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Centralized versus decentralized provision of local public goods: a political economy approach

Timothy Besley[a,*], Stephen Coate[b]

[a] *Department of Economics London School of Economics London WC2A 2AE, UK*
[b] *Department of Economics Cornell University, Ithaca, NY 14853, USA*

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Abstract

This paper takes a fresh look at the trade-off between centralized and decentralized provision of local public goods. It argues that the sharing of the costs of local public spending in a centralized system will create a conflict of interest between citizens in different jurisdictions. When spending decisions are made by a legislature of locally elected representatives, this conflict of interest will play out in the legislature. Depending on precisely how the legislature behaves, the result may be excessive public spending or allocations of public goods characterized by uncertainty and misallocation across districts. The extent of the conflict of interest between districts is affected by spillovers and differences in tastes for public spending. Thus, the relative performance of centralized and decentralized systems depends upon spillovers and differences in tastes for public spending, but for different reasons than suggested in the existing literature.

1. Introduction

This paper revisits the following classic problem in public finance. An economy is divided into geographically distinct districts. In each district there is a local public good. The public goods benefit those citizens in the districts in which they are located, but may also have beneficial spillovers to the other districts. Then how should authority to provide the public goods be allocated and how should the costs of provision be shared? Specifically, should there be a *centralized* system in which

*Corresponding author.

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spending decisions are made by a central government and financed from general revenues or a *decentralized* system in which choices are made by local governments and financed by local taxation?

The standard approach to this question, formalized in Oates (1972), assumes that, in each system, governments maximize the aggregate surplus of their constituents and that, in a centralized system, the government chooses a uniform level of public spending for each district. The drawback with a decentralized system is that local governments will neglect benefits going to other districts and thus local public goods will be under-provided in the presence of spillovers. The drawback with a centralized system is that it produces a 'one size fits all' outcome that does not reflect local needs. *Oates' Decentralization Theorem* states that, without spillovers, a decentralized system will be preferred. Otherwise, there is a trade-off whose resolution depends on the extent of heterogeneity in tastes and the degree of spillovers.

The assumption that centralization implies uniformity is crucial to the logic of this trade off. However, it is neither empirically nor theoretically satisfactory. On the empirical front, there are many examples of goods provided unequally by a central government in a federal system. The case of federal highway spending in the United States illustrates this well.[1] A significant fraction of funds in the Federal Highway Aid Program are earmarked by legislators for specific projects in their districts. Moreover, while the remaining funds are allocated according to a formula, this formula is manipulated to target spending to particular favored states.[2] From a theoretical point of view, it is also unclear why a government charged with providing public goods in a centralized system cannot differentiate the levels according to the heterogeneous tastes in each district.

Here we dispense with the assumption that provision will be uniform across jurisdictions and present an alternative vision of the drawbacks of centralization, stemming from political economy concerns. We argue that the fact that costs of local public spending are shared in a centralized system creates a conflict of interest between citizens in different districts. They may be expected to disagree both about the level of public spending as well as its allocation between the districts. If, as is typically the case in centralized systems, spending decisions are made by a legislature of locally elected representatives, this conflict of interest will play out in the legislature. As we show, precisely how it does so will depend on how the legislature behaves.

From an analytical point of view, the innovation of the paper is to model public spending under centralization as being determined by a legislature of locally elected representatives. This requires modelling both the behavior of representatives in the legislature and districts' choices about the type of representative to elect. Our model of the election of representatives draws on the citizen-candidate model of representative

[1] Other U.S. examples include spending on river and harbor projects by the Army Corps of Engineers (see Ferejohn, 1974) and spending on parks by the Department of the Interior.

[2] In the words of Senator Patrick Moynihan, 'You don't have a formula here, you have 50 negotiated numbers' (Washington Post, May 23, 1998—cited in Knight, 2002). See Knight (2002) for further analysis of the allocation of funds in the Federal Highway Aid Program.

democracy (Osborne and Slivinski, 1996; Besley and Coate, 1997), in particular the extension to legislative elections due to Coate (1997).

Two specifications of legislative behavior are studied. The benchmark case assumes that spending on local public goods in the legislature is determined by a minimum winning coalition of representatives.[3] This creates two resource allocation problems. The first is *misallocation*—spending is skewed towards those districts whose representatives are inside the winning coalition. The second is *uncertainty*—each district is unsure of the amount of public good that it will receive, reflecting the uncertainty in the identity of the minimum winning coalition. Both of these problems weaken the case for centralization.

Our alternative specification assumes that the legislature maximizes the surplus of its members (a cooperative legislature).[4] Even this benign behavior is not sufficient to achieve a surplus maximizing outcome in the economy as a whole. This is because such legislative behavior creates incentives for voters to *strategically delegate* by electing representatives with high demands for public spending. This leads to over-provision of public goods in a centralized system.

In both cases, these drawbacks from centralized decision making with shared costs must be weighed up against the benefits of improved coordination of spillovers. If spillovers are high and districts have similar tastes for public spending, then a centralized system produces good policy choices no matter how the legislature behaves. As spillovers become less significant and districts more heterogeneous, the problems of centralized decision making worsen. Thus, the desiderata determining whether decentralization or centralization is best are the same as under the standard approach. However, the logic is entirely different.

The potential importance of legislative behavior for the performance of centralized systems has been stressed by Inman and Rubinfeld (1997a,b). This paper can be thought of as developing an analysis that integrates their concerns with those emphasized in the standard approach. Also related is the independent work of Lockwood (2002). Like us, he is critical of the assumption that centralization implies uniformity in public spending across districts and develops a political economy analysis of decentralization versus centralization of public good provision. He also assumes that a centralized system forms policy in a legislature comprising of elected representatives from each district. He specifies an extensive form bargaining game for the legislature which predicts that spillovers affect the nature of the legislative outcome. However, in contrast to this paper, he assumes that the local public good in each district is discrete and that citizens are homogeneous. The latter assumption makes legislative elections straightforward. Lockwood's focus is complementary with ours, paying greater attention to legislative processes and less attention to election outcomes.

Our approach should be contrasted with an alternative political economy approach which sees the drawbacks of centralization as being more prone to *politicalagency*

[3] See, for example, Buchanan and Tullock (1962), Riker (1962), Ferejohn et al. (1987) and Baron and Ferejohn (1989).

[4] This is in the spirit of the universalism model of Weingast (1979).

problems.[5] Underpinning this alternative view is the notion that unconstrained choices by politicians would not reflect their constituents' interests. In our approach, given the way the decision-making process works, representatives are perfect agents for the median citizen in their district. Thus the drawbacks of centralization stem from the basic conflict of interest among citizens of different districts working through the decision-making process.

The remainder of the paper is organized as follows. Section 2 outlines the framework for our analysis. As background, Section 3 provides a brief review of the standard approach. Section 4 then presents our political economy analysis for the benchmark of a non-cooperative legislature. Section 5 considers the case where the legislature acts on a more cooperative basis. Section 6 provides further discussion and Section 7 offers some concluding remarks.

2. The framework

The economy is divided into two geographically distinct districts indexed by $i \in \{1, 2\}$. Each district has a continuum of citizens with a mass of unity.[6] There are three goods in the economy; a single private good, x, and two local public goods, g_1 and g_2, each one associated with a particular district. The latter can be thought of as roads or parks. Each citizen is endowed with some of the private good. To produce one unit of either of the public goods, requires p units of the private good.

Each citizen in district i is characterized by a public good preference parameter λ. The preferences of a type λ citizen in district i are

$$x + \lambda[(1 - \kappa) \ln g_i + \kappa \ln g_{-i}].$$

The parameter $\kappa \in [0, 1/2]$ indexes the degree of *spillovers*; when $\kappa = 0$ citizens care only about the public good in their own district, while when $\kappa = 1/2$ they care equally about the public goods in both districts. While spillovers are the same for all citizens, those with higher λ's value public goods more highly.[7]

[5] One strand of this literature, dating back to Tiebout (1956), sees the advantages of decentralization in this respect as stemming from the mobility of citizens across local jurisdictions. The idea is that the ability of citizens to vote with their feet sharpens the constraints faced by local policy-makers (see, for example, Courant et al., 1979; Epple and Zelenitz, 1981 and Oates, 1972). This results in decentralized policies more closely reflecting citizens' preferences. Other approaches focus more directly on how centralization changes agency relationships. Seabright (1996) develops an incomplete contracts model in which centralization improves coordination but has costs in terms of diminished accountability, the latter being defined as the probability that the welfare of the region determines the re-election of the government. This basic trade-off is also at the heart of Tommasi and Weinschelbaum (1999) who emphasize how principal agent problems between citizens and governments can worsen under centralization. Bardhan and Mookherjee (2000) emphasize how differences in political awareness and political competition can affect the likelihood of capture by special interests under centralized or decentralized decision making. Whether agency problems worsen under centralization is not completely clear-cut in their framework.

[6] We ignore issues of mobility in this analysis. While such considerations are obviously important, incorporating them is sufficiently difficult that they are best left for a separate paper.

[7] The reader is referred to our discussion paper for a treatment with more general preferences.

