term effect' is unbiased.

The results reported in table 7 show that the 'last-term effect' is smaller (less negative) for larger legislatures. The coefficient on the interaction term is positive and statistically significant at the ten percent level when we look at total transfers per capita to a district and at the five percent level when we look at discretionary transfers alone.[43] Once again, we find no effect for non-discretionary transfers. This is consistent with our model and provides strong, albeit indirect, evidence in support of the Law of 1/N. To get a sense of the quantitative importance of House size on electoral incentives, we note that the 'last-term effect' on discretionary transfers is equal to $21 per capita in the smallest of the states, Arizona. In Ohio with a medium sized House of Representatives, the effect is approximately $9 per capita, while in Missouri with the largest number of districts, it is almost zero.

[Table 7. The number of districts and the 'last-term effect']

6 Conclusion

Most rational choice models of politics are predicated on the assumption that electoral incentives matter for the behavior of politicians. This paper contributes fresh empirical evidence that this basic assumption also applies at the level of individual legislators. It studies the role of electoral incentives in a context with many legislators each representing their own constituency. This is in contrast to much of the existing literature which focuses on the relationship between a single politician and his electorate, and which shows that electoral incentives typically improve welfare by alleviating the agency problem between politicians and their voters. We argue that in the context of distributive politics, electoral incentives acquire a different and somewhat darker role. They do so by inducing politicians to pursue parochial interests and thus potentially aggravating the underlying common pool problem.

We use the variation in electoral incentives generated by legislative term limits in seven US states to estimate how these incentives affect the allocation of the state budget. Exploring a rich, new dataset on the flows of state funding to about 600 legislative district, we find strong evidence that legislators bring less pork back to their district when they can no longer run for re-election. The magnitude of this 'last-term effect' is a 3.5 percent fall in the total per capita transfer to the district during the legislators last term. Put the other way around, this

find indirect evidence of the Law of 1/N in that larger city councils tend to spend a larger fraction of these block grants.

[43] We have experimented with a number of alternative definitions of House size, including the number of legislators, and with using district size instead of number of districts. Qualitatively, the results are unchanged [not reported].

shows that electoral incentives encourage legislators to bring extra pork-barrel spending to their district, thus aggravating the underlying common pool problem of distributive politics.

The theoretical literature on legislative bargaining in the tradition of Baron and Ferejohn (1989) suggests that some legislators may be in a better position to bring pork-barrel to their districts than others.[44] We abstract from such differences and our estimate of 'last-term effect' is an average effect of electoral incentives on pork-barrel spending across all term-limited legislators. An important task for future research is to unpack this average and to study the role of asymmetries in the power that legislators hold over the budget allocation and the mechanisms through which such powers get bestowed.

One intriguing aspect of our results on the 'last-term effect' is the strong party differences: we find that Democrats respond to electoral incentives in a way that Republicans do not. One possible interpretation of this is that the Republican Party enforces stronger party discipline. This raises a number of interesting questions for future research about the mechanisms through which parties do that and the extent to which party discipline help alleviate incentive and common pool problems.

The richness of our data allows us to provide a new test of the Law of 1/N. Most existing tests focus on the relationship between the number of districts (or seats) and total spending of the polity under consideration. Our theoretical model implies that the 'last-term effect' should be weaker in states with a large number of districts. We find strong evidence that this is also true empirically. We take this, not only as evidence consistent with our particular model of distributive politics, term limits, and electoral incentives, but, more generally, to add credence to the empirical relevance of the Law of 1/N.

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Appendix A: Proofs

Proof of proposition 1.

Notation With N districts and two types of legislators, there are $N!$ different compositions of the legislature. Let the set of all possible compositions be Σ with elements σ. Let Σ^{-k} be the set of all possible configurations of the legislature consisting of the $N-1$ legislators other than legislator k and let a typical element be σ'. We let ρ_k denote the vote decision of voters in a district k represented by a first-term legislator, with $\rho_k = 1$ if he is re-elected and $\rho_k = 0$ if not. Last-term legislators are, by definition, never re-elected.

We can write the expected utility (as seen from the perspective of period t) of legislator k for period $t+1$ onwards as

$$w_k\left(T, \rho_k\right) + \rho_k M_2 + E_{\sigma'}\left[\tau_k(.)\right] + W_k. \tag{18}$$

The expected utility consists of four terms. The first term, $w_k\left(T, \rho_k\right)$ is the expected utility associated with the pork delivered to his own district in period $t+1$. This depends on his type and on whether or not he is re-elected. The second term represents the ego-rent for period $t+1$ which is only enjoyed if he is re-elected for the second and last term. The third term, $E_{\sigma'}\left[\tau_k(.)\right]$, represents the expected tax cost associated with the pork-barrel given to the $N-1$ other districts during period $t+1$. The realized tax bill, $\tau_k(.)$, for district k at time $t+1$ is independent of whether legislator k is re-elected or not, but depends on the configuration σ' of the rest of legislature (excluding district k) and on what the equilibrium choices of these legislators are. Each configuration σ' arises with a certain probability depending on δ and we take the expectation over this. The final term, W_k, is the payoff from period $t+2$ onwards when legislator k is back in the private sector irrespective of him being re-elected for a second term or not (the term limit binds and he is forced to step down if elected for the second term).

