The impact of referendums on the centralisation of public goods provision: a political economy approach

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Abstract   The paper compares decision-making on the centralisation of public goods provision in the presence of regional externalities under representative and direct democratic institutions. A model with two regions, two public goods and regional spillovers is developed in which uncertainty over the true preferences of candidates makes strategic delegation impossible. The political economy argument against centralisation of Besley and Coate (J Public Econ 87:2611–2637, 2003) does therefore not apply. Instead, it is shown that the existence of rent extraction by delegates alone suffices to make cooperative centralisation more likely through representative democracy under reasonable assumptions. In the case of non-cooperative centralisation, the more extensive possibilities for institutional design under representative democracy increase the likelihood of centralisation. Direct democracy may thus be interpreted as a federalism-preserving institution.

Keywords   Centralisation · Direct democracy · Representative democracy ·
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JEL Classification   H11 · H77 · H72 · H73

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1 Introduction

In the literature on fiscal federalism, a variety of theoretical reasons for the decentralisation (or symmetrically: against the centralisation) of economic policies is offered. The literature concerned with the costs and benefits of decentralised public good provision in the tradition of Oates (1972) has identified regional differences in preferences as an important rationale for decentralisation. The crucial insight is that a centralised provision of a uniform supply of public goods under conditions of demand heterogeneity is associated with costs for those whose preferences are not taken into account. Preference heterogeneity has also been an important feature of a number of subsequent theoretical approaches. For example, Alesina and Spolaore (1997), in a theory of the optimal size of nations, introduce the fundamental tradeoff between economies of scale in the production of public goods and the costs that arise due to heterogeneous preferences.

The problem becomes more complicated if regional public goods cause spatial externalities. If individuals in jurisdiction A gain a utility from a public good provided in B and free-ride on the policies of B, underprovision of the public good is a standard result. Welfare may then principally be improved through a number of different channels: if a central authority is politically or technologically restricted to setting a uniform level of public goods in A and B, then a tradeoff between the welfare gains from internalising spillovers and the welfare losses due to a deviation from regional preferences has to be analysed. Centralisation may or may not enhance welfare, and the type of centralisation—with either a rigidly uniform policy, or some degree of flexibility on the central level—will have an impact on the overall welfare effect (Alesina et al. 2005).

This tradeoff disappears, however, if the central authority can set regionally different levels of public goods. *Prima facie*, centralisation that internalises spillovers ought to be generally Pareto improving under this condition. However, additional caveats have been introduced in models that also take political economy arguments into consideration, such as Besley and Coate (2003) who show that individuals exploit cost-sharing rules in a centralised regime. Being able to externalise a portion of the costs to taxpayers from other jurisdictions, they strategically delegate public goods lovers to the central level. This results in an overall overprovision of public goods. In a technically similar model, Dur and Roelfsema (2005) show that not only over-, but also underprovision may occur under a centralised regime if the public goods provided have a regional cost component that cannot be shared through the central budget. In other models concerned with budgetary effects of (de-)centralisation, Persson and Tabellini (1994) argue that centralised regimes are more vulnerable to lobbying and therefore associated with larger budgets, while Mazza and van Winden (2002) show that when a two-tier government with central and regional authorities is modeled, smaller budgets may result compared to a purely decentralised system. Their model is designed to closely reflect the institutions of the European Union: one authority comprised of delegates from the regions (the Council) decides on the overall size of the budget, while a central authority (the Commission) decides on its apportionment. The fixed size of the overall budget reduces the incentives of special interest groups to lobby for specific spending measures, possibly even so far that a smaller budget results in the centralised regime.

While the contributions sketched above focus on the effects of (de-)centralisation once it has occured, a different question concerns the process of institutional change itself: under which conditions can we expect centralisation of government to take place at all? Ellingsen (1998) presents a model where the decision to centralise in the face of spillovers hinges on the size and heterogeneity of regions and shows that different combinations of the relative size of regions and inter- as well as intra-regional heterogeneity are associated with very different probabilities of centralisation. In contrast, a model by Redoano and Scharf (2004) focuses on a comparison of the centralisation decisions under direct and representative democracy. They show that under the latter, a pro-centralization jurisdiction can commit to a reluctant jurisdiction by sending a delegate with preferences close to that of the majority in the reluctant jurisdiction. Therefore, centralisation is more likely to occur under representative democracy in their model.

Regarding the question posed, the model presented here is most closely related to that by Redoano and Scharf (2004): is centralisation more likely to occur under direct or under purely representative democracy? There are, however, important differences in the approach to the problem. While the model by Redoano and Scharf understands centralisation as harmonisation, our model allows a centralised regime to set different levels of public good supply over different regions. Furthermore, while Redoano and Scharf focus on problems of commitment that occur in the process of centralisation, we allow for rent extraction as a general problem of political delegation to appear in the model. Nevertheless, it will be shown that even under these very different assumptions, the theoretical result presented by Redoano and Scharf is robust: centralisation is more likely to occur under representative compared to direct democracy if rent-extraction is pervasive. Moreover, direct democracy is used by voters as an instrument to veto collusive centralisation that benefits representatives. The paper also differs in an important aspect from the above-mentioned approach of Alesina et al. (2005). There, the focus is on the effects of different rules of determining policy on the central level on the willingness to centralise, and in particular the focus is on flexibility. Our approach, on the other hand, emphasizes the importance of controlling non-benevolent representatives.

The argument will proceed as follows: in Sect. 2, we lay out the relevance of the issue discussed here and locate it within the broader context of the related literature. Section 3 introduces the model and its core assumptions. In Sect. 4, we derive the ideal policies for the median voter and for the representative under different political institutions, and in Sect. 5, we show that given a sufficiently large control problem in representative democracy, direct democracy effectively works to impede centralisation and can be seen as a federalism-preserving institution, regardless whether the centralised regime works with a cooperative or a non-cooperative rule for decision-making. Finally, Sect. 6 draws some conclusions.

2 Centralisation and institutions: why is it an issue?

In the model by Redoano and Scharf, the difference between representative and direct democracy is the instrument of strategic delegation which is available under the former,

but not under the latter type of institutions for collective decision-making. Successful strategic delegation requires that the true preferences of candidates for office are common knowledge. Candidates can only then credibly commit to implementing the policy (and only the policy) that is in accordance with their own preferences. This approach therefore follows the pioneering contributions of Besley and Coate (1997) as well as Osborne and Slivinski (1996), who essentially exclude political control problems from their analysis. In this class of citizen-candidate models, voters know in advance exactly what to expect from the candidates that stand for election.