In each district, the range of preference types is $[0, \overline{\lambda}]$. The *mean type* in district i is denoted by m_i and we assume throughout that this equals the median type.[8] We assume that the average citizen in district 1 is at least as pro-public spending as his counterpart in district 2, so that $m_1 \geq m_2$. We also assume that $2m_1 < \overline{\lambda}$. The role of this assumption will become apparent in the sequel.

Under a *decentralized system*, the level of public good in each district is chosen by the government of that district and public expenditures are financed by a uniform head tax on local residents. Thus, if district i chooses a public good level g_i, each citizen in district i pays a tax of pg_i.[9] Under a *centralized system*, the levels of both public goods are determined by a government that represents both districts, with spending being financed by a uniform head tax on all citizens. Thus, public goods levels (g_1, g_2), result in a head tax of $\frac{p(g_1+g_2)}{2}$.

Our criterion for comparing the performance of centralized and decentralized systems will be aggregate public good surplus. With public good levels (g_1, g_2), this is

$$S(g_1, g_2) = [m_1(1-\kappa) + m_2\kappa] \ln g_1 + [m_2(1-\kappa) + m_1\kappa] \ln g_2 - p(g_1 + g_2).$$

The surplus maximizing public good levels are given by

$$(g_1, g_2) = \left(\frac{m_1(1-\kappa) + m_2\kappa}{p}, \frac{m_2(1-\kappa) + m_1\kappa}{p} \right).$$

When m_1 exceeds m_2, district 1's level is higher for all $\kappa < 1/2$.

3. The standard approach

This framework permits a simple exposition of the standard approach due to Oates (1972). Laying it out will set the stage for the political economy analysis to follow. In a decentralized system, each district's policy is assumed to be chosen independently by a government whose objective is to maximize public goods surplus in the district. Accordingly, the expenditure levels in the two districts (g_1^d, g_2^d) will form a Nash equilibrium. This requires that:

$$g_i^d = \text{argmax}_{g_i} \{ m_i[(1-\kappa) \ln g_i + \kappa \ln g_{-i}^d] - pg_i \}, \quad i \in \{1, 2\}.$$

Taking first-order conditions and solving yields:

$$(g_1^d, g_2^d) = \left(\frac{m_1(1-\kappa)}{p}, \frac{m_2(1-\kappa)}{p} \right).$$

Each district's government only takes account of the benefits received by citizens in his district and, accordingly, local public good decisions are only surplus maximizing when

[8] This is by no means necessary to undertake the analysis. It just serves to simplify the results. The interested reader should have no trouble understanding how relaxing the assumption alters the results.

[9] We will assume throughout that citizens endowments are large enough to meet their tax obligations.

there are no spillovers. With spillovers, public goods are under-provided in both districts and this under-provision is increasing in the extent of spillovers.

In a centralized system, it is assumed that the government chooses a uniform level of the public good to maximize aggregate public goods surplus. This level, denoted g^c, satisfies

$$g^c = \arg\max_g \{[m_1 + m_2] \ln g - 2pg\},$$

yielding

$$g^c = \frac{m_1 + m_2}{2p}.$$

The common level of public good is now independent of the level of spillovers and equals the surplus maximizing level when the districts are identical. However, when m_1 exceeds m_2, centralization under-provides public goods to district 1 and over-provides them to district 2 except when $\kappa = 1/2$.

It is clear from these results that, when districts are homogeneous, centralization dominates decentralization whenever spillovers are present. Moreover, when districts are not identical, decentralization dominates when there are no spillovers while centralization is better when spillovers are maximal. It can also be shown that surplus under decentralization is decreasing in spillovers, so that there is a critical level of spillovers above which centralization dominates. This yields the following result.[10]

Proposition 1. *Suppose that the assumptions of the standard approach are satisfied. Then*

(i) *If the districts are identical and spillovers are present ($\kappa>0$), a centralized system produces a higher level of surplus than does decentralization. Absent spillovers ($\kappa=0$), the two systems generate the same level of surplus.*
(ii) *If the districts are not identical, there is a critical value of κ, greater than 0 but less than 1/2, such that a centralized system produces a higher level of surplus if and only if κ exceeds this critical level.*

Thus, without spillovers, a decentralized system is superior—a result referred to as *Oates' Decentralization Theorem*. With spillovers and identical districts, a centralized system is preferred. With spillovers and non-identical districts, it is necessary to compare the magnitude of the two effects. Centralization is desirable if and only if spillovers are sufficiently large.[11]

This result is appealing and has remained the dominant approach for a generation. However, the trade-off suggested by the standard approach relies critically on the

[10] The proof of this and the subsequent results may be found in the Appendix A.

[11] While Oates' analysis is typically interpreted as suggesting that heterogeneity hurts the case for centralization, this does not follow logically from his assumptions. To establish such a result, it would be necessary to show that as districts became more heterogeneous, the critical level of spillovers increased. Proposition 1 only tells us that the critical level of spillovers is higher for an economy with heterogeneous districts than for an economy with identical districts. In fact, there is no guarantee that the critical level is decreasing in heterogeneity. This is because heterogeneity can worsen the social costs of under-provision and hence has an ambiguous effect on surplus under decentralization.

assumption that expenditures under centralization are uniform across districts, an assumption that is neither theoretically nor empirically satisfactory. It is a particularly strange assumption given that the government maximizes social surplus under centralization. If the government were permitted to choose different levels of public goods for the two districts, it could choose the surplus maximizing level for each district and a centralized system would always produce at least as much surplus as a decentralized system and strictly more in the presence of spillovers. The key to making further progress is to relax the uniformity assumption, but then to model the decision making institutions which shape resource allocation under centralization. It is to this task that we turn now.

4. A political economy approach

Our model of political decision making is based on the citizen-candidate approach. Policy makers are elected citizens who follow their policy preferences when in office. Voters elect candidates whose policy preferences yield outcomes they like.

4.1. Policy determination under decentralization

Under decentralization, each district elects a single representative from among its members to choose policy.[12] Representatives are characterized by their public good preferences λ. The policy determination process has two stages. First, elections determine which citizens are selected to represent the two districts. Second, policies are chosen simultaneously by the elected representative in each district.

Working backwards, let the types of the representatives in districts 1 and 2 be λ_1 and λ_2. Then the policy outcome $(g_1(\lambda_1), g_2(\lambda_2))$ satisfies

$$g_i(\lambda_i) = \arg\max_{g_i}\{\lambda_i[(1-\kappa)\ln g_i + \kappa \ln g_{-i}(\lambda_{-i})] - pg_i\} \quad \text{for } i\in\{1,2\}.$$

Solving this yields

$$(g_1(\lambda_1), g_2(\lambda_2)) = \left(\frac{\lambda_1(1-\kappa)}{p}, \frac{\lambda_2(1-\kappa)}{p}\right).$$

Each district's spending is higher the stronger is the public good preference of its representative and lower the higher the level of spillovers.

Turning to the election stage, if the representatives in districts 1 and 2 are of types λ_1 and λ_2, a citizen of type λ in district i will enjoy a public goods surplus

$$\lambda\left[(1-\kappa)\ln\frac{\lambda_i(1-\kappa)}{p} + \kappa \ln\frac{\lambda_{-i}(1-\kappa)}{p}\right] - \lambda_i(1-\kappa).$$

These preferences over types determine citizens' voting decisions. A pair of representative types $(\lambda_1^*, \lambda_2^*)$ is majority preferred under decentralization if, in each district i, a

[12] We recognize that, in the real world, decisions in decentralized systems are typically made by legislatures consisting of elected representatives of each of the sub-districts of the districts. Our assumption that decisions are made by a single representative is simply trying to capture the reality that there will be a greater commonality of interest across these sub-districts than across districts.

majority of citizens prefer the type of their representative to any other type $\lambda \in [0, \bar{\lambda}]$, given the type of the other district's representative λ^*_{-i}.

We assume that the elected representatives in the two districts will be of these majority preferred types. Thus, if the majority preferred types are $(\lambda^*_1, \lambda^*_2)$, the policy outcome under decentralization will be $(\lambda^*_1(1-\kappa)/p, \lambda^*_2(1-\kappa)/p)$.[13] The optimal type of representative for a citizen of type λ in district i maximizes $\lambda(1-\kappa)\ln(\lambda_i(1-\kappa)/p) -\lambda_i(1-\kappa)$. It is easy to see that each citizen prefers a candidate of his own type. Citizens' preferences over types are *single − peaked*[14] implying that a pair of representative types is majority preferred under decentralization if and only if it is a median pair; i.e., $(\lambda^*_1, \lambda^*_2) = (m_1, m_2)$. Thus we have:

Lemma 1. *Under the assumptions of the political economy approach, the policy outcome in a decentralized system is*

$$(g_1, g_2) = \left(\frac{m_1(1-\kappa)}{p}, \frac{m_2(1-\kappa)}{p} \right).$$

This has a conventional flavor since local public good provision respects the preferences of the median voter within a district.[15] Under our assumption that the median taste in each district equals the mean, our political economy analysis agrees with the standard analysis of decentralization.