Separating equilibria Assume that there is a ready supply of voters willing to run for office if called upon. We shall verify this assumption below. Let the candidate equilibrium strategy for a first-term legislator of type T be $\widetilde{p}_k^T$ and those for a last-term legislator p^T.

The candidate equilibrium strategies for last-term legislators are optimal for the two types of legislators since there is no re-election concern. Consider the first-term legislator in some district k. Fix the proposed equilibrium strategies of the $N-1$ other legislators, some of whom will be in their first term while others will be in their second, and collect them in the vector p^*_{-k}. These induce a particular tax cost borne by district k, $\tau_k(\sigma', p^*_{-k})$.

Firstly, suppose the first-term legislator of district k is of type H. If he seeks re-election by mimicking the equilibrium strategy of first-term legislators of type L ($\widetilde{p}_k^L$) his payoff is

$$\begin{aligned} & y + v(\widetilde{p}_k^L) - \frac{\widetilde{p}_k^L}{N} - a^H c(\widetilde{p}_k^L) - \tau_k(\sigma', p^*_{-k}) + M_1 \\ & + \left[M_2 + w_k\left(H,1\right) - E_{\sigma'}\left[\tau_k(\sigma', p^*_{-k})\right] + W_k\right], \end{aligned} \tag{19}$$

where $w_k\left(H,1\right) = y + v(p^H) - \frac{p^H}{N} - a^H c(p^H)$ because legislator k will be in office for a second term and will put in the minimum effort to deliver p^H at the personal cost $a^H c(p^H)$. If, on the other hand, he plays his first-term equilibrium strategy $\widetilde{p}_k^H = p^H$ he gets:

$$\begin{aligned} & y + v(p^H) - \frac{p^H}{N} - a^H c(p^H) - \tau_k(\sigma', p^*_{-k}) + M_1 \\ & + \left[w_k\left(H,0\right) - E_{\sigma'}\left[\tau_k(\sigma', p^*_{-k})\right] + W_k\right], \end{aligned} \tag{20}$$

where

$$w_k\left(H,0\right) = y + \delta\left(v(\widetilde{p}_k^L) - \frac{\widetilde{p}_k^L}{N}\right) + (1-\delta)\left(v(p^H) - \frac{p^H}{N}\right) \tag{21}$$

because if he is replaced by a legislator of type L that legislator will be in his first term and, in equilibrium, deliver $\widetilde{p}_k^L$, while if he is replaced by a legislator of type H, the equilibrium amount of pork delivered to the district will be p^H. Comparing and rearranging these two equations yield the following restriction on $\widetilde{p}_k^L$:

$$\begin{aligned} v(\widetilde{p}_k^L) - \frac{\widetilde{p}_k^L}{N} - a^L c(\widetilde{p}_k^L) \;\; & \leq \;\; (1-\delta)\left(v(p^H) - \frac{p^H}{N}\right) + \delta\left(v(\widetilde{p}_k^L) - \frac{\widetilde{p}_k^L}{N}\right) \\ & \quad + (a^H - a^L)c(\widetilde{p}_k^L) - M_2 \end{aligned} \tag{22}$$

Denote the largest value of $\widetilde{p}_k^L$ at which this constraint binds by $\widehat{p}^H$. This is the same for all districts because p^H is independent of k. This condition will always be satisfied if it holds for $\widetilde{p}_k^L = p^H$ and in this case, legislators of type H have no incentive to mimic at all. We rule this out by assuming that $M_2 > M_H \equiv a^H c(p^H)$. This guarantees that $\widehat{p}^H > p^H$.

Secondly, consider a first-term legislator of type L. If he plays the proposed equilibrium strategy, $\widetilde{p}_k^L$, to get re-elected, then he gets

$$\begin{aligned} & y + v(\widetilde{p}_k^L) - \frac{\widetilde{p}_k^L}{N} - a^L c(\widetilde{p}_k^L) - \tau_k(\sigma', p_{-k}^*) + M_1 \\ & + \left[M_2 + w_k\left(L, 1\right) - E_{\sigma'}\left[\tau_k(\sigma', p_{-k}^*)\right] + W_k \right], \end{aligned} \tag{23}$$

where $w_k\left(L,1\right) = y + v(p^L) - \frac{p^L}{N} - a^L c(p^L)$. If, on the other hand, he deviates and puts in the minimum effort required to deliver p^L in his first term with the consequence that he is not re-elected, he gets

$$\begin{aligned} & y + v(p^L) - \frac{p^L}{N} - a^L c(p^L) - \tau_k(\sigma', p_{-k}^*) + M_1 \\ & + \left[w_k\left(L, 0\right) + E_{\sigma'}\left[\tau_k(\sigma', p_{-k}^*)\right] + W_k \right], \end{aligned} \tag{24}$$

where

$$w_k\left(L,0\right) = y + \delta\left(v(p^L) - \frac{p^L}{N}\right) + (1-\delta)\left(v(p^H) - \frac{p^H}{N}\right) \tag{25}$$

because the replacement legislator is expected to deliver p^H if he is of type H and p^L if he is of type L (and, therefore, is conjectured to deviate).