Laying emphasis on the possibility of strategic delegation therefore implies that an important rationale for having fiscal federalism, namely the control of self-interested representatives between elections, is excluded from the theoretical considerations by assumption. At the other end of the theoretical continuum, the literature on market-preserving federalism (Weingast 1995; Qian and Weingast 1997) stresses the importance of this issue. From this perspective, political decentralisation raises the single government's costs of encroaching its citizens' property rights. Decentralisation limits the scope of viable political interventions into individual rights and liberties, and thus ultimately also works to preserve the functioning of the market process. A somewhat related argument had already been made by Brennan and Buchanan (1980), who argued that the competitive pressure between decentralised governments serves to inhibit fiscal exploitation of the citizens.

In our model, we return to this original idea of political economics and reckon that there is uncertainty about the true preferences and motives of candidates for political office, so that political control between elections is a problem that cannot be solved by perfect delegation. As citizens listening to political speeches, we have little means to reliably distinguish between cheap talk or opportunistic schmooze on the one hand, and an honest revelation of personal preferences on the other. Acknowledging this, we introduce into our model uncertainty regarding the candidates' actual preferences, and therefore analyse the centralisation of public good provision in the light of a control problem that citizens have with regard to their representatives.

The argument that such issues are relevant in decisions regarding the vertical allocation of competencies has already been brought up in some strands of the literature. For example, Blankart (2000) has argued in a case study comparison of Germany and Switzerland that government centralisation in Germany has followed from the building of an expenditure cartel by representatives of the sub-national *Länder*. In Switzerland, on the other hand, direct legislation is argued to have frustrated such attempts. However, Blankart did not support this reasoning with a theoretical model. In a different theoretical approach, de Figueiredo and Weingast (2005) explore the concept of self-enforcing federalism. Their focus is on balancing the competencies between local governments and the center such that, on the one hand, the central government is sufficiently strong to enforce contributions to federation-wide public goods provision, and, on the other hand, the local governments can coordinate on policing encroachments by the central government.

In our present paper, we show in a formal model that the existence of sufficiently high levels of rent extraction by representatives makes citizens relatively reluctant to centralise political competencies. If they have direct-democratic control mechanisms, then a centralisation of competencies occurs less often compared to an institutional

framework in which centralisation decisions are made by consenting representatives. In this sense, we argue that making decisions to centralise contingent on the consent of a majority of voters should also be considered as a part of a constitution, if one wishes to self-enforce a federal structure of government.

Some econometric evidence already exists which hints at the fact that direct-democratic instruments are used by citizens in order to decentralise fiscal competencies or to prevent centralisation. For example, Matsusaka (2004) shows for the United States that the popular initiative has been used to shift public spending from the state to the local level. These efforts of decentralising spending competencies are noticed against the background of a secular trend of fiscal centralisation that is observed elsewhere. Matsusaka and McCarty (2001) cast some theoretical and empirical doubt on the presumption that the initiative always helps to solve agency problems. Following their line of argument, under conditions of uncertainty about voters' preferences the threat with an initiative can be used by interest groups to draw the representative towards their political bliss points.

This argument is, however, valid only for the initiative, where interest groups can act as agenda setters. If, in contrast, majority approval in an obligatory referendum is necessary before a policy is executed, while the proposal itself is drafted by the representative, then the direct-democratic instrument works as a control mechanism. Proposals that are not beneficial to the median voter cannot be passed and the obligatory referendum binds the representative to the policy preferences of the median voter. The same tendency holds for an optional referendum, but the presence of significant costs of organising such a referendum renders an outcome that is further away from the policy the median voter prefers.

In an empirical companion paper to this study, Feld et al. (2008) report evidence from the Swiss cantonal and local level, which strongly supports the hypothesis that fiscal centralisation is less pronounced in cantons where the instrument of a fiscal referendum is available to voters. In the present paper, we offer a formal theoretical interpretation of these empirical results and argue that it is generally more difficult to centralise decision-making on public goods when this decision is subject to a popular referendum, vis-a-vis purely representative democracy. This holds for both cooperative and non-cooperative decision-making of local representatives on the central level. In the first case, the possibility of rent-extraction by representatives is chiefly responsible for the result, while in the second case, the difficulty to institutionally steer direct-democratic decision-making through interventions such as gerrymandering is the driving force.

3 Assumptions of the model

In this section, a simple model is introduced with two regions that are equally sized in terms of the number of citizens. Local governments supply one type of public goods each, and interjurisdictional spillovers of utility may occur. Public goods of both jurisdictions enter individual utility functions, and the degree to which the foreign public good is enjoyed depends on the intensity of spillovers. For example, one region might supply a publicly funded theatre that can also be visited by citizens of

the other jurisdiction, where a public park is provided that is also open to inhabitants of the former jurisdiction.

Suppose that, partially resembling the specifications of Besley and Coate (2003) as well as Dur and Roelfsema (2005), an individual I in one of the regions $i, j \in 1, 2$ with $i \neq j$ has the utility function

$$U_i^I = x + \lambda^I [b(g_i) + \gamma b(g_j)] \tag{1}$$

where x is the amount of private goods consumed, g is the quantity of a local public good, $\gamma \in (0, 1]$ is the spillover parameter. It has several natural interpretations; for example, γ may signify geographical proximity between the two regions, or preference intensity for the type of public good supplied in the neighbouring jurisdiction. It therefore appears reasonable to allow γ to assume values over the entire range of the interval between zero and unity. Later, γ^* will denote that threshold level of spillovers where for any $\gamma > \gamma^*$ centralisation is strictly preferred over a decentralised regime. The function $b : \mathbb{R}_+ \to \mathbb{R}_+$ is a strictly concave, increasing valuation function for public goods.