4.2. Policy determination under centralization

Policy determination under centralization also has an election and a policy selection stage. In the first of these, one citizen from each district is elected to serve in a legislature. The legislature then determines public spending in each district. A key issue is how to approach decision making in the legislature. There is no standard model in the literature although a number of different approaches have been suggested.[16] Our benchmark model captures the *minimum winning coalition* view of distributive policy-making.[17] Under this

[13] There are two possible justifications. First, there is an equilibrium of the citizen-candidate model in which a candidate of the majority preferred type from each district runs and is elected unopposed. This assumes that the costs of running are small and that no public good would be provided if no-body ran. The logic is basically that in Proposition 2 of Besley and Coate (1997). If there are perquisites of office, then multiple candidates of the majority-preferred type might run. Second, if in each district, two Downsian parties compete for office by selecting candidates, equilibrium will involve both parties in each district selecting candidates of the majority preferred type.

[14] Given any two types λ_i and λ_i' such that $\lambda_i < \lambda_i' < \lambda$ or $\lambda < \lambda_i' < \lambda_i$, type λ citizens always prefer type λ_i' citizens.

[15] The assumption that preferences are additive is critical for this result. It would no longer be optimal for the median voter to elect a median citizen with $\kappa > 0$, if the public goods were complements or substitutes. For example, substitutes give an incentive for the median types to elect a citizen below the median to represent them, thus accentuating the free-rider problem.

[16] See Collie (1988) for a review.

[17] Distributive policies are those, like centrally financed local public goods, that primarily benefit the constituents of one district but whose costs are borne collectively.

view, a coalition of 51% of the representatives forms to share the benefits of public spending among their districts. Districts whose representatives do not belong to this coalition are only allocated spending to the extent that this benefits coalition members. The logic is that, in a majority rule legislature, if there were any more than 51% of the representatives in the coalition supporting the spending bill, the majority of coalition members would benefit from expelling the surplus members and further concentrating spending on their own districts. Since there are many possible minimum winning coalitions, this view suggests that there will be uncertainty concerning the identity of the coalition that coalesces to determine spending.[18]

In our two district model, each representative can be thought of as a minimum winning coalition, so we may capture this view by assuming that each district's representative is selected to choose policy with equal probability. Thus, if the representatives are of types λ_1 and λ_2, the policy outcome will be $(g_1^1(\lambda_1), g_2^1(\lambda_1))$ with probability 1/2 and $(g_1^2(\lambda_2), g_2^2(\lambda_2))$ with probability 1/2 where $(g_1^i(\lambda_i), g_2^i(\lambda_i))$ is the optimal choice of district i's representative; that is,

$$(g_1^i(\lambda_i), g_2^i(\lambda_i)) = \arg\max_{(g_i, g_{-i})} \left\{ \lambda_i[(1-\kappa)\ln g_i + \kappa \ln g_{-i}] - \frac{p}{2}(g_i + g_{-i}) \right\}.$$

It is easily checked that

$$(g_i^i(\lambda_i), g_{-i}^i(\lambda_i)) = \left(\frac{2\lambda_i(1-\kappa)}{p}, \frac{2\lambda_i\kappa}{p} \right), \quad i \in \{1, 2\}.$$

We refer to this legislative behavior as *non-cooperative* as it leaves open the possibility of gains to cooperation among representatives. Below, we consider the implications of assuming that the legislators capture these gains by some form of bargaining.

If the representatives' types are λ_1 and λ_2, a citizen of type λ in district i obtains an expected public goods' surplus of

$$\frac{1}{2}\left\{ \lambda\left[(1-\kappa)\ln\frac{2\lambda_i(1-\kappa)}{p} + \kappa \ln\frac{2\lambda_i\kappa}{p}\right] - \lambda_i \right.$$
$$\left. + \lambda\left[(1-\kappa)\ln\frac{2\lambda_{-i}\kappa}{p} + \kappa \ln\frac{2\lambda_{-i}(1-\kappa)}{p}\right] - \lambda_{-i} \right\}.$$

A pair of representative types $(\lambda_1^*, \lambda_2^*)$ is majority preferred if, in each district a majority of citizens prefer the type of their representative to any other type, given the other district's representative type. As above, we assume that the elected representatives in the two

[18] In some theories, the identity of the minimum winning coalition depends on the policy preferences of the legislators (Ferejohn et al., 1987 and Baron, 1991). This creates incentives for voters to select representatives whose preferences are such that they are included in the minimum winning coalition (Niou and Ordeshook, 1985; Chari et al., 1997 and Coate, 1997). In equilibrium, therefore, the set of elected representatives is such that the identity of the minimum winning coalition is uncertain. While our specification of non-cooperative legislative behavior abstracts from such considerations, they only serve to reinforce the basic thrust of our arguments.

districts will be of the majority preferred types.[19] Thus, if the majority preferred representative types are $(\lambda_1^*, \lambda_2^*)$, the policy outcome will be $(2\lambda_1^*(1-\kappa)/p, 2\lambda_1^*(\kappa)/p)$ with probability $1/2$ and $(2\lambda_2^*\kappa/p, 2\lambda_2^*(1-\kappa)/p)$ with probability $1/2$.

This model of the legislature implies that each district *i*'s representative only affects the outcome if he is selected to choose policy and then he selects his utility maximizing policy. This implies that each citizen prefers a candidate of his own type. Thus, a pair of representative types is majority preferred if and only if it is a median pair; i.e., $(\lambda_1^*, \lambda_2^*) = (m_1, m_2)$. This establishes:

Lemma 2. *Under the assumptions of the political economy approach, the policy outcome under a centralized system with a non-cooperative legislature is random, generating* $(g_1, g_2)=(2m_1(1-\kappa)/p, 2m_1\kappa/p)$ *with probability 1/2 and* $(g_1, g_2)=(2m_2\kappa/p, 2m_2(1-\kappa)/p)$ *with probability 1/2.*

This result highlights the two principal drawbacks of centralization with a non-cooperative legislature:

- *Uncertainty:* each district is unsure of the amount of public good that it will receive, reflecting the uncertainty in the identity of the minimum winning coalition.
- *Misallocation:* public spending across the districts is skewed towards those inside the winning coalition.

The misallocation problem is at its worse when spillovers are low, since those in the minimum winning coalition have little incentive to allocate public goods to districts outside the coalition. Higher levels of spillovers lead those in the minimum winning coalition to spend more on other districts, but spending remains biased towards coalition members.[20] When spillovers are maximal, spending is allocated equally across districts but when m_1 exceeds m_2, district 1's representative over-provides local public goods, while district 2's representative under-provides them. It is only when the districts are identical and spillovers are complete ($\kappa = 1/2$), that centralization produces the surplus maximizing level of local public goods.

4.3. Decentralization versus centralization

We have already seen that public goods levels are surplus maximizing under decentralization in the absence of spillovers. Centralization, on the other hand, produces the surplus maximizing public goods levels only if the districts are identical and spillovers are complete. Thus, with identical districts, decentralization dominates when spillovers are small and centralization dominates when spillovers are large. With non-identical districts,

[19] The two justifications given in the decentralized case remain valid. See Coate (1997) for more discussion of the citizen-candidate approach to legislative elections.

[20] To be more precise, aggregate surplus would increase if spending were marginally reallocated from the district whose representative selects spending to the other district.

decentralization is still better when spillovers are small. However, what happens when spillovers are high is less clear.

Our next proposition establishes that centralization does dominate decentralization for high spillovers even when districts are not identical. It also establishes that the performance of centralization is increasing in κ. It follows that there is a critical value of spillovers above which centralization dominates in both the identical and non-identical district case.

Proposition 2. *Suppose that the assumptions of the political economy approach are satisfied and that the legislature is non-cooperative. Then*

(i) *If the districts are identical, there is a critical value of κ, strictly greater than 0 but less than 1/2, such that a centralized system produces a higher level of surplus if and only if κ exceeds this critical level.*
(ii) *If the districts are not identical, there is a critical value of κ, strictly greater than 0 but less than 1/2, such that a centralized system produces a higher level of surplus if and only if κ exceeds this critical level. This critical level is higher than that in the standard approach.*

The problems of uncertainty and misallocation lie behind part (i) of Proposition 2. The result obtained here contrasts with the standard approach which prescribes centralization for *all* spillover levels when districts are identical. Small spillovers particularly exacerbate the problem of public goods being misallocated across districts. Higher spillover levels improve the prospects for centralization as they alleviate the selfishness of the minimum winning coalition which now has an incentive to allocate more spending to districts whose representatives are outside the coalition. This increases aggregate surplus and strengthens the case for centralization. At the same time, decentralization becomes less attractive at high spillover levels as locally elected leaders have a larger incentive to free-ride on each other's policies.

Uncertainty and misallocation problems also underpin part (ii) of Proposition 2. Allowing for heterogeneity in tastes across the districts will tend to create an even larger disparity between what members of the winning coalition and those outside it desire. This adds an extra dimension to the conflict of interest that is present under centralization.[21] Comparing part (ii) with its counterpart in Proposition 1, the trade-off implied by the political economy approach for heterogeneous districts has the same qualitative features as the standard approach—when spillovers are low, decentralization dominates; when they are high, centralization dominates.[22] However, part (ii) proves that the critical spillover level is higher, establishing that the political economy approach implies a weaker case for centralization.