Comparing and rearranging these two equations yield the following restriction on $\widetilde{p}_k^L$:

$$\begin{aligned} v(\widetilde{p}_k^L) - \frac{\widetilde{p}_k^L}{N} - a^L c(\widetilde{p}_k^L) \;\; \geq \;\; & (1-\delta)\left(v(p^H) - \frac{p^H}{N}\right) \\ & + \delta\left(v(p^L) - \frac{p^L}{N}\right) - M_2 \end{aligned} \tag{26}$$

We denote the largest value of $\widetilde{p}_k^L$ at which this constraint binds by $\widehat{p}^L$ which we note is the same for all districts. If the second term ego-rent is too low, this condition may fail for all $\widetilde{p}_k^L$ and legislators of type L prefer not to run again. To ensure that legislators of type L always want to seek re-election *if* they could achieve this by putting in the minimum amount of effort and deliver p^L, we assume that $M_2 > M_L$ where

$$M_L \equiv a^L c(p^L) + (1-\delta)\left[(v(p^H) - \frac{p^H}{N}) - (v\left(p^L\right) - \frac{p^L}{N}) \right]. \tag{27}$$

This guarantees that $\widehat{p}^L > p^L$. To establish that $\widehat{p}^L > \widehat{p}^H$, we can calculate the difference between the right-hand sides of inequalities (26) and (22):

$$\delta\left(v(p^L)-\frac{p^L}{N}\right)-\delta\left(v(\widetilde{p}_k^L)-\frac{\widetilde{p}_k^L}{N}\right)-\left(a^H-a^L\right)c(\widetilde{p}_k^L)<0 \tag{28}$$

for $M_2 > M_L$. We note that $v(\widetilde{p}_k^L)-\frac{\widetilde{p}_k^L}{N}-a^Lc(\widetilde{p}_k^L)$ is decreasing in $\widetilde{p}_k^L$ for $\widetilde{p}_k^L \geq p^L$. As a consequence all $\widetilde{p}_k^L \in \left[\widehat{p}^H, \widehat{p}^L\right]$ will generate separation. Given that, Bayes rule requires that the voters of district k believe that their incumbent is of type L if $p_k = \widetilde{p}_k^L$ and of type H if $p_k = p^H$. It is, therefore, a best response for voters in district k to re-elect if $p_k = \widetilde{p}_k^L$ and not to re-elect if $p_k = p^H$.

Equilibrium Refinements We can reduce the set of separating equilibria to a singleton if we impose the restriction known as elimination of weakly dominated strategies on voters' out-of-equilibrium beliefs. By dominated we mean deviations that yield a lower overall payoff to a legislator than his equilibrium payoff irrespective of how he privately thinks voters will revise their beliefs after such a deviation. It is clear that all p_k in $\left[\widehat{p}^H, \widehat{p}^L\right]$ are dominated for type H and so, it is reasonable to suppose that voters, should they observe a deviation within this range, would conclude that the legislator behind the deviation could not have been of type H. With this restriction in place, a first-term legislator of type L can pick his most-preferred separating strategy from the set $\left[\widehat{p}^H, \widehat{p}^L\right]$, i.e., the spending level that is least costly: $\max\{\widehat{p}^H, p^L\}$. This is the unique undominated separating equilibrium. The additional restriction on out-of-equilibrium beliefs that we need is that any deviation to a $p_k \notin \left[\widehat{p}^H, \widehat{p}^L\right]$ must in the eyes of voters have been generated by type H.

Signalling or separating equilibrium Whether the undominated separating equilibrium is a signalling or screening equilibrium depends on whether or not condition (22) holds at $\widetilde{p}_k^L = p^L$. If it does, then $\max\{\widehat{p}^H, p^L\} = p^L$ and the screening equilibrium applies; if not, then $\max\{\widehat{p}^H, p^L\} = \widehat{p}^H$ and the signalling equilibrium applies. Evaluating condition (22) at $\widetilde{p}_k^L = p^L$, we see that it does not bind for $M_2 > M_S$ where M_S is defined as

$$M_S \equiv a^Hc(p^L)+(1-\delta)\left[(v(p^H)-\frac{p^H}{N})-(v\left(p^L\right)-\frac{p^L}{N})\right]. \tag{29}$$

Clearly, $M_S > \max\{M_L, M_H\}$ because $a^H > a^L$ and because $p^L > p^H$. So for $M_2 > M_S$, $\widetilde{p}_k^L = \widehat{p}^H$ and for $M_2 \in [\max\{M_L, M_H\}, M_S]$, $\widetilde{p}_k^L = p^L$. We note that if M is larger than

$$M_y \equiv a^Hc(y)+(1-\delta)\left[(v(p^H)-\frac{p^H}{N})-(v\left(y\right)-\frac{y}{N})\right] > M_S \tag{30}$$

then it is impossible within the budget for individual legislators of type L to signal their type and the separating equilibria cannot exist. Consequently, we impose that $M_2 < M_y$.