Furthermore, we assume that the parameter λ which denotes the preferences for public goods is distributed over an interval $(0, \bar{\lambda}]$ such that the median preference is identical in both regions, $\lambda_i^m = \lambda_j^m = 1$. We therefore assume that different public goods with positive spatial spillovers are supplied in the two regions, but that the preference intensity of the median voter for public goods is identical in both regions. This latter assumption serves primarily to simplify the analysis, but it can also be interpreted as an attempt to make the conditions for centralisation through popular approval as favourable as possible. If there was heterogeneity regarding λ amongst the median voters, this would have a negative effect on the likelihood of centralisation through referendum. Restricting the analysis to positive spillovers here is warranted in our opinion, since as a real-world problem, free-riding on the supply of public goods in neighbouring jurisdictions is a by far more acute problem compared to negative spatial externalities generated by local or regional consumption of public goods. The analysis can, however, be generalised to include negative spillovers.

We let the public good preferences of candidates for political office be distributed over the same interval and also assume that, if a representative is drawn randomly, her *ex ante* expected public goods preference is $E(\lambda^r) = 1$. As will become clear in Sect. 4, it would generally be beneficial for an office-seeking candidate to signal that he is of some type $\lambda^r \neq 1$. However, we assume that there are simply no mechanisms to credibly do so. With this assumption, we deviate from a substantial part of the earlier literature. For example, Alesina (1988) shows for a repeated game between two ideologically motivated candidates that, given that their respective political bliss points are common knowledge, there will generally be (imperfect) convergence of the programmes announced and implemented by the candidates. In a different framework that does not incorporate post-electoral mechanisms of commitment to electoral promises, Besley and Coate (1997) argue that candidates will always implement their own preferred policies when elected, and their derivation of political equilibria accordingly depends on candidate preferences being common knowledge.

In contrast, the assumption that the true preferences of a representative are not observable is probably not unrealistic, since we frequently observe in political practice that announced platforms are tailored strategically to win majorities and are not identical with the actual preferences of candidates running for office. Even if political parties exist and cater to different constituencies, it can usually be observed that successful parties cover a very broad range of heterogeneous positions, so that membership in a particular party is also not a very clear signal of a candidate's true type λ^r. Furthermore, the decision to centralise competencies normally is relevant for longer periods of time. It is a decision on an institutional change, and future incumbents who are completely unknown at the time of decision-making are expected to work within this institutional framework. Therefore, it is useful to work with the assumption that the decision on centralisation is not made by taking account of one particular incumbent's type λ^r, but by taking account of the expected types of as yet unknown future incumbents.

Regarding the supply of public goods, we assume that both regions are inhabited by an equal number of n individuals. Also, the technologies of public goods provision are identical in both regions and public goods are financed through a lump sum tax τ paid by every citizen. We also assume that a representative who is in office can secure a rent from every unit of a local public good that is supplied under his legislation. Thus, while a representative formally has to pay the same head tax as every other citizen, his effective contribution is only $\sigma\tau$ with $\sigma \in (0, 1]$ (i.e. he secures a rent of $1-\sigma$ per unit of public goods, but will never be able to free-ride completely with $\sigma = 0$). Effective tax revenue will then amount to $T = (n-1)\tau + \sigma\tau$. We assume that tax revenue can be transformed into public goods according to a linear relation $g = T/(n-1+\sigma)$ such that $g = \tau$.[1] The pivotal role of rent-extraction is therefore that it alters the price of public goods taken into account by a non-benevolent representative. As will be shown below, this does play a crucial role in generating a relative reluctance of citizens to delegate competencies to the central level.

4 Three regimes of public good provision

For all scenarios that will be discussed in this paper, the assumed utility function ensures single-peaked preferences for the level of the public good that a voter prefers in her home jurisdiction. There, the political problem is also unidimensional. Candidates are office-seeking and motivated by the rent that can be extracted when being in office. In all local elections and referenda, the median voter theorem therefore applies in the sense that all candidates have an incentive to offer a platform that coincides with the commonly known median voter's preferences. They cannot, however, credibly commit to implement this platform in post-election politics. With uncertainty regarding the true type λ^r, in his institutional comparison of different regimes, the median voter evaluates the representative outcomes with $E(\lambda^r) = 1$.

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[1] This is a relatively innocent assumption, given that there is normally no natural dimension in which an output of public goods is measured.

Note that an alternative approach would be to focus on expected utility given the uncertainty about λ^r in regions i and j, i.e. on

$$E[U^I] = x - E[\tau] + \lambda^I \left[\int_0^{\bar{\lambda}} f(\lambda_i^r) b(g(\lambda_i^r)) \, d\lambda_i^r + \gamma \int_0^{\bar{\lambda}} h(\lambda_j^r) b(g(\lambda_j^r)) \, d\lambda_j^r \right]$$

with $f(\cdot)$ and $h(\cdot)$ denoting the density functions for the types of representatives in the two regions. Using this approach would lead to similar qualitative predictions. For example, we would still expect a problem of overspending to occur in representative compared to direct-democratic regimes. However, there is another reason besides analytical tractability for choosing our approach. Remember that for the voter on the constitutional level, pondering centralisation, the interesting question is: What is the political outcome in a representative-democratic regime with a typical, expected representative. This question is answered by using our approach. In addition to this, using expected utility would introduce an additional element of uncertainty. From the perspective of a risk-averse median voter, the case of cooperative centralisation discussed below would then involve the choice between a secure direct-democratic outcome and a political lottery on the central level. In this sense, using expected utility would reinforce our results: voters would become even more reluctant to centralise.

Regarding the political institutions of public goods provision, three different regimes need to be distinguished: decentralised and centralised provision of public goods, where the latter can either be non-cooperative, or cooperative with representatives seeking a consensus on the level of public goods in both regions.

4.1 Decentralised public good provision

In this case, the median voter in each jurisdiction is interested to solve

$$g_i^{Dm} = \arg\max_{g_i > 0} \quad U_i^m - g_i \tag{2}$$

which leads to the first-order condition of $b'(g_i) = 1$ for an optimal g_i^{Dm}. A representative on the other hand aims at

$$g_i^{Dr} = \arg\max_{g_i > 0} \quad U_i^r - \sigma g_i \tag{3}$$

where $U_i^r = x + \lambda^r [b(g_i) + \gamma b(g_j)]$, which leads to the first-order condition of $b'(g_i) = \sigma/\lambda^r$ for an optimal g_i^{Dr}. A median voter endowed with perfect knowledge would thus choose a representative with a preference for public goods $\lambda^r = \sigma$. Without credible signaling mechanisms for the representatives' true public goods preferences, however, the expected true value of λ^r is $E(\lambda^r) = 1$. In this case, representative

democracy is associated with expected overspending due to rent-extraction.[2] If, on the other hand, a budget referendum is obligatory or can be organised at sufficiently low cost, overspending will be avoided. Plainly, direct democracy serves as a substitute for strategic voting in order to enforce the bliss point of the median voter as the policy that is to be implemented.