[21] It is straightforward to show that surplus under centralization is decreasing in heterogeneity.

[22] The conclusion that centralization dominates decentralization at high spillovers does not hold under all specifications of public good benefits. Our discussion paper presents an example in which the conclusion is false at high levels of cross-district heterogeneity. The distinguishing feature of public good benefits in that example is that the marginal benefit of public goods does not go to infinity as the level of public goods becomes small. The discussion paper also presents some more general conditions under which the relative performance of centralization is increasing in the degree of spillovers.

5. Centralization with a cooperative legislature

Under the minimum winning coalition view of legislative decision-making, policy outcomes are ex ante Pareto inefficient from the viewpoint of the representatives. Since the number of legislators is typically relatively small, Coasian logic suggests that legislators should find their way around the inefficiency created by majoritarian decision criteria (Wittman, 1989). This theoretical observation, coupled with the empirical observation that (at least in the United States) minimum winning coalitions for this type of spending seem the exception rather than rule, has led many to abandon the minimum winning coalition view of legislative behavior in favor of more cooperative approaches. In this section, we study whether our basic conclusions of the previous section hold with more cooperative legislative behavior.

5.1. Policy determination

Even though there are gains from cooperation, this does not imply an obvious alternative for predicting legislative choices—there are many pairs of public spending levels that are both efficient from the viewpoint of the representatives and that *ex ante* Pareto dominate minimum winning coalition outcomes. Here we assume that the behavior of legislators can be described by the *utilitarian bargaining solution*; that is, they agree to the public goods allocation that maximizes their joint surplus.[23] This solution would seem to offer centralization the best chance of dominating decentralization given our welfare criterion. However, as we show, it will create a different type of problem, viz. strategic delegation.

If the representatives are of types λ_1 and λ_2, the policy outcome, $(g_1(\lambda_1,\lambda_2), g_2(\lambda_1,\lambda_2))$, will now maximize the representatives' joint surplus which is given by

$$\sum_{i\in\{1,2\}} \left\{ \lambda_i[(1-\kappa)\ln g_i + \kappa \ln g_{-i}] - \frac{p}{2}(g_i + g_{-i}) \right\}.$$

It is straightforward to verify that

$$(g_1(\lambda_1,\lambda_2), g_2(\lambda_1,\lambda_2)) = \left(\frac{\lambda_1(1-\kappa)+\lambda_2\kappa}{p}, \frac{\lambda_1\kappa+\lambda_2(1-\kappa)}{p} \right).$$

Thus, *if districts were to elect representatives that reflected the preferences of their median citizens, the legislature would select the surplus maximizing public good levels*.

[23] Our utilitarian solution may be motivated by the literature on universalism in legislatures. Based on study of the United States Congress, Weingast (1979) suggested that legislators avoid the problems associated with minimum winning coalitions by developing a norm of universalism that allows each representative to participate in decision making. On this view, each representative chooses the spending he would like for his own district and the legislature passes an omnibus bill consisting of all these spending levels. Unfortunately, however, this produces a vector of spending levels that are inefficient for the representatives, which undermines the justification for the theory (see, for example, Schwartz, 1994). An alternative formalization, is that the norm also requires representatives to take account of the costs and benefits to their colleagues (Inman and Fitts, 1990) and our utilitarian solution is a natural way of capturing this.

When the representative types are λ_1 and λ_2, a citizen of type λ in district i obtains public goods surplus

$$\lambda\left[(1-\kappa)\ln\frac{\lambda_i(1-\kappa)+\lambda_{-i}\kappa}{p}+\kappa\ \ln\frac{\lambda_{-i}(1-\kappa)+\lambda_i\kappa}{p}\right]-\frac{(\lambda_1+\lambda_2)}{2}.$$

A pair of majority preferred representative types is defined in the usual way. A public goods pair (g_1,g_2) is a policy outcome under centralization with a cooperative legislature if there exists a majority preferred pair $(\lambda_1^*,\lambda_2^*)$ such that $(g_1,g_2)=((\lambda_1^*(1-\kappa)+\lambda_2^*\kappa)/p,(\lambda_1^*\kappa+\lambda_2^*(1-\kappa))/p)$.

The main additional complication created by a cooperative legislature is in finding the majority preferred types. This is because the public good level for each district depends on the type of the legislator in *both* districts and, thereby, generates incentives for citizens in each district to delegate policy making strategically to a representative with different tastes than their own.[24] Characterizing such incentives turns out to be quite complicated.

To begin, observe that a pair of representative types $(\lambda_1^*,\lambda_2^*)$ is majority preferred if and only if in each district i the median type prefers λ_i^* to any other type $\lambda\in[0,\overline{\lambda}]$, given the other district's representative type λ_{-i}^*.[25] This means that $(\lambda_1^*,\lambda_2^*)$ is majority preferred if and only if it is a Nash equilibrium of the two player game in which each player has strategy set $[0,\overline{\lambda}]$ and player $i\in\{1,2\}$ has payoff function

$$U_i(\lambda_1,\lambda_2,m_i)=m_i\left[(1-\kappa)\ln\frac{\lambda_i(1-\kappa)+\lambda_{-i}\kappa}{p}\right.$$
$$\left.+\kappa\ \ln\frac{\lambda_{-i}(1-\kappa)+\lambda_i\kappa}{p}\right]-\frac{(\lambda_1+\lambda_2)}{2}.$$

In this game, the district i median citizen tries to manipulate λ_i so that he obtains something close to his preferred policy outcome anticipating the subsequent working of the legislature. Since he only has one degree of freedom, λ_i, and two objectives (g_1,g_2), this instrument is rather blunt. While raising λ_i always leads to an increase in district i's level of public goods, if $\kappa>0$, it also raises the public goods level in the other district.

To state the equilibrium, define $\hat{\kappa}$ as the solution to

$$\frac{[\hat{\kappa}^3+\hat{\kappa}(1-\hat{\kappa})^3]}{\hat{\kappa}(1-\hat{\kappa})}=\frac{m_1}{m_2}.$$

[24] This is reminiscent of Persson and Tabellini (1992) who consider strategic delegation in a bargaining context to model European integration.

[25] Observe that if district i elects a citizen of a higher type, then it receives more of both public goods. It follows that if citizens of type λ prefer a type λ_i' candidate to a type $\tilde{\lambda}_i$, where $\lambda_i'<\tilde{\lambda}_i$ ($\lambda_i'>\tilde{\lambda}_i$), then so must all citizens of types lower (higher) than λ. This implies that a majority of citizens in district i prefer a type λ_i' candidate to a type $\tilde{\lambda}_i$ candidate if and only if the median type prefers a type λ_i' candidate to a type $\tilde{\lambda}_i$ candidate.

In the case of identical districts, $\hat{\kappa} = 1/2$. In the non-identical districts case, $\hat{\kappa} < 1/2$. Then[26]:

Lemma 3. *Under the assumptions of the political economy approach, the policy outcome under a centralized system with a cooperative legislature is*

$$(g_1, g_2) = \left(\frac{2m_1[(1-\kappa)^4 - \kappa^4]}{\left[(1-\kappa)^2 - \frac{m_1}{m_2}\kappa^2\right]p}, \frac{2m_1[(1-\kappa)^4 - \kappa^4]}{\left[\frac{m_1}{m_2}(1-\kappa)^2 - \kappa^2\right]p} \right)$$

if $\kappa < \hat{\kappa}$, *and*

$$(g_1, g_2) = \left(\frac{2m_1(1-\kappa)}{p}, \frac{2m_1\kappa}{p} \right),$$

if $\kappa \geq \hat{\kappa}$.

Clearly, the cooperative legislature does not select the surplus maximizing public good levels. This reflects the fact that, while a cooperative legislature deals with the problems of uncertainty and misallocation that characterized the non-cooperative legislature, a new drawback of centralization creeps in:

- *Strategic delegation:* each district's median voter delegates policy-making to a representative with a different preference for public goods.

The precise direction of the distortion depends upon the circumstances as we will now explain.

With identical districts $(m_1 = m_2 = m)$ the Lemma implies that $(g_1, g_2) = 2m[(1-\kappa)^2 + \kappa^2]/p$. Since the surplus maximizing level of public goods is m/p, it follows that local public goods are over-provided for all $\kappa < 1/2$. The extent of over-provision is decreasing in the degree of spillovers, with the surplus maximum achieved at $\kappa = 1/2$. The incentives to delegate strategically can be seen most clearly in the case of zero spillovers. Then, the optimal spending levels for district 1's median voter are $(g_1, g_2) = (2m/p, 0)$. Assuming that district 2 elects a representative with the median preference, electing a representative of type m would produce a public goods outcome $(g_1, g_2) = (m/p, m/p)$ Electing a representative with a stronger taste for public spending raises district 1's public goods allocation, with no impact on district 2's. Each district is thus drawn to elect a type $2m$ representative.[27]

As spillovers increase, the optimal spending levels in the two districts for each district's median voter converge. Moreover, electing a representative with a higher taste

[26] The logarithmic specification of public goods benefits is key to allowing us to obtain an explicit solution for the equilibrium policy choices when the districts are not identical. With identical districts, a solution can be obtained with more general specifications. Our discussion paper furnishes the details.