Voluntary supply of candidates We need to verify that voters want to run for office. We assume that they do not learn their type until they are in office. As a consequence, the decision to accept the call to run is based on a comparison between the expected utility of running (and selecting the type-specific equilibrium effort levels) and not running. The assumption that $M_2 \geq \max\{M_L, M_H\}$ is sufficient to ensure that all types of legislators are willing to run for a second term, conditional on having accepted to serve the first. So, we can focus on finding a condition on the first-term ego-rent that is sufficient to induce a randomly selected citizen to accept to run. Define the expected per-period utility of a voter in district k who is not running as:

$$Eu(p_k) = (1-\delta)\left[v(p^H) - \frac{p^H}{N}\right] + \delta\left[v(\widetilde{p}_k^L) - \frac{\widetilde{p}_k^L}{N}\right]. \tag{31}$$

Now, consider a voter who before he knows his type as a legislator is called upon to run in an open race against another randomly chosen voter from his district. If he runs, (and plays the type-specific equilibrium strategy), he wins with probability $\frac{1}{2}$ and his expected utility is

$$(1-\delta)\left(\frac{1}{2}\left(v(p^H) - \frac{p^H}{N} - a^H c(p^H) + M_1\right) + \frac{1}{2}Eu(p_k)\right) \tag{32}$$

$$+\delta\left(\frac{1}{2}\left(v(\widetilde{p}_k^L) - \frac{\widetilde{p}_k^L}{N} - a^L c(\widetilde{p}_k^L) + M_1\right) + \frac{1}{2}Eu(p_k)\right). \tag{33}$$

If does not run, he expects someone else to run and his payoff is simply $Eu(p_k)$. Evaluating the difference between these two payoffs at $\widetilde{p}_k^L = y$, we conclude that

$$M_1 > (1-\delta)\, a^H c(p^H) + \delta a^L c(y) \tag{34}$$

is sufficient to ensure that any randomly selected citizen will accept the call to run.
Proof of proposition 4. We want to evaluate the sign of

$$\frac{d\widehat{p}^H}{dN} - \frac{dp^L}{dN}. \tag{35}$$

We note that $\frac{dp^L}{dN} = -\frac{1}{D_1}$ where $D_1 = N^2(v''(p^L) - a_L c''(p^L)$. Total differentiation of equation (22) yields

$$\frac{d\widehat{p}^H}{dN} = \frac{a^H c'(p^H)\frac{dp^H}{dN} + \frac{1}{N^2}(p^H - \widehat{p}^H)}{v'(\widehat{p}^H) - \frac{1}{N} - \frac{a^H c'(\widehat{p}^H)}{1-\delta}}. \tag{36}$$

The denominator is negative because $\widehat{p}^H > p^H$. The first term of the nominator is positive, while the second term is negative. We can rewrite the denominator, which we shall refer to as D_2, as

$$\begin{aligned} D_2 &= v'(\widehat{p}^H) - \frac{1}{N} - \frac{a^H c'(\widehat{p}^H)}{1-\delta} \\ &= v'(\widehat{p}^H) - v'(p^H) + a^H c'(p^H) - a^H c'(\widehat{p}^H) - \frac{\delta a^H c'(\widehat{p}^H)}{1-\delta} \end{aligned} \tag{37}$$

since p^H by definition satisfies $v'(p^H) - a^H c'(p^H) - \frac{1}{N} = 0$. Substituting this into equation (35) gives

$$\frac{d\widehat{p}^H}{dN} - \frac{dp^L}{dN} = \frac{1}{D_2 D_1}\left[a^H c'(p^H)\frac{dp^H}{dN}D_1 + \frac{1}{N^2}(p^H - \widehat{p}^H)D_1 + D_2\right]. \tag{38}$$

A sufficient condition for this to be negative is that $\frac{1}{N^2}(p^H - \widehat{p}^H)D_1 + D_2 \leq 0$. Expanding this expression using the definitions of D_1 and D_2 gives

$$\begin{aligned} & -(\widehat{p}^H - p^H)(v''(p^L) - a^L c''(p^L)) + \\ & v'(\widehat{p}^H) - v'(p^H) + a^H c'(p^H) - a^H c'(\widehat{p}^H) - \frac{\delta a^H c'(\widehat{p}^H)}{1-\delta} \\ = \quad & \\ & -(\widehat{p}^H - p^H)v''(p^L) + \left(v'(\widehat{p}^H) - v'(p^H)\right) \\ & +a^H \left((\widehat{p}^H - p^H)c''(p^L) - \left(c'(\widehat{p}^H) - c'(p^H)\right)\right) \\ & -\frac{\delta a^H c'(\widehat{p}^H)}{1-\delta} + (\widehat{p}^H - p^H)\left(a^L - a^H\right)c''(p^L). \end{aligned} \tag{39}$$

Under the assumption that the $v''' = 0$ and $c''' = 0$, this reduces to

$$-\frac{\delta a^H c'(\widehat{p}^H)}{1-\delta} + (\widehat{p}^H - p^H)\left(a^L - a^H\right)c''(p^L) < 0 \tag{40}$$

and we conclude that a sufficient condition for $\frac{d\widehat{p}^H}{dN} - \frac{dp^L}{dN} < 0$ is that $v''' = 0$ and $c''' = 0$.