4.2 Centralised, cooperative public good provision

To analyse this institutional framework, we assume, closely related to Weingast (1979), that both elected representatives announce their wishes for the level of public goods in their own jurisdiction and engage in pork-barrelling thereafter, i.e. every representative is able to implement her ideal spending proposal for her own jurisdiction, but has no influence on the policy chosen for the other jurisdiction. In our framework this, however, does not imply that representatives always prefer centralisation to a decentralised regime, since depending on the values of σ and γ the resulting overall degree of overspending may deter them from the decision to centralise. As long as no credible commitment to avoid extreme overspending can be implemented (which we assume) there are therefore ranges of parameter values where even representatives with the ability to engage in pork-barrelling shun centralisation.

Under all centralised regimes, a simple cost-sharing rule is assumed, which divides the costs of public good provision equally between both jurisdictions.[3] This is reasonable, because in a unitary regime, common standards of fiscal non-discrimination require that the tax system is identical for all citizens, regardless of their geographic location. This, however, immediately implies in our framework that the lump sum taxes are identical for all taxpayers, so that the fiscal burden is uniformly divided across regions. Under cooperative centralisation, each representative then solves

$$g_i^C = \arg\max_{g_i > 0} \quad U_i^r - \frac{\sigma}{2}(g_i + g_j) \tag{4}$$

so that the first-order condition is $b'(g_i) = \sigma/2$. From the symmetry assumption, it follows that $g_j^C = g_i^C$. Letting the median voter in each jurisdiction decide about which public good levels he would prefer under this regime of cost sharing would, on the other hand, lead to the first-order conditions $b'(g_i) = 1/2$ for his own and $b'(g_j) = 1/2\gamma$ for the foreign jurisdiction, respectively. Measured against the median preferences, a collusive agreement between regional representatives would therefore always lead to overspending, even if $\sigma = 1$, as long as spillovers are not complete and $\gamma < 1$.

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[2] The actual extent of overspending in reality will of course depend on influences not formally considered here, such as the likelihood and severity of ex post-punishment via retrospective voting.

[3] Generally, bargaining over the cost-sharing rule could also be endogenized, as Lorz and Willmann (2005) show. However, they also use a model of strategic delegation which, as discussed above, is a fundamentally different approach than ours.

4.3 Centralised, non-cooperative public good provision

We let the cost-sharing rule from the cooperatively centralised regime remain in place. However, the spending levels under non-cooperative centralisation are not decided upon by collusive agreement between representatives. Rather, decision-making power is delegated to centralised institutions of collective decision-making. Suppose further that, on the central level, a decision is made between a spending proposal drafted in i and a spending proposal drafted in j. Then, $p \in (0, 1)$ denotes the probability that a proposal from i is chosen at the central level, and correspondingly, $(1 - p)$ is the probability of choice for the proposal from j. The uncertainty about the outcome of the centralized decision will usually have multiple causes: voter turnout may be different across jurisdictions, in a representative system constituencies may be shaped to influence the result in a certain direction and so on.

If a decentralised referendum democracy is the status quo, then in a first step the regional constituencies have to decide which policies they would implement on the central level, if they were successful. Note that the utility function used here generates preferences over the two public goods that belong to the class of intermediate preferences as introduced by Grandmont (1978). This ensures existence of a median voter equilibrium in the two-dimensional policy space including g_i and g_j. Since the individually optimal quantity of both g_i and g_j increases strictly monotonously with λ, political disagreement is essentially reduced to a single dimension and a condorcet winner exists.

If a non-cooperative spending proposal is passed by a referendum, the median voter on the regional level will choose

$$\left\{ g_i^{Nm}, g_j^{Nm} \right\} = \arg \max_{g_i > 0; g_j > 0} \quad U_i^m - \frac{1}{2}(g_i + g_j) \tag{5}$$

with the first-order conditions being $b'(g_i) = 1/2$ and $b'(g_j) = 1/2\gamma$. If, on the other hand, a non-cooperative spending proposal is drafted by a representative, his choice will be

$$\left\{ g_i^{Nr}, g_j^{Nr} \right\} = \arg \max_{g_i > 0; g_j > 0} \quad U_i^r - \frac{\sigma}{2}(g_i + g_j), \tag{6}$$

yielding as first-order conditions $b'(g_i) = \sigma/2$ and $b'(g_j) = \sigma/2\gamma$.

Non-cooperative centralisation therefore introduces an additional element of uncertainty. With a probability p, the median voter or representative from i is in the comfortable situation to implement her ideal spending proposals in both i and in j. With probability $(1 - p)$, she has to live under a spending proposal drafted in j, which becomes more unfavourable, the lower the value of the spillover parameter γ is.

5 Pathways to a centralisation of spending competencies

We have seen in the preceding section that from the perspective of the median voter, a centralised regime is associated with a number of additional risks vis-a-vis a decentralised regime—general overspending in a cooperatively centralised regime,

and a possibly complete loss of political control in a non-cooperatively centralised regime. Representatives are confronted with quite similar problems, though. They risk losing political power completely under non-cooperative centralisation, and they may face a spending proposal from the other jurisdiction under cooperative centralisation that, from their own perspective, implies extreme overspending, particularly if spillovers are low.

Thus, there is no a priori reason to believe that centralisation via referendum is more or less easy to achieve compared to centralisation by consenting representatives. In this section, we will explore these different pathways to a centralised regime in detail. It will be shown that (i) if spillovers are sufficiently high and rent-extraction by representatives is sufficiently low, then citizens and representatives are indeed willing to take the risks of centralisation and that (ii) for all pathways to centralisation there are simple and reasonable conditions under which the median voter is relatively reluctant to centralise compared to her representative.