[27] The strategic incentive to elect representatives with strong preferences for local public spending also arises in the analysis of Chari et al. (1997).

for public goods increases spending in the other district. Thus, the districts elect representatives with preferences closer to the median. In the limiting case of complete spillovers, each district elects a representative of the median type and local public goods are provided optimally.

Heterogeneity creates an additional conflict over the *level* of public spending, which is seen most clearly in the case of maximal spillovers. If $\kappa = 1/2$ and each district elects a representative of the median type, the public goods levels are $g_1 = g_2 = (m_1 + m_2)/2p$. This common level is too high for district 2's median voter and too low for district 1's. This gives district 2's median voter an incentive to have a lower representative type to reduce public goods spending, while district 1's median voter desires a representative with a higher valuation. They pull in opposite directions until one or both districts has put in their most extreme type. Our assumption that $2m_1 < \overline{\lambda}$ implies that district 1 can obtain its preferred level of public goods when district 2 has put in its most extreme type so that district 1's median voter ends up getting his preferred outcome of $g_1 = g_2 = m_1/p$.

This additional conflict of interest creates a complex relationship between spillovers and public goods levels. Analyzing the solutions described in the Lemma, we can show that district 1's public good level is decreasing in the level of spillovers for κ sufficiently small and $\kappa > \hat{\kappa}$. However, it is increasing in spillovers for κ sufficiently close to but less than $\hat{\kappa}$.[28] This appears puzzling as district 1's median voter's preferred public good level is actually decreasing in spillovers. The result reflects the conflict over spending levels that emerges as spillovers increase. To prevent district 2 from pulling down spending in both districts, district 1's median voter elects a representative with a higher preference for public goods, raising district 1's public good level. District 2's public good level is decreasing in the level of spillovers for $\kappa \leq \hat{\kappa}$ and increasing thereafter. It increases for spillover levels in excess of $\hat{\kappa}$, because it is now effectively controlled by district 1's median voter.

Comparing these outcomes with the surplus maximizing levels of public spending, district 1's public good level is always too high. The level provided to district 2 is too high for small κ and when κ is sufficiently large. However, it is less than the surplus maximizing level for κ sufficiently close to $\hat{\kappa}$. This under-provision is in sharp contrast to the over-provision results for the case of identical districts.

5.2. Decentralization versus centralization

Centralization produces the surplus maximizing public goods levels only when the districts are identical and spillovers are complete. Thus, with identical districts, decentralization dominates when spillovers are small and centralization is better when spillovers are large. With identical districts, the performance of centralization improves as κ increases and a critical value of spillovers exists above which centralization is welfare superior. With non-identical districts, decentralization continues to dominate when spill-

[28] This and the other claims concerning the public good levels described in Lemma 3 are established in our discussion paper.

overs are small and centralization dominates when spillovers are maximal. These findings are laid out in:

Proposition 3. *Suppose that the assumptions of the political economy approach are satisfied and that the legislature is cooperative. Then*

(i) *If the districts are identical, there is a critical value of* κ, *strictly greater than* 0 *but less than* 1/2, *such that a centralized system produces a higher level of surplus if and only if* κ *exceeds this critical level.*
(ii) *If the districts are not identical, then a decentralized system produces a higher level of surplus when spillovers are sufficiently small, while a centralized system produces a higher level when spillovers are sufficiently large.*

The bottom line is that the basic lessons of Proposition 2 generalize to the case of a cooperative legislature. For both identical and heterogenous districts, decentralization dominates centralization for low levels of spillovers, while centralization dominates for high levels of spillovers. The only nuance here is that we cannot show that there exists a critical level of spillovers in the case of heterogeneous districts. This reflects the fact that there is no general presumption that the relative performance of centralization is always increasing in spillovers. Surplus under centralization is decreasing in κ for κ sufficiently close to $\hat{\kappa}$. In this range, increasing spillovers both increases district 1's public good which is over-provided and decreases district 2's public good which is under-provided.

The findings in this section are particularly interesting as the model of legislative behavior assumes that legislators behave in a surplus maximizing way. Despite this, centralization is strictly inferior to decentralization when spillovers are small, even in the case of identical districts. This is because the shared financing of public goods under centralization leads voters to delegate strategically to representatives who provide excessive levels of public goods. Such strategic delegation is individually rational, but collectively self-defeating. Even when spillovers are significant and districts share an interest in each other's public goods, the conflict of interest over the level of public spending means that centralization can yield policy outcomes that are far from the surplus maximizing ideal.

6. Discussion

Throughout, we have assumed that, under a centralized system the costs of public spending are shared equally among districts. This is justified on empirical grounds since most centralized systems of government appear to operate (approximately) according to such rules.[29] However, our approach offers some insight into why this might be the case.

[29] We do not mean that tax burdens are common across districts. However, it is typical to have a common tax *code*. In the U.S., it would probably be unconstitutional for the federal government to tax incomes at different rates across states. That said, the federal government can offer tax credits for things like charitable contributions or research and development which may have a differential impact across jurisdictions.

Non-uniform taxation can be incorporated into the model by allowing the legislature to choose both a pair of public good levels and a pair of district-specific taxes. Assuming that the taxes can be negative, they can play two roles: raising revenue for public spending and permitting cross-district redistribution. With a non-cooperative legislature, allowing non-uniform taxation completely eliminates the case for centralization.[30] Specifically, for all levels of spillovers, surplus under decentralization is at least as high as that under centralization. Since the winning coalition can extract wealth from the other districts in the form of tax financed transfers, coalition members effectively pay the whole cost of public spending. The budgetary externality found under uniform financing is therefore eliminated, which reduces the incentive to provide public goods and eliminates the case for centralization entirely.[31] Thus, uniform financing may be necessary for centralization to occur at all.

The budgetary externality due to uniform financing can provide a valuable boost to public spending levels if spillover levels are high. This suggests a rather different spin on the usual discussion of budgetary externalities as contained, for example, in Weingast et al. (1981) or Chari et al. (1997). However, these contributions focus on the case where $\kappa = 0$. But this is precisely the case, as we have shown, when centralization is not a good idea. Once spillovers enter the picture, it is important to provide some appropriate marginal budgetary subsidy to boost the level of spending. For small spillovers, a large budgetary externality is likely to be too distortionary so that the preference for decentralization is maintained. As κ becomes large, the virtues of this financing externality come to dominate.

Given the potential benefits of imposing uniform cost sharing, then why not also impose a uniform spending allocation? If this were optimal in our framework then it might be used to motivate the uniformity constraint imposed by the standard approach. In fact, it is not obvious that a uniform spending constraint raises aggregate surplus. This can be investigated by solving for the majority preferred representative types when the legislature is subject to a uniformity constraint and comparing aggregate surplus at the implied policy outcomes with that under the unconstrained policy outcomes. With a non-cooperative legislature, a uniformity constraint is indeed surplus enhancing under our conditions.[32] However, with a cooperative legislature, uniformity can reduce aggregate surplus when districts are heterogeneous.[33] It is clear from this that any case for uniformity in spending would be dependent on the way in which political institutions (in our case legislative bargaining) works.

However, we have doubts about the practical feasibility of uniform spending. Most notions of equal treatment would have little to do with equal expenditures *per se*. Deciding

[30] The implications of non-uniform taxation in the cooperative legislature case are more difficult to anticipate because our model of decision making yields no prediction about the allocation of taxes between districts. This is because the representatives' utilities are linear in income and hence the sum of their payoffs is independent of the distribution of income. In particular, therefore, it is possible that they agree on a uniform sharing rule, in which case the analysis of the previous section applies.

[31] Our discussion paper provides the proof.

[32] In the non-cooperative case with a uniformity constraint, each district would elect a type m_i representative and the policy outcome would be $(g_1, g_2) = (m_1/p, m_1/p)$ with probability $1/2$ and $(g_1, g_2) = (m_2/p, m_2/p)$ with probability 1/2. It is straightforward to show that this yields a higher level of surplus than the outcome described in Lemma 2.

[33] In the cooperative case with a uniformity constraint, district 1 would elect a type $2m_1$ representative and district 2 a type 0. The policy outcome would then be $(g_1, g_2) = (m_1/p, m_1/p)$. We have verified by simulations that this outcome yields a lower level of surplus than that described in Lemma 3 when districts are very heterogeneous.

what constitutes equal provision of flood defences for a land-locked and coastal area has nothing to do with uniform provision. Similarly, defining equal access to roads in an urban and rural area may imply very different levels of spending. These inherent heterogeneities in spending needs make it hard indeed to imagine a satisfactory scheme of uniform provision. Indeed, experience suggests that, even when spending is allocated formulaically, it is possible for legislators to manipulate such formulas to favor their own districts.

7. Conclusion

The relative merits of decentralized and centralized systems of public spending have long been of interest to public economists. The standard approach suggests that the drawback of centralization is that it produces 'one size fits all' policy outcomes that are insensitive to the preferences of localities. However, this drawback follows by assumption and once the constraint that central governments must choose uniform levels of public spending is relaxed, the standard approach suggests that centralization is always preferred.