Appendix B: Data

This appendix provides a detailed description of the sources of our dataset and how we constructed it from these sources. The description follows this outline:

B1. List of data sources
B2. Transfers
B3. Legislators

B1. List of data sources

1. Transfers from the state budget to local government units.

   (a) Counties, municipalities, townships and special districts: US Census Bureau, State and Local Government Finances (SLGF), Individual Unit Files, 1992–2006 (http://www.census.gov/govs/estimate/).

   (b) School districts: US Census Bureau, Public Elementary-Secondary Education Finance Data (PESEF), 1992–2006 (http://www.census.gov/govs/school/).

2. Legislators: The State Elections Database (Carsey et al. (2008)) supplemented by state legislative rosters, election records and almanacs of US state governments (either available on-line or received by approaching state legislatures).

3. Term limits: National Conference of State Legislatures (http://www.ncsl.org/).

4. Control variables: US Census Bureau, USA Counties (http://censtats.census.gov /usa/usa.shtml).

5. Geographical coverage of local government units:

   (a) Counties, municipalities and townships: US Census Bureau, State and Local Government Finances (SLGF), Directory Information Files, 1992–2006 (http://www.census.gov /govs/estimate/) and US Census Bureau, Government Integrated Directory, 1992, 1997 and 2002 (http://www.census.gov/govs/go /historical_data.html).

   (b) Special districts: US Census Bureau, 2002 Census of Governments, Government Organization Public Use Files (http://www.census.gov/govs/www /02PubUse-doc_GovOrg.html).

6. Boundary information: US Census Bureau, 2007, TIGER/Line Shape files (http://www.census.gov /geo/www/tiger/).

7. Redistricting information: National Conference of State Legislatures (http://www.ncsl.org/) and The United States Elections Project (http://elections.gmu.edu), and TIGER data (see 6 above).

B2. Transfers

We use the so-called 'local government accounts' to identify recipients of state funds and the amounts they get from state budgets. These data are collected by the US Census Bureau and come from two sources: The State and Local Government Finance (SLGF) database and the Public Elementary-Secondary Education Finance (PESEF) database.

The SLGF 'Individual Unit Files' contain the annual accounts of the following local government units: counties, municipalities, townships, school districts, and special districts (divisions established for provision of a particular kind of public service, e.g. water districts, library districts, housing development agencies etc.).[45] We take the data on counties, municipalities, townships and special districts from the SLGF, and the data on school districts from the PESEF, for reasons we explain below.

From the SLGF database's revenue accounts of local government units, we identify the moneys each unit received from the state budget by the line item 'intergovernmental revenue from state governments' (item codes beginning with C). These are disaggregated into broad categories of services for which the transfers are intended: education, health and hospitals, highways, housing and community development, public welfare, utilities (water supply, gas supply, electric power, sewerage), public mass transit systems, general local government support, and 'all other' (US Census Bureau (2006)). Although the Census classification of government finances changes during our sample period, the categories of interest for our study are not affected.[46]

The SLGF database contains a census of all local government units in 1992, 1997, and 2002. In other years, the SLGF database contains a sample of the local government units. We used the data from the three census years to contrast the local governments that are included in the sample years only to the entire population of local government units. This exercise shows that, although the sampled units, on average, account for only 10% of all local governments, they receive over 80% of all state transfers. This fact alleviates potential concerns regarding the effect of a smaller sample size in non-census years.

Even though school districts are included in the SLGF database, the source of the data on transfers to school districts is the Public Elementary–Secondary Education Finance (PESEF) database. We prefer this source for two reasons. First, the PESEF database contains information on the entire population of school districts each year and thus has a more complete coverage than the SLGF database. Second, the PESEF database disaggregates state support for education. The line items we use are those under the headings 'Revenue from state sources' and 'State payments on behalf of local education agency'. We separate one category – 'Revenue from state sources: General Formula Assistance' – from the rest and refer to it as 'formula spending', while we aggregate the remaining line items into the category 'non-formula spending'.

The transfer data are extracted from the individual Census files for each year and com-

[45] The Census refers to school and special districts as 'special-purpose governments' http://www.census.gov/govs/go/population_of_interest.html.