5.1 Centralization via referendum

Taking a decentralised referendum democracy as the status quo, the crucial question is to see under which conditions the electorate in both regions will agree to a centralisation of public spending. There are two possible approaches to centralisation in this case. One is to aim at a cooperatively centralized regime, which by definition involves representative government on the central level. The other is to aim at a non-cooperative regime on the central level, where a nation-wide referendum is held to determine g_i and g_j simultaneously. In general, one could also think of a third alternative which would be a hybrid regime involving elements of centralised and decentralised decision-making. A cost-sharing rule between regions could be introduced, while decisions on the quantities of g_i and g_j could be made in separate, local referenda. Such a regime is implicitly covered by the following considerations. It is identical to a cooperatively centralised regime in the special case involving no rent-extraction at all, i.e. with $\sigma = 1$, so that the results that will be derived in the following subsections can be carried over to this hypothetical hybrid regime.

To examine the first approach to centralisation, we compare the median voter's utility under a decentralised, direct-democratic regime with that under a cooperatively centralised regime. It is easy to see that centralisation will be preferred if

$$b\left(g_i^C\right) + \gamma b\left(g_j^C\right) - \frac{1}{2}\left(g_i^C + g_j^C\right) > b\left(g_i^{Dm}\right) + \gamma b\left(g_j^{Dm}\right) - g_i^{Dm}. \quad (7)$$

Since it follows from our symmetry assumption that $g_i^C = g_j^C$ and $g_i^{Dm} = g_j^{Dm}$, we can note

Lemma 1 *If σ is sufficiently large to ensure that the left hand side of* (8) *is not smaller than 1/2, then there exists always a $\gamma_1^* \leq 1$ so that*

$$\frac{b\left(g_i^C\right) - b\left(g_i^{Dm}\right)}{g_i^C - g_i^{Dm}} > \frac{1}{1+\gamma} \quad (8)$$

and the median voter prefers cooperatively centralised over direct-democratic decentralised provision of public goods.

Proof Equation (8) follows immediately from (7). From our first-order conditions, it follows that the slope of $b(\cdot)$ at g_i^{Dm} equals unity, while it equals $\sigma/2 \leq 1/2$, at g_i^C. The left hand side of (8) displays the slope of the secant that runs through g_i^C and g_i^{Dm}. Therefore, and due to the concavity of $b(\cdot)$, the value of the left hand side has to be strictly smaller than unity and larger than $\sigma/2$. The latter also follows straightforwardly from the concavity of $b(\cdot)$. For very small values of σ, the slope of the secant may be smaller than the right hand side of (8) even for $\gamma = 1$. Thus, centralization will only be favoured if the rents appropriated by the representatives are sufficiently small and the spillovers are sufficiently large. □

Even with complete spillovers, the median voter will resist centralisation if the degree of rent-extraction by representatives is sufficiently large. In the case analysed here, citizens give up means of controlling their representatives when they agree to centralise, and they are only willing to do so if the overspending induced by rent-extraction is not too excessive.

If the decentralised, direct-democratic regime competes against a non-cooperative, centralised regime with direct-democratic decision-making over the spending proposals, centralisation will be preferred if

$$
p\left[b\left(g_i^{Nm}\right) + \gamma b\left(g_j^{Nm}\right)\right] + (1-p)\left[b\left(g_j^{Nm}\right) + \gamma b\left(g_i^{Nm}\right)\right] - \frac{1}{2}\left[g_i^{Nm} + g_j^{Nm}\right]
$$
$$
> b\left(g_i^{Dm}\right) + \gamma b\left(g_j^{Dm}\right) - g_i^{Dm}. \tag{9}
$$

Note that the costs are not state-dependent due to the symmetry assumption; the same amount will be spent on public goods regardless of which spending proposal is implemented, but it will be differently allocated across regions. Based upon this inequality, we can state

Lemma 2 *For any $p \in [0, 1]$, there exists a $\gamma_2^* \leq 1$ that is sufficiently large to render a centralised direct-democratic regime the preferred regime of public goods provision. For $p = 1$, centralisation is preferred for any $\gamma \in [0, 1]$ from the perspective of the jurisdiction whose probability to prevail equals unity.*

Proof See the appendix.

Let $v(p, \gamma)$ denote the expected benefits from centralisation and $w(\gamma)$ denote the expected extra costs, as written for $p = 1$ in the proof of Lemma 2. It is straightforward that with $\gamma = 1$ the outcome is the same regardless of which jurisdiction decides on the central level, so that $v(p, 1)$ is independent of p. But if we look at the values of $v(p, \gamma)\forall \gamma \in (0, 1]$ in γ, then we see that these values decline if p declines, and may even become negative for a combination of low values of p and γ. In other words, and given the fact that the value of w is not state-dependent, the interval $[\gamma_2^*, 1]$ where centralisation is preferred shrinks with a declining p. The intuition behind this result is straightforward. If the probability of political success on the central level

declines, the expected benefits of centralisation *ceteris paribus* also decline. If the value of the spillover parameter γ would rise at the same time (e.g. due to technological innovations increasing the spatial range of a local public good), this could, however, compensate for the decline of p. The interests of regions i and j become less divergent, so that it becomes less important that the spending proposal from the own jurisdiction is eventually implemented by a non-cooperative centralised regime.

The obvious problem with centralisation decisions is that not both jurisdictions can have $p \approx 1$ at the same time. If it is very likely that the proposal from i succeeds on the central level, then it has to be very unlikely that the proposal from j succeeds. From these considerations follows

Lemma 3 *The interval $[\gamma_2^*, 1]$ where both median voters simultaneously favour centralisation is the largest, when $p = 1/2$.*

Proof It is obvious that the interval of consensual centralisation is the largest, when both median voters have the same threshold spillover level for favouring centralisation. Given our symmetry assumptions, this is the case at $p = 1/2$. ◻

5.2 Centralisation by consenting representatives

Decision-making on the centralisation of spending competencies is highly path-dependent. If budgetary decisions in the local jurisdictions are subject to a popular referendum, it is usually not possible for representatives to decide upon the centralisation of spending decisions—the centralisation decision itself would have to be legitimised via a referendum. Thus, the status quo for centralisation by consenting representatives are local jurisdictions with representative decision-making—in other words, we assume that representatives cannot on their own authority suspend local direct democracy by creating a centralised representative system. For a representative to favour cooperative centralisation, it is then necessary that

$$b\left(g_i^C\right) + \gamma b\left(g_j^C\right) - \frac{\sigma}{2}\left(g_i^C + g_j^C\right) > b\left(g_i^{Dr}\right) + \gamma b\left(g_j^{Dr}\right) - \sigma g_i^{Dr} \quad (10)$$

Solving this inequality and taking *Lemma 1* into account leads to

Proposition 1 *Cooperative centralisation will be strictly preferred by representatives for a level of spillovers $\gamma_3^* < \gamma_1^*$ with rent-extraction in an interval $\sigma \in (0, \bar{\sigma})$. For lower levels of rent-extraction, γ_3^* can assume a value larger or smaller than γ_1^*, depending on the properties of $b(g)$. Contrary to direct democracy, decision-making by representatives also ensures that even with very high levels of rent extraction, i.e. with $\sigma \to 0$, there is a level of spillovers where centralisation is strictly preferred.*

Proof See the appendix.