This paper has offered an alternative vision of the drawbacks of centralization, stemming from political economy considerations. The fact that costs are shared in a centralized system, creates a conflict of interest between citizens in different jurisdictions. When decisions are made by a legislature of locally elected representatives, this conflict of interest will play out in the legislature. If decisions on local public goods are made by a minimum winning coalition of representatives, the allocation of public goods may be characterized by uncertainty and misallocation across districts. If decisions are made in a more cooperative way, then strategic delegation via elections may produce excessive public spending.

The analysis suggests that modeling the detail of political decision-making is important to understanding the trade-off between centralization and decentralization. Our approach shows why even relatively homogeneous polities may face a cost of centralizing whether or not the legislature is cooperative. This insight is underpinned by the way in which spillovers affect the conflict of interest played out in the legislature in a system of common pool finance. Moreover, with a cooperative legislature, the familiar presumption that the performance of centralization improves with higher spillovers does not emerge. All of this notwithstanding, the key insight remains that heterogeneity and spillovers are correctly at the heart of the debate about the gains from centralization. It is perhaps comforting that the well-known lessons of the standard approach can be given a more satisfactory underpinning.

Much remains to be done to develop our understanding of the decentralization versus centralization question from this political economy perspective. One weakness of the analysis is that we have assumed that the only function of decentralized and centralized governments was providing the public goods in question. In reality, both levels of government determine numerous issues and hence the political consequences of transferring responsibility for one area of spending are likely to be much more subtle than our analysis suggests. A further weakness, is that in modelling political decision making in a centralized system, we have assumed that a legislature of locally elected representatives has the entire responsibility for policy decisions. However, it is typically the case that decision-making power is shared with a generally elected leader such as a president. It would be interesting to study how such leaders might mitigate the drawbacks of centralization that we have identified. More generally, one might expect a centralized system to perform very differently if representatives were elected via a proportional representation list system rather than through local winner-take-all elections.

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Appendix A

Proof of Proposition 1. Part (i) of the proposition follows immediately from the relationship between the public goods levels under the two systems and the surplus maximizing levels. For part (ii), note that aggregate public goods surplus under decentralization is given by:

$$S^d(\kappa) = [m_1(1-\kappa) + m_2\kappa]\ln\frac{m_1(1-\kappa)}{p} + [m_2(1-\kappa) + m_1\kappa]\ln\frac{m_2(1-\kappa)}{p}$$
$$-m_1(1-\kappa) - m_2(1-\kappa),$$

while surplus under centralization is:

$$S_t^c(\kappa) = [m_1 + m_2]\ln\frac{m_1+m_2}{2p} - m_1 - m_2.$$

From our earlier discussion, we know that when $m_1 \neq m_2$, $S_t^c(0) < S^d(0)$ and $S_t^c(1/2) > S^d(1/2)$. It is also clear that surplus under centralization is independent of κ. To prove the result it suffices to show that surplus under decentralization is decreasing in κ. We leave this to the reader. □

Proof of Proposition 2. Aggregate public goods surplus under decentralization is as under the traditional approach, while surplus under centralization is:

$$S_n^c(\kappa) = [m_1(1-\kappa) + m_2\kappa]\frac{\ln\frac{2m_1(1-\kappa)}{p} + \ln\frac{2m_2\kappa}{p}}{2}$$
$$+[m_2(1-\kappa) + m_1\kappa]\frac{\ln\frac{2m_2(1-\kappa)}{p} + \ln\frac{2m_1\kappa}{p}}{2} - m_1 - m_2.$$

We begin by establishing three claims concerning surplus under centralization.

Claim 1. $S_n^c(\cdot)$ is increasing in κ.

Differentiating, we obtain

$$\frac{\mathrm{d}S_n^c(\kappa)}{\mathrm{d}\kappa} = (m_2 - m_1)[\varphi(m_1) - \varphi(m_2)] + \frac{m_1 + m_2}{2\kappa(1-\kappa)}(1 - 2\kappa),$$

where

$$\varphi(m_i) = \ln\frac{2m_i(1-\kappa)}{p} - \ln\frac{2m_i\kappa}{p}.$$

By the *Mean-Value Theorem*, there exists $m \in (m_2, m_1)$ such that

$$\varphi(m_1) - \varphi(m_2) = \varphi'(m)(m_1 - m_2).$$

But,

$$\varphi'(m) = 0$$

and hence

$$\frac{\mathrm{d}S_n^c(\kappa)}{\mathrm{d}\kappa} = \frac{m_1 + m_2}{2\kappa(1-\kappa)}(1 - 2\kappa) > 0.$$

Claim 2. $S_n^c(0) < S^d(0)$ and $S_n^c(1/2) > S^d(1/2)$.

The former statement follows immediately from the fact that decentralization produces the surplus maximizing public good levels when $\kappa = 0$, while centralization does not. For the latter statement, note that we may write $S^d(1/2) = \psi(1/2)$ and $S_n^c(1/2) = \psi(1)$, where

$$\psi(\gamma) = \frac{(m_1 + m_2)}{2}\left[\ln\frac{\gamma m_1}{p} + \ln\frac{\gamma m_2}{p}\right] - \gamma(m_1 + m_2).$$

Now observe that

$$\psi'(\gamma) = (m_1 + m_2)\left[\frac{1}{\gamma} - 1\right].$$

It follows that $\psi(1/2) < \psi(1)$, which implies the desired conclusion.

Claim 3. *For all κ, $S_n^c(\kappa) \leq S_t^c(\kappa)$ with the inequality holding strictly for $\kappa < 1/2$.*

We first claim that for all κ

$$S_n^c(\kappa) \leq \frac{(m_1 + m_2)}{2}\left[\ln\frac{m_1}{p} + \ln\frac{m_2}{p}\right] - (m_1 + m_2),$$

with the inequality holding strictly for all $\kappa < 1/2$. To see this, observe that

$$S_n^c\left(\frac{1}{2}\right) = \frac{(m_1 + m_2)}{2}\left[\ln\frac{m_1}{p} + \ln\frac{m_2}{p}\right] - (m_1 + m_2)$$

and recall from Claim 1 that $S_n^c(\cdot)$ is increasing. Next observe that, by concavity,

$$\begin{aligned}\frac{(m_1 + m_2)}{2}\left[\ln\frac{m_1}{p} + \ln\frac{m_2}{p}\right] - (m_1 + m_2) &< [m_1 + m_2]\ln\frac{m_1 + m_2}{2p} - m_1 - m_2 \\ &= S_t^c(\kappa).\end{aligned}$$

The proposition follows easily from these Claims. Claims 1 and 2 imply the existence of a critical value of κ, strictly greater than 0 but less than $1/2$, such that a centralized system produces a higher level of surplus if and only if κ exceeds this critical level. This is true whether or not the districts are identical. Claim 3 and the fact that surplus under decentralization is the same as under the traditional approach imply that, when districts are not identical, the critical level under the traditional approach is lower than that implied by the political economy approach. □

Proof of Lemma 3. As observed in the text, $(\lambda_1^*, \lambda_2^*)$ is majority preferred under centralization with a cooperative legislature if and only if $(\lambda_1^*, \lambda_2^*)$ is a Nash equilibrium of the two player game in which each player has strategy set $[0, \overline{\lambda}]$ and player $i \in \{1, 2\}$ has payoff function $U_i(\lambda_1, \lambda_2, m_i)$. We prove the Lemma by calculating the set of equilibria of this game and computing the associated policy outcomes.

Note first that each player's payoff function is a twice continuously differentiable and strictly concave function of his strategy and each player's strategy set is compact and convex. Thus, the set of equilibria is non-empty. Moreover, $\partial^2 U_1/\partial\lambda_1\partial\lambda_2 < 0$ and $\partial^2 U_2/\partial\lambda_2\partial\lambda_1 < 0$, implying that types are strategic substitutes.

For $i = 1, 2$, let $r_i\colon[0, \overline{\lambda}] \to [0, \overline{\lambda}]$ denote the district i median voter's *reaction function.* By definition, for all $\lambda_2 \in [0, \overline{\lambda}]$,

$$r_1(\lambda_2) = \arg\max\{U_1(r_1, \lambda_2, m_1)\colon r_1 \in [0, \overline{\lambda}]\},$$

and for all $\lambda_1 \in [0, \overline{\lambda}]$,

$$r_2(\lambda_1) = \arg\max\{U_2(\lambda_1, r_2, m_2)\colon r_2 \in [0, \overline{\lambda}]\}.$$

Then, $(\lambda_1^*, \lambda_2^*)$ is an equilibrium of the game if and only if $(\lambda_1^*, \lambda_2^*) = (r_1(\lambda_2^*), r_2(\lambda_1^*))$.