[46] Although according to the Census Classification Manuals categories C28, C47 and C67 are not in use after 1988, we found a handful of observations using these codes in the data. We disregarded these.

bined it into one large dataset. We (successfully) conducted a number of consistency checks, aggregating the transfers and comparing them to the aggregate data from other Census sources and to the total revenues and spending of local governments.

We deflate all transfer data by the annual CPI published by Bureau of Labour Statistics (using their base of 1982-84). To calculate per capita transfers in a given year and district, we took each district's population to be equal to the Census Bureau's state population estimate for that year divided by the number of house districts in the state. The justification for this is the legal requirement that all legislative districts must have the same number of people in them.

B3. Legislators

The data on state representatives are constructed from the State Elections Database collected by Carsey et al. (2008). We transform the biannual observations on elections (and in case of Louisiana, one observation every four years) into an annual dataset containing a representative for each district for each year. From these data (which go back to 1968), we calculate the number of terms that each legislator have served at any given point in time. Given each state's term limit laws, we then calculate the year when each legislator cannot run for re-election. In doing so, we take account of partial terms resulting from special elections and service interruptions. We follow the states' rules on how these should be treated, which differ across states.

We cleaned the States Elections Database to ensure that 1) the same legislator is always referred to by exactly the same name, 2) different legislators are referred to by different names, and 3) there are no missing data. We filled in the missing data and resolved any ambiguities in the dataset using election records, legislative rosters and state government almanacs of individual states, either from the relevant state's official web sites or by contacting them directly.

The key variable that enabled us to match legislators to pork-barrel spending (calculated using legislative district boundaries from the TIGER database) is the district number. In the seven states in our main sample, the district numbering system in the State Elections Database and in the TIGER database is the same. Two states have multiple member districts (Arizona and South Dakota). For these, we matched each representative to the total transfer received by the district. We take this into account by clustering the standard errors in our estimations at district-year level.

B4. Matching local government units to geographical entities

In order to match the location of a recipient of state funding to the legislative district in which it is situated, we need to know which geographical area is covered by each local government unit. Once identified, we assume that the benefits of the state transfers are confined to this area (this assumption is discussed in section 3). In case of counties, municipalities and townships this was a straightforward task since the area served by these local governments correspond to the relevant geographical divisions. The data on geographical borders of these divisions, as well as for school districts, are available from the US Census Bureau in the form of TIGER shape files. However, no data are available on the boundaries of special districts. So, we match the special districts to the geographical areas they cover using two approaches. First, for some special districts, the Government Organization 2002 File provides information on whether special district boundaries coincide with a) a county, b) a municipality or a township, c) lie entirely within a county or d) cover more than one county (with other counties listed). We match these special districts to the Federal Information Processing Standard (FIPS) codes accordingly. Unable to identify boundaries for category c), we dropped these special districts from the sample. Second, for the majority of special districts that did not have any information on the area they serve in the Government Organization 2002 File, we tried to infer their geographical location from the name. For example, 'Grundy County Rural Fire Protection District' we classified as providing services to Grundy County. Using both of these methods we are able to locate just under 60% of the 4,867 special districts covered by the SLGF database.

Having identified geographical service areas, we then proceed to match the local government units to the boundaries for the respective geographical units contained in the TIGER database. In order to complete this matching, we had to go through one more step. This is because the SLGF Individual Unit Files identify each local government unit using a special Census code, while the TIGER database uses Federal Information Processing Standard (FIPS) codes. We matched the special Census code to the FIPS code using the SLGF Directory Information Files and the Census's Government Integrated Directory.[47] This additional step was not necessary for school districts since they have the same identifier in the TIGER and PESEF database. For some years, a few school districts in the PESEF database do not have an identification code; we interpolated those from other years.

We match the five types of local government units (counties, municipalities, townships, special districts, and school districts) to the geographical boundaries of the area that they serve using TIGER 2007 shape files. We use the shape files based on Census 2000 data. Whilst we are able to match most of the local government units in this way, there were some for which no TIGER boundary data were available. More specifically, we match all counties, virtually all municipalities, and all school districts. However, TIGER data do not contain any of the township boundaries, and so we could not match townships and special districts that serve townships. Dropping townships and special districts that we cannot match from the sample reduces the number of local government units by 40%. These units, however, account for a very small fraction of total state transfers and we can match 98% of all non-school district transfers (and 100% of school district transfers).

[47] We checked to see that virtually no geographical entities changed their FIPS codes throughout out sample period.

B5. Matching transfers to representatives

To identify the House district that benefits from particular state transfers, we matched the geographical boundaries of the local government units to the geographical boundaries of state House districts. We, then, calculate the total transfer received by a House district as the sum of all transfers received by local government units located in it. Below we describe this in more detail, discussing several complications.