Why is it possible that, even with the opportunity of rent-extraction, representatives may favour decentralization over centralization when the level of possible rent-extraction is relatively low in the interval of $(\bar{\sigma}, 1)$? The intuition is as follows: for voters,

the amount of public goods supplied under decentralization, g^{Dm} does not depend on σ, because the decentralized regime is one with direct-democratic control, where by assumption no rents are appropriated. Therefore, they have a fixed reference point against which they can compare the centralized regime. For low levels of rent-appropriation on the central level, this comparison is relatively favourable, and moderate spillover-levels are sufficient to convince voters of centralization. With increasing appropriation of rents (i.e. $\sigma \to 0$), the comparison becomes gradually less favourable for the centralized regime and the spillover levels necessary for consent rise, until the point where no consent on centralization can be reached at all.

Representatives do not have a fixed reference point, because for them, $g^{Dr}_\sigma < 0$. Their supply of the public good on the regional level does also increase whenever the level of rent appropriation increases. With $\sigma \to 0$, the first-order conditions of the representative for the two regimes converge. The supplies of g^C and g^{Dr} are almost identical. Similarly, with $\sigma \to 1$, when we move into the steeper branch of the marginal utility curve, the difference between both levels of public goods is relatively small in absolute terms. In between, however, the positive difference $g^C - g^{Dr}$ reaches a maximum value. This implies that for intermediate values of σ, a situation can occur where the level of rent appropriation is not very high, yet at the same time $g^C - g^{Dr}$ is large in absolute terms. In this case, the costs of centralization are high, but the benefits may not increase as quickly, if the marginal utility of public good consumption is already low. Higher spillover levels are then needed for the representative to compensate for this effect.

5.3 Centralisation by non-cooperative representatives

Once again, we assume institutional path-dependence in the sense that direct-democratic centralisation leads to a direct-democratic regime on the central level, whereas centralisation conceded by representatives will install a form of representative democracy on the central level. We have looked at the former case in Sect. 5.1 and will look at the latter case now. Let p at this time denote the probability that a spending proposal drafted by the representative from i wins in the unitary legislature, while $(1 - p)$ now denotes the probability that the representative from j prevails. Centralisation is then chosen by the delegate from i (and symmetrically by her colleague from j) if

$$p \left[b \left(g_i^{Nr} \right) + \gamma b \left(g_j^{Nr} \right) \right] + (1 - p) \left[b \left(g_j^{Nr} \right) + \gamma b \left(g_i^{Nr} \right) \right] - \frac{\sigma}{2} \left[g_i^{Nr} + g_j^{Nr} \right]$$
$$> b \left(g_i^{Dr} \right) + \gamma b \left(g_j^{Dr} \right) - \sigma g_i^{Dr} \tag{11}$$

and this calculus leads to

Lemma 4 *For any $p \in [0, 1]$, there exists a $\gamma_4^* \leq 1$ that is sufficiently large to make a non-cooperatively centralised regime the preferred choice for the representative, compared to a decentralised regime.*

Proof See the appendix.

There is, however, a twist in this mode of centralisation if we compare it with non-cooperative centralisation determined by the approval of the two median voters. We have seen that in cooperative centralisation, the possibility of rent-extraction does play a crucial role—as soon as rent-extraction occurs, the risk of additional overspending causes the median voter to be more reluctant than the representative, as the move to install a cooperatively centralised regime also includes the waiving of referendum control on the central level. With a non-cooperative regime on the central level, we do not have this problem. There can be a nation-wide referendum on the central level, and the median voter expects to be successful there with a certain positive probability. And in addition to this, the absence of the universalist mode of policy-making on the central level also reduces the expected overall magnitude of overspending.

From the perspective of the representative, non-cooperative centralisation is also not more appealing per se than for the median voter, because the ability to extract rents is not generally beneficial in this scenario. To illustrate this, a look at the differential magnitudes of rent-extraction is helpful. Under cooperative centralisation, a glance at (10) reveals for the level of extracted rents that

$$\frac{(1-\sigma)}{2}\left(g_i^C + g_j^C\right) > (1-\sigma)g_i^{Dr}$$

due to the fact that the amount of public goods is strictly greater in the cooperative regime than in the decentralised regime. However, (11) reveals that

$$\frac{(1-\sigma)}{2}\left(g_i^{Nr} + g_j^{Nr}\right) \gtreqqless (1-\sigma)g_i^{Dr}.$$

With very low spillovers, either g_i^{Nr} or g_j^{Nr} will assume a very low value, depending on which representative prevails on the central level, so that overall realised rent-extraction is lower in the centralised regime. With high levels of spillovers, on the other hand, the left hand side of the inequality will be strictly greater than the right hand side.

A low value of the parameter σ does therefore not generally render centralisation more favourable for the representatives if the centralised regime that is to be implemented makes use of non-cooperative means of collective decision-making. If, for instance, $b(g) = a \cdot g^\theta$ with $a > 0, \theta \in (0, 1)$ is chosen as the specification for the valuation function, then σ has no impact at all on the value of γ_4^*. For other specifications, such as $b(g) = ln(1 + a \cdot g)$, the numerical effect of even very high levels of rent extraction is diminutively small.