Some general features of the reaction functions follow from the properties of the payoff functions. The fact that each player's payoff is a strictly concave and differentiable function of his strategy implies (i) that $r_1(\lambda_2) = 0$ if $\partial U_1(0, \lambda_2, m_1)/\partial\lambda_1 < 0$; (ii) that $r_1(\lambda_2) = \overline{\lambda}$ if $\partial U_1(\overline{\lambda}, \lambda_2, m_1)/\partial\lambda_1 > 0$; and (iii) that otherwise $r_1(\lambda_2)$ is implicitly defined by the first-order condition $\partial U_1(r_1(\lambda_2), \lambda_2, m_1)/\partial\lambda_1 = 0$. In addition, the fact that types are strategic substitutes implies that $r_1(\lambda_2)$ is non-decreasing. Similar remarks apply to the district 2 median voter's reaction function.. It remains therefore to determine the details of each player's reaction function. Let $\overline{\lambda}_1(\overline{\lambda}_2)$ denote the level of

$\lambda_1(\lambda_2)$ beyond which district 2's median voter (district 1's median voter) would like a type 0 representative. These levels are implicitly defined by the equalities

$$\partial U_1(0, \overline{\lambda}_2, m_1)/\partial \lambda_1 = 0,$$

and

$$\partial U_2(\overline{\lambda}_1, 0, m_2)/\partial \lambda_2 = 0.$$

Using the facts that

$$\frac{\partial U_1}{\partial \lambda_1} = m_1 \left[\frac{(1-\kappa)^2}{\lambda_1(1-\kappa) + \lambda_2 \kappa} + \frac{\kappa^2}{\lambda_2(1-\kappa) + \lambda_1 \kappa} \right] - \frac{1}{2},$$

and

$$\frac{\partial U_2}{\partial \lambda_2} = m_2 \left[\frac{(1-\kappa)^2}{\lambda_2(1-\kappa) + \lambda_1 \kappa} + \frac{\kappa^2}{\lambda_1(1-\kappa) + \lambda_2 \kappa} \right] - \frac{1}{2},$$

we obtain

$$\overline{\lambda}_1 = 2m_2 \left\{ \frac{(1-\kappa)^3 + \kappa^3}{\kappa(1-\kappa)} \right\}$$

and

$$\overline{\lambda}_2 = 2m_1 \left\{ \frac{(1-\kappa)^3 + \kappa^3}{\kappa(1-\kappa)} \right\},$$

Observe that $((1-\kappa)^3 + \kappa^3)/\kappa(1-\kappa)$ is decreasing in κ, takes on the value 1 when $\kappa = 1/2$ and tends to infinity as κ goes to zero. This implies that $\overline{\lambda}_1 \geq 2m_2$ and $\overline{\lambda}_2 \geq 2m_1$.

Next we characterize the highest type representative each district's median voter would want. It is straightforward to show that

$$\frac{\partial U_1(2m_1, 0, m_1)}{\partial \lambda_1} = 0$$

and

$$\frac{\partial U_2(0, 2m_2, m_2)}{\partial \lambda_2} = 0,$$

which implies that district i's median voter desires a type $2m_i$ candidate when the other district selects a type 0 candidate. By assumption, $2m_i < \overline{\lambda}$, so that the upper bound constraint on type choice is not binding here. It follows that for both districts $i = 1, 2$, $r_i(0) = 2m_i$.

. We may conclude from the above that for all $\lambda_2 \in [0, \min\{\overline{\lambda}_2, \overline{\lambda}\}]$, $r_1(\lambda_2)$ is implicitly defined by the first-order condition

$$\frac{\partial U_1(r_1(\lambda_2), \lambda_2, m_1)}{\partial \lambda_1} = 0$$

and for all $\lambda_2 \in (\min\{\overline{\lambda}_2, \overline{\lambda}\}, \overline{\lambda}]$,

$$r_1(\lambda_2) = 0.$$

Further, we know that $r_1(0) = 2m_1$ and that $r_1(\lambda_2)$ is downward sloping on $[0, \min\{\overline{\lambda}_2, \overline{\lambda}\}]$. Similarly, for all $\lambda_1 \in [0, \min\{\overline{\lambda}_1, \overline{\lambda}\}]$, $r_2(\lambda_1)$ is implicitly defined by the first-order condition

$$\frac{\partial U_2(\lambda_1, r_2(\lambda_1), m_2)}{\partial \lambda_2} = 0$$

and for all $\lambda_1 \in (\min\{\overline{\lambda}_1, \overline{\lambda}\}, \overline{\lambda}]$,

$$r_2(\lambda_1) = 0.$$

Further, we know that $r_2(0) = 2m_2$ and that $r_2(\lambda_1)$ is downward sloping on $[0, \min\{\overline{\lambda}_1, \overline{\lambda}\}]$.

We can now prove the lemma. If $\kappa < \hat{\kappa}$, it follows from the definition of $\hat{\kappa}$ in the text that $((1-\kappa)^3 + \kappa^3)/\kappa(1-\kappa) > m_1/m_2$. This in turn implies that

$$\overline{\lambda}_1 = 2m_2 \left\{ \frac{(1-\kappa)^3 + \kappa^3}{\kappa(1-\kappa)} \right\} > 2m_1.$$

This inequality implies that there exist no boundary equilibria in which $\lambda_i^* = 0$ for one or more districts. If $\lambda_2^* = 0$, then $\lambda_1^* = r_1(0) = 2m_1$, but since $2m_1 < \overline{\lambda}_1$ we know that $r_2(2m_1) > 0$ which contradicts the fact that $\lambda_2^* = 0$. If $\lambda_1^* = 0$, then $\lambda_2^* = r_2(0) = 2m_2$, but since $2m_2 < \overline{\lambda}_2$ we know that $r_1(2m_2) > 0$ which contradicts the fact that $\lambda_1^* = 0$. Since $\max r_i(\lambda_{-i}) < \overline{\lambda}$, it is apparent that there can be no boundary equilibria in which $\lambda_i^* = \overline{\lambda}$ for one or more districts.

It follows that there must exist an interior equilibrium. Any such equilibrium $(\lambda_1^*, \lambda_2^*)$ must satisfy the first-order conditions $\partial U_i(\lambda_1^*, \lambda_2^*, m_i)/\partial \lambda_i = 0$ for $i \in \{1, 2\}$. Using the expressions for $\partial U_i/\partial \lambda_i$, $i \in \{1, 2\}$ from above, we may write these first-order conditions as:

$$m_1 \left[\frac{(1-\kappa)^2}{\lambda_1^*(1-\kappa) + \lambda_2^*\kappa} + \frac{\kappa^2}{\lambda_2^*(1-\kappa) + \lambda_1^*\kappa} \right] = \frac{1}{2},$$

and

$$m_2 \left[\frac{(1-\kappa)^2}{\lambda_2^*(1-\kappa) + \lambda_1^*\kappa} + \frac{\kappa^2}{\lambda_1^*(1-\kappa) + \lambda_2^*\kappa} \right] = \frac{1}{2}.$$

Combining the two first-order conditions, we obtain

$$\lambda_1^*(1-\kappa)+\lambda_2^*\kappa=[\lambda_2^*(1-\kappa)+\lambda_1^*\kappa]\frac{m_1(1-\kappa)^2-m_2\kappa^2}{m_2(1-\kappa)^2-m_1\kappa^2}.$$

Using this and the first-order conditions for λ_1^* and λ_2^* respectively yields:

$$\lambda_1^*(1-\kappa)+\lambda_2^*\kappa=\frac{2m_1m_2[(1-\kappa)^4-\kappa^4]}{m_2(1-\kappa)^2-m_1\kappa^2}$$

and

$$\lambda_2^*(1-\kappa)+\lambda_1^*\kappa=\frac{2m_1m_2[(1-\kappa)^4-\kappa^4]}{m_1(1-\kappa)^2-m_2\kappa^2}.$$

Thus, as claimed, the policy outcome is

$$(g_1,g_2)=\left(\frac{2m_1[(1-\kappa)^4-\kappa^4]}{\left[(1-\kappa)^2-\dfrac{m_1}{m_2}\kappa^2\right]p},\frac{2m_1[(1-\kappa)^4-\kappa^4]}{\left[\dfrac{m_1}{m_2}(1-\kappa)^2-\kappa^2\right]p}\right).$$

If $\kappa\geq\hat{\kappa}$, it follows that $((1-\kappa)^3+\kappa^3)/\kappa(1-\kappa)\leq m_1/m_2$, which in turn implies that

$$\overline{\lambda}_1=2m_2\left\{\frac{(1-\kappa)^3+\kappa^3}{\kappa(1-\kappa)}\right\}\leq 2m_1.$$

This inequality implies that there exists a boundary equilibrium in which $(\lambda_1^*,\lambda_2^*)=(2m_1,0)$. This is because $r_2(2m_1)=0$ and $r_1(0)=2m_1$. The same arguments from above imply that there exist no other boundary equilibria. We also claim that there are no interior equilibria. Any such equilibrium $(\lambda_1^*,\lambda_2^*)$ must satisfy the first-order conditions $\partial U_i(\lambda_1^*,\lambda_2^*,m_i)/\partial\lambda_i=0$ for $i\in\{1,2\}$. These first-order conditions imply that

$$\begin{aligned}&m_1[\lambda_2^*(1-\kappa)^3+\lambda_1^*\kappa(1-\kappa)^2+\lambda_1^*(1-\kappa)\kappa^2+\lambda_2^*\kappa^3]\\=\;&m_2[\lambda_1^*(1-\kappa)^3+\lambda_2^*\kappa(1-\kappa)^2+\lambda_2^*(1-\kappa)\kappa^2+\lambda_1^*\kappa^3].\end{aligned}$$