Overlaps. Geographical boundaries for areas served by local government units and for state legislative districts are available in the TIGER 2007 shape files. Each boundary is a polygon whose location on the map is described by several points and their coordinates. We input these into software which calculates the area overlap between each local recipient of state money and each state House district. Smaller local government units - small and medium sized municipalities and the special districts which serve them - typically lie within one legislative district in their entirety. In such cases, it is straightforward to compute the transfers that the district receives from state budget as the sum of the transfers to these local government units. On the other hand, larger local government units, e.g., school districts and counties, often straddle two or more legislative districts. In such cases, we attribute a share of the transfers to each legislative district. The share is equal to the percentage area overlap between the jurisdiction of each local government unit and the legislative district.[48] This provides an estimate of the size of the transfer from the state budget allocated to each legislative district in each year.

Fiscal years. Both the SLGF and the PESEF database report annual data for the end of a fiscal year rather than by calendar year. In all seven states in the sample, the fiscal year starts in July; so, for example, the 2002 SLGF database, provides fiscal information for the period from July 1, 2001 to June 30, 2002. We allocate state transfers to the representative who is in office when the appropriate budget is drafted. For example, the 2002 SLGF data is matched to legislators who are in office in 2001.[49] So unlike the Census, in this paper, 2001 refers to fiscal year July 1, 2001 to June 20, 2002 and so on.

Redistricting. The boundaries of state legislative districts get redrawn once every ten years, following the decennial Census.[50] During our sample period, this occurs once, after the year 2000 Census. We need to take this into account because we use these boundaries to match the local government units to House districts. We create separate matches for the pre- and post-redistricting legislative boundaries.[51] In all states in the sample, except

[48] This is equivalent to assuming that benefits from the state transfers are uniformly distributed across the local geographical entity that receives the funds (discussed in section 3). We checked our findings for robustness by re-estimating the regressions using an alternative weighting by the population of the overlap for the cases where a local government straddles the border of a legislative district. We continue to find that there is a significant negative 'last term effect' in education spending, and it is due to the behavior of the Democrats.

[49] In our sample five states have annual budgets, and two (Arizona and Ohio) have (some) biannual budgets. In the latter two states, House elections are held for all districts on the same date and the biannual budget is always drafted in the first year after the elections (i.e., in the first year of a representative's two-year term), and so, the same matching algorithm applies to them.

[50] This is required by law to ensure that all districts have an equal number of people.

[51] TIGER 2007 contains shape files for both pre- and post-redistricting legislative boundaries for the states

Louisiana, the first election after redistricting is held at the end of 2002 with the legislators taking office in January 2003. Thus, all legislators who are in office up to 2002 are matched to transfers constructed using pre-redistricting boundaries; while post-redistricting boundaries are used to construct transfers for the legislators who are in office from 2003 onwards (i.e., beginning with the fiscal year July 1, 2003-June 30, 2004). In Louisiana, the first election using post-redistricting district boundaries is at the end of 2003, and so, the representatives who hold office from 2004 onwards are matched to transfers calculated using the boundaries of the new districts.

B6. Controls

Annual data on characteristics of legislative districts does not exist. We construct estimates using annual data on counties from the US Census Bureau, USA Counties database and a matching procedure similar to the one we used to compute district-specific transfers. For example, to estimate the number of citizens over 65 years of age in a legislative district, we first identify all the counties that (party or wholly) lie in the district. We, then, take a weighted sum of the counties' population of over 65 years olds where each county's weight is the share of its area that lies in the legislative district of interest. We constructed estimates of the school-age population and income per capita in the same way.

B7. States without term limits

Alongside the seven states with term limits that comprise our main sample, we construct a similar dataset for seven states without term limits. We use these data for the estimations reported in table 7 (columns 1 and 2). Our choice of states for this group is constrained by two requirements: 1) they should never have had term limits (this narrows the possibilities down to 29 states) and 2) the TIGER database must contain data on legislative boundaries (this further reduces the possibilities down to 22). To focus on states that are as comparable as possible to the states with term limits in our main sample, we select seven states from the same regions and require within each region that the selected state borders at least one of the states with term limits in our sample. The sample of states with term limits includes three states in the Midwest (Ohio, Missouri and South Dakota), two in the South (Louisiana and Oklahoma), and two in the West (Arizona and Colorado). So, for the comparison sample, we select four states in the Midwest (Illinois, North Dakota, Kansas and Iowa), two states from the South (Alabama and Tennessee) and one state from the West (New Mexico). Table B1 provides a brief summary of these data.

<Table B1. States without term limits>

in the sample.

Table 1. State Houses of Representatives and term limits in the seven states

State	Number of legislators	Number of districts	Democrats, share of total	Year of first election under TL	Maximum allowed service under TL (years)	Year term limits bind*	Term limited legislators	Average service before TL	Average service after TL
Arizona	174	30	0.37	1992	8	2000	27	7.7	5.6
Colorado	175	65	0.41	1990	8	1998	41	8.5	6.4
Louisiana	210	105	0.74	1995	12	2007	49	15.1	n/a
Missouri	396	163	0.53	1994	8	2002	87	10.9	8.9**
Ohio	236	99	0.42	1992	8	2000	67	12.3	6.6
Oklahoma	184	101	0.60	1992	12	2004	29	13.6	n/a
South Dakota	199	35	0.32	1992	8	2000	28	8.3	5.8
Entire sample	1,574	598					328	11.7	6.3