Nevertheless, even with σ not playing a role, one can argue that centralisation is more likely to occur under a representative regime if under direct democratic centralisation $p \neq 1/2$. It follows from *Lemma 3* that the range of spillovers for which centralisation is commonly preferred in both jurisdictions will be maximised if $p = 1/2$. The same argument holds when representatives decide about non-cooperative centralisation. There are, though, many reasons that may lead to unequal winning probabilities for the two spending proposals if we relax some of the more stringent assumptions of our model for a moment. There may be differences in the culture of political

participation, the costs of getting to the urn may be higher in a more rural compared to a more urban jurisdiction and so on. In a direct democracy, where a majority of the entire electorate decides, it is hardly feasible to shape formal political institutions in order to manipulate p. Under representative democracy, on the other hand, electoral practices to manipulate p are available such as the purposeful shaping of constituencies (Gilligan and Matsusaka 1999, 2006). If this is possible, then under representative democracy the range $[\gamma^*, 1]$ where centralisation is favoured can be extended by finding formal political institutions for the central level that ensure that p converges towards $1/2$. These considerations straightforwardly lead to

Proposition 2 *Representatives are more inclined to favour centralisation of spending competencies than voters in direct-democratic decision-making under non-cooperative central decision-making, since a representative system allows for the adjustment of p via the choice of appropriate formal institutions in the case that $p \neq 1/2$ at the outset.*

5.4 Direct-democratic veto power

So far, we have restricted ourself to path-dependent processes of centralisation. However, instruments of direct democracy also frequently serve to veto decisions that have been made by representatives. With regard to the argument that centralisation is often nothing else than a collusion of representatives in order to appropriate higher rents (Blankart 2000), it is therefore of particular interest to analyse if a referendum can serve as a mechanism to avoid such collusive activities. Indeed, many countries have constitutional provisions that require popular approval for substantial revisions of the formal institutional framework.

In order to see under which conditions a collusive (i.e. cooperative) attempt to centralize spending competencies is approved by the median voter, we need to compare her utility under a decentralised representative democracy, which is the status quo, and a cooperatively centralised regime, which will be accepted if

$$b\left(g_i^C\right) + \gamma b\left(g_j^C\right) - g_i^C > b\left(g_i^{Dr}\right) + \gamma b\left(g_j^{Dr}\right) - g_i^{Dr} \tag{12}$$

which leads to

Proposition 3 *For any $\sigma \leq \hat{\sigma}$ where $\hat{\sigma} \not< 1/2$ the median voter will never approve cooperative centralisation by representatives, regardless of the value of γ. For $\sigma > \hat{\sigma}$, cooperative centralisation is approved if γ is sufficiently large.*

Proof Taking into account that symmetry implies $g_i^C = g_j^C$ and $g_i^{Dr} = g_j^{Dr}$, the condition for approval simplifies to

$$\frac{b\left(g_i^C\right) - b\left(g_i^{Dr}\right)}{g_i^C - g_i^{Dr}} > \frac{1}{1+\gamma} \tag{13}$$

Due to the first-order conditions from Sect. 3 and the strict concavity of $b(\cdot)$, the value of the left hand side cannot rise above σ or fall below $\sigma/2$. From this, it follows immediately that even for $\gamma = 1$, the inequality cannot hold if $\sigma < 1/2$. Since the actual value will, depending on the slope of $b(\cdot)$, lie within in the interval $(\sigma/2, \sigma)$, we have $\hat{\sigma} > 1/2$. If $\sigma > \hat{\sigma}$, the inequality will hold for sufficiently high spillover levels. □

Again, the fact that high spillover levels align the interests of both median voters can attenuate the risk of overspending that is associated with the universalist mode of decision-making on the central level, and lead the median voter to approve of cooperative centralisation. However, if the magnitude of rent-extraction is too large, then the spillover effect does not suffice to warrant centralisation from the viewpoint of the voter. She avoids collusive overspending by vetoing the centralisation process in a referendum.

6 Discussion and conclusions

The main result of the paper is that in a political environment with uncertainty regarding the true preferences of candidates for political office, where strategic delegation is not feasible, the existence of sufficiently high rents that can be extracted from holding political office makes centralisation more unlikely in a direct-democratic framework compared to a representative democracy, if decision-making on the central level is made cooperatively. Furthermore, direct democracy does indeed serve as veto instrument for the voter vis-á-vis the representative. If, on the other hand, central decision-making is non-cooperative and the decisive voter is for some reason more likely to come from one region than from the other, then under a one-man-one-vote principle only a representative system allows (for example through gerrymandering) to move p on the central level closer to $1/2$ and thereby increase the willingness to centralise.

It is useful to emphasize again at this point that the theoretical perspective taken in this paper has a deliberate focus on the imperfections of democratic decision-making. Voters do suffer from uncertainty when they attempt to delegate decision-making competencies to representatives, and the ignorance regarding the true preferences of candidates does impede them from using the instrument of strategic delegation in our model. Since even political parties usually host a broad continuum of different types of candidates, we hold this to be an empirically reasonable assumption. Certainly, if voters observe an elected representative and her decisions, they will be able to form more informed beliefs about this specific representative. However, this possibility is deliberately not in the focus of this paper. We are not interested in voters' learning about specific candidates in time, but rather in forward-looking and, most importantly, *institutional* decisions. We are interested in decisions concerning institutional change that are made without knowing which particular candidates will ultimately act within the future institutional framework. To model this perspective, it appears to be reasonable to abstract from the short-termed forming of beliefs about particular politicians.

Concerning the results of the paper, there are also some more general implications beyond the propositions given above. Most importantly, the general implication is that cooperative centralisation is more appealing to representatives than non-cooperative centralisation if their aim is to appropriate rents in the political process. If they have

a choice, and if they do not believe that their own probability of prevailing in non-cooperative centralisation is overwhelmingly large, they will attempt to find a mode of cooperative policy-making on the central level.

Another implication is that if they are not controlled by means of direct-democratic intervention, then a higher level of rent extraction (a lower value of σ) is associated with a more forceful incentive for representatives to cooperatively centralise. The worse the instruments of controlling representatives already are, the more they are inclined to induce additional overspending through centralisation, which allows them to appropriate additional rents. This may hint at an explanation for the emergence of centralisation processes in historical time. If—for whatever reason—the institutions of decentralised economies become more sclerotic, allowing for more rents to be extracted, then eventually a threshold level for σ may be reached which then triggers attempts to centralise political competencies.