This means that

$$\lambda_2^*=\frac{[m_2((1-\kappa)^3+\kappa^3)-m_1\kappa(1-\kappa)]}{[m_1((1-\kappa)^3+\kappa^3)-m_2\kappa(1-\kappa)]}\lambda_1^*$$

But the assumption that $\kappa \geq \hat{\kappa}$ implies that $\lambda_2^* \leq 0$ if $\lambda_1^* > 0$, which, in turn, is inconsistent with the hypothesis that $(\lambda_1^*, \lambda_2^*) > (0,0)$. Thus, the only equilibrium is that $(\lambda_1^*, \lambda_2^*) = (2m_1, 0)$ which implies that

$$(g_1, g_2) = \left(\frac{2m_1(1-\kappa)}{p}, \frac{2m_1\kappa}{p}\right),$$

as required. □

Proof of Proposition 4. *Letting $(g_1^c(\kappa), g_2^c(\kappa))$ be the policy outcome under centralization with a cooperative legislature and spillovers κ, surplus is given by*

$$S_c^c(\kappa) = [m_1(1-\kappa) + m_2\kappa] \ln g_1^c(\kappa) + [m_2(1-\kappa) + m_1\kappa] \ln g_2^c(\kappa)$$
$$-p(g_1^c(\kappa) + g_2^c(\kappa)).$$

For part (i), we know from the earlier discussion that when $m_1 = m_2 = m$, $S_c^c(0) < S^d(0)$ and $S_c^c(1/2) > S^d(1/2)$. We also know from the proof of Proposition 1, that surplus is decreasing in spillovers under decentralization. Thus, it suffices to show that surplus is increasing in spillovers under centralization. We leave this to the reader.

For the first part of (ii), note that when $m_1 \neq m_2$, $S_c^c(0) < S^d(0)$. Since both surplus functions are continuous functions of κ, for each (m_1, m_2) there exists $\varepsilon > 0$ such that $S_c^c(\kappa) < S^d(\kappa)$ for all $\kappa < \varepsilon$. Similar logic establishes the second part of (ii), if $S_c^c(1/2) > S^d(1/2)$. Thus, it remains to establish this inequality. Let (m_1, m_2) be given and suppose that $m_1 > m_2$. We can find $\xi > 0$ and $\gamma \in [1/2, 1]$ so that $(m_1, m_2) = (\xi\gamma, \xi(1-\gamma))$. In addition, since $\kappa < 1/2$, we have that

$$g_1^c\left(\frac{1}{2}\right) = g_2^c\left(\frac{1}{2}\right) = \frac{\xi\gamma}{p}.$$

This implies that

$$S_c^c\left(\frac{1}{2}; \gamma\right) = \xi \ln \frac{\xi\gamma}{p} - 2\xi\gamma.$$

Under decentralization, surplus is given by:

$$S^d\left(\frac{1}{2}; \gamma\right) = \frac{\xi}{2}\left\{\ln \frac{\xi\gamma}{2p} + \ln \frac{\xi(1-\gamma)}{2p}\right\} - \frac{\xi}{2}.$$

Taking differences, we have that

$$
\begin{aligned}
&S_c^c\left(\frac{1}{2};\gamma\right)-S^d\left(\frac{1}{2};\gamma\right)\\
&\quad=\xi\ln\frac{\xi\gamma}{p}-2\,\xi\gamma-\frac{\xi}{2}\left\{\ln\frac{\xi\gamma}{2p}+\ln\frac{\xi(1-\gamma)}{2p}\right\}+\frac{\xi}{2}\\
&\quad=\xi\ln\xi\gamma-\frac{\xi}{2}\left\{\ln\xi\gamma-\ln 2+\ln\frac{\xi(1-\gamma)}{2}\right\}-\frac{3\xi\gamma}{2}+\frac{\xi(1-\gamma)}{2}\\
&\quad=\frac{\xi}{2}\left\{\ln 2+\ln\frac{2\gamma}{1-\gamma}\right\}-\frac{3\xi\gamma}{2}+\frac{\xi(1-\gamma)}{2}.
\end{aligned}
$$

Differentiating the difference with respect to γ yields

$$
\begin{aligned}
\frac{d\left[S_c^c\left(\frac{1}{2};\gamma\right)-S^d\left(\frac{1}{2};\gamma\right)\right]}{\mathrm{d}\gamma}&=\frac{\xi}{2\gamma(1-\gamma)}-2\xi\\
&=\xi\frac{1-4\gamma(1-\gamma)}{2\gamma(1-\gamma)}\geq 0.
\end{aligned}
$$

Thus, this difference is non-decreasing in γ. Accordingly, if $S_c^c(1/2;\gamma)>S^d(1/2;\gamma)$ at $\gamma=1/2$, then the inequality holds for all γ in the relevant range. But $\gamma=1/2$ corresponds to the symmetric case and we indeed know that surplus under centralization is higher than decentralization then. □

References

Bardhan, P., Mookherjee, D., 2000. Capture and governance at local and national levels. American Economic Review 90 (2), 135–139.

Baron, D., 1991. Majoritarian incentives, pork barrel programs and procedural control. American Journal of Political Science 35 (1), 57–90.

Baron, D., Ferejohn, J., 1989. Bargaining in legislatures. American Political Science Review 83, 1181–1206.

Besley, T., Coate, S., 1997. An economic model of representative democracy. Quarterly Journal of Economics 112 (1), 85–114.

Buchanan, J., Tullock, G., 1962. The Calculus of Consent. University of Michigan Press, Ann Arbor.

Chari, V.V., Jones, L., Marimon, R., 1997. The economics of split-ticket voting in representative democracies. American Economic Review 87 (5), 957–976.

Coate, S., 1997. Distributive Policy Making as a Source of Inefficiency in Representative Democracies, Institute of Economic Research, University of Pennsylvania, Working Paper No. 97-041.

Collie, M., 1988. The legislature and distributive policy making in formal perspective. Legislative Studies Quarterly 13 (4), 427–458.

Courant, P.N., Gramlich, E.M., Rubinfeld, D.L., 1979. Public employee market power and the level of government spending. American Economic Review 69 (5), 806–817.

Epple, D., Zelenitz, A., 1981. The implications of competition among jurisdictions: does Tiebout need politics? Journal of Political Economy 89 (6), 1197–1217.

Ferejohn, J., 1974. Pork Barrel Politics: Rivers and Harbors Legislation 1947–1968. Stanford University Press, Stanford, CA.

Ferejohn, J., Morris, F., McKelvey, R., 1987. Sophisticated voting and agenda independence in the distributive politics setting. American Journal of Political Science 31, 167–193.

Inman, R., Fitts, M., 1990. Political institutions and fiscal policy: evidence from the U.S. historical record. Journal of Law, Economics and Organization 6, 79–132.

Inman, R., Rubinfeld, D., 1997a. Rethinking federalism. Journal of Economic Perspectives 11 (4), 43–64.

Inman, R., Rubinfeld, D., 1997b. The political economy of federalism. In: Mueller, D.C. (Ed.), Perspectives on Public Choice: A Handbook. Cambridge University Press, Cambridge.

Knight, B., 2002. Endogenous Federal Grants and Crowd-out of State Government Spending: Theory and Evidence from the Federal Highway Aid Program. American Economic Review 92 (1), 71–92.

Lockwood, B., 2002. Distributive Politics and the Benefits of Decentralization. Review of Economic Studies 69 (2), 313–338.

Niou, E., Ordeshook, P., 1985. Universalism in congress. American Journal of Political Science 29, 246–258.

Oates, W., 1972. Fiscal Federalism. Harcourt Brace, New York.

Osborne, M., Slivinski, A., 1996. A model of political competition with citizen-candidates. Quarterly Journal of Economics 111 (1), 65–96.

Persson, T., Tabellini, G., 1992. The politics of 1992: fiscal policy and european integration. Review of Economic Studies 59 (4), 689–701.

Riker, W., 1962. The Theory of Political Coalitions. Yale University Press, New Haven.

Schwartz, T., 1994. Representation as agency and the pork-barrel paradox. Public Choice 78, 3–21.

Seabright, P., 1996. Accountability and decentralization: an incomplete contracts model. European Economic Review 40 (1), 61–90.

Tiebout, C., 1956. A pure theory of local expenditures. Journal of Political Economy 64 (5), 416–424.

Tommasi, M., Weinschelbaum, F., 1999. A Principal-Agent Building Block for the Study of Decentralization and Integration, typescript.

Weingast, B., 1979. A rational choice perspective on congressional norms. American Journal of Political Science 23, 245–262.

Weingast, B., Shepsle, K., Johnson, C., 1981. The political economy of benefits and costs: a neoclassical approach to distributive politics. Journal of Political Economy 89, 642–664.

Wittman, D., 1989. Why democracies produce efficient results. Journal of Political Economy 97 (6), 1395–1424.