*The year when the first set of term-limited legislators cannot run again ** This is greater than 8 due to provisions for special elections in Missouri.
TL = term limits

Table 2. Total transfers from the state budget to legislative districts

	Per capita 1984 US$			
State	Mean	Standard deviation	*N*	Share of transfers in total state spending per capita
Arizona	557	473	720	0.36
Colorado	426	364	780	0.28
Louisiana	384	386	1,470	0.21
Missouri	347	164	1,956	0.23
Ohio	498	177	1,188	0.28
Oklahoma	398	220	1,212	0.26
South Dakota	262	160	840	0.17
Total	400	294	8,166	0.26

Note: *N* is equal to number of districts time the number of years, except for Arizona and South Dakota, where there are two representatives per district *N* is two times number of districts times years. The sample period is 1993-2004, except for Louisiana where the period is 1992-2005.

Table 3. Breakdown of transfers to legislative districts by transfer type

Per capita 1984 US$

Type	Mean	Standard deviation	Min[1]	Max	Share of transfers in total state spending on this activity
Discretionary transfers, total	142	128	2	2,023	
Education, non-formula	70	70	0	686	0.83
Local government support	20	50	0	749	1
Highways	21	26	0	368	0.14
Health	8	21	0	259	0.07
Housing	1	8	0	441	0.21
Transit	1	2	0	94	0.34
Other	21	41	0	1,341	n/a
Non-discretionary transfers, total	258	206	0	1,968	
Education, formula	234	175	0	1,740	0.83
Welfare	25	73	0	1,226	0.07
Utilities	0.6	4	0	91	0.01

Notes: N=8,166. [1] zero transfers were received in several districts in Oklahoma in 1993.
[2] share of all primary & secondary education transfers in total state spending on primary & secondary education. (separate data on total formula spending are not available)

Table 4. Test of the 'last-term effect': The main results

	(1)	(2)	(3)	(4)
	Transfers per capita			
	Total	Education	Discretionary	Non-discretionary
Last term	-14.4*	-9.8*	-9.5*	-5.0
	(6.6)	(4.2)	(4.2)	(4.2)
N	8,166	8,166	8,166	8,166

Note: Estimates include legislator fixed effects and state-specific year effects. Robust in standard errors parentheses, clustered at district-year level. *N* is the number of observations.
** significant at 1% level, * significant at 5% level, + significant at 10% level.

Table 5. Test of the 'last-term effect': Democrats versus Republicans

	(1)	(2)	(3)	(4)
	Total	Education	Discretionary	Non-discretionary
Last term, Democrats	-17.3*	-15.6**	-13.1**	-4.2
	(7.5)	(5.6)	(5.3)	(5.1)
Last term, Republicans	-11.9	-4.9	-6.5	-5.5
	(7.6)	(4.7)	(4.3)	(4.6)
Democrat	5.4	-3.1	-3.0	8.4
	(16.2)	(14.4)	(7.5)	(12.6)
N	8,166	8,166	8,166	8,166

Note: Estimates include legislator fixed effects and state-specific year effects. Robust standard errors in parentheses, clustered at district-year level. *N* is the number of observations.
** significant at 1% level, * significant at 5% level, + significant at 10% level

Table 6. The 'last-term effect' without term limits

	States without term limits All legislators		States with term limits Legislators who leave before TL binds	
	(1)	(2)	(3)	(4)
	Total transfers	Discretionary transfers	Total transfers	Discretionary transfers
Last term, ex-post	-2.6	-0.8	-3.9	-3.0
	(3.1)	(2.3)	(4.9)	(2.8)
N	8,473	8,473	5,115	5,115

Note: Estimates include legislator fixed effects and state-specific year effects. TL=term limits.
Robust standard errors in parentheses, clustered at district-year level. N is number of observations.
** significant at 1% level, * significant at 5% level, + significant at 10% level

Table 7. The number of districts and the 'last-term effect'

	(1)	(2)	(3)
	Total transfers	Discretionary transfers	Non-discretionary transfers
Last term	-38.2*	-26.5**	-11.7
	(17.3)	(9.3)	(9.7)
Last term*Number of districts	0.26+	0.18*	0.07
	(0.14)	(0.08)	(0.08)
N	8,166	8,166	8,166

Notes: Estimates include legislator fixed effects and state-specific year effects.
Robust standard errors in parentheses, clustered at district-year level
** significant at 1% level, * significant at 5% level, + significant at 10% level
N is the number of observations.

Table B1. States without term limits

State	Mean transfers per capita	Number of districts	Sample years
Alabama	435	105	1995-2005
Iowa	472	100	1993-2004
Illinois	460	118	1993-2004
Kansas	539	125	1993-2004
North Dakota	389	49/47*	1993-2004
New Mexico	665	70	1993-2004
Tennessee	543	99	1993-2004
Average	495		

* before/after redistricting following 2000 Census

Figure 1: Identification example