Of course, the model leaves several aspects of real-life decision-making out of consideration. For example, the representatives' tendency to centralise may be mitigated by influences not formally considered here, such as the threat of punishment through retrospective voting. But since it is well known that direct democracy leads to tighter control of politicians compared to representative democracy, such mitigating influences do not principally threaten our result: representative democracy often enough offers the necessary niches to centralise against the will of the median voter, e.g. by centralising at the beginning of a term and hoping for prospective or myopic voting in the next elections, or by accompanying an unpopular centralising decision with a popular decision elsewhere.

Appendix

Proof of Lemma 2

In a first step, we will show that for $p = 1$, centralisation is preferred for any level of spillovers. If $\gamma = 1$, the first-order conditions from Sect. 2 always lead to $g_i^{Nm} = g_j^{Nm}$. The symmetry assumption ensures that $g_i^{Dm} = g_j^{Dm}$. Then (9), collapses to

$$2\left[b\left(g_i^{Nm}\right) - b\left(g_i^{Dm}\right)\right] > g_i^{Nm} - g_i^{Dm} \tag{14}$$

$$\Rightarrow \frac{b\left(g_i^{Nm}\right) - b\left(g_i^{Dm}\right)}{g_i^{Nm} - g_i^{Dm}} > \frac{1}{2} \tag{15}$$

which is always true, since with $b'(g_i) = 1/2$ at $g_i = g_i^{Nm}$, with $g_i^{Dm} < g_i^{Nm}$ and with the strict concavity of $b(\cdot)$, the left hand side of (15) necessarily assumes a higher value than $1/2$. If $\gamma = 0$, then g_j^{Nm} is set at zero and (9) collapses to

$$b\left(g_i^{Nm}\right) - b\left(g_i^{Dm}\right) > \frac{g_i^{Nm}}{2} - g_i^{Dm} \tag{16}$$

Adding $g_i^{Nm}/2$ to each side and sorting leads to

$$\frac{b\left(g_i^{Nm}\right) - b\left(g_i^{Dm}\right)}{g_i^{Nm} - g_i^{Dm}} > 1 - \frac{g_i^{Nm}}{2\left(g_i^{Nm} - g_i^{Dm}\right)}. \tag{17}$$

Since $g_i^{Nm} > g_i^{Dm}$, the right hand side can be rewritten with $g^{Nm} = z \cdot g^{Dm}$ as

$$1 - \frac{z g_i^{Dm}}{2 g_i^{Dm}(z-1)} \to 1 - \frac{z}{2(z-1)} \quad \text{with} \quad z > 1 \tag{18}$$

For any $z \in (1, \infty]$, (18) never assumes a value higher than $1/2$. Inequality (16) is always true so that for $\gamma = 0$, centralisation will always be preferred if $p = 1$. Concerning other values of γ, there is a complication as far as the benefits of centralisation are not necessarily rising monotonously with γ. Let

$$v(p = 1, \gamma) \equiv b(g_i^{Nm}) - b\left(g_i^{Dm}\right) + \gamma\left[b\left(g_j^{Nm}\right) - b\left(g_j^{Dm}\right)\right] \tag{19}$$

denote the expected benefits and

$$w(\gamma) \equiv \frac{1}{2}\left(g_i^{Nm} + g_j^{Nm}\right) - g_i^{Dm} \tag{20}$$

denote the expected additional costs from centralisation. Then we have

$$\frac{\partial w}{\partial \gamma} = \frac{1}{2}\frac{\partial g_j^{Nm}}{\partial \gamma} \tag{21}$$

which, given the the fact that the demand for the foreign public good increases unambiguously with the spillover γ, is necessarily positive. On the other hand,

$$\frac{\partial v}{\partial \gamma} = b\left(g_j^{Nm}\right) - b\left(g_j^{Dm}\right) + \gamma b'\left(g_j^{Nm}\right)\frac{\partial g_j^{Nm}(\gamma)}{\partial \gamma} \tag{22}$$

which, after inserting the first-order condition, can be written as

$$\frac{\partial v}{\partial \gamma} = b\left(g_j^{Nm}\right) - b\left(g_j^{Dm}\right) + \frac{1}{2}\frac{\partial g_j^{Nm}(\gamma)}{\partial \gamma} \tag{23}$$

Because the difference between the first two terms will be negative for small γ and because, as can be inferred from the first-order conditions and using the implicit function theorem, $g_j^{Nm}(\gamma)$ is either strictly convex with a relatively flat slope for small values of γ, or linear, v may be declining in an interval $(0, \bar{\gamma}]$ and rises monotonously thereafter.

With $v(p, \gamma)$ being strictly convex, $w(\gamma)$ rising strictly monotonously and $v(1, 1) > w(1)$, it is a necessary condition for $v(1, \gamma) < w(\gamma)$ at some $\gamma \in [0, 1)$ that $v(1, \hat{\gamma}) < w(\hat{\gamma})$ with $\hat{\gamma}$ being exactly that value of γ, where the slopes of w and v are identical. Equating both partial derivatives yields the condition that $b(g_j^{Nm}) = b(g_j^{Dm})$, which is the case exactly at $\hat{\gamma} = 1/2$. Equating $v(1, \hat{\gamma})$ and $w(\hat{\gamma})$ and keeping in mind that in this case, $g_j^{Nm} = g_{i,j}^{Dm}$, we find that $v(1, \hat{\gamma}) > w(\hat{\gamma})$ if

$$\frac{b\left(g_i^{Nm}\right) - b\left(g_i^{Dm}\right)}{g_i^{Nm} - g_i^{Dm}} > \frac{1}{2}, \tag{24}$$

which is always the case, since once again the left hand side is the slope of the secant and can, due to our first-order conditions, not be smaller than $1/2$. Therefore, for $p = 1$, centralisation is preferred irrespective of the degree of spillovers.

The next step is to show that even for $p = 0$, it is possible that centralisation is preferred. For this purpose, it is sufficient to look at (9), where it is obvious that with $\gamma = 1$ and due to the symmetry assumption, the left hand side of the inequality assumes the same value for any $p \in [0, 1]$. Note that the costs are not state-dependent due to the symmetry assumption; the same amount will be spent on public goods regardless of which spending proposal is implemented, but the amount will be differently allocated across regions. Therefore, the argument that has been made for $p = 1, \gamma = 1$ is also valid for $p \in [0, 1], \gamma = 1$. □

Proof of Proposition 1

Step 1 We know that the median voter will approve centralization if

$$\left[b\left(g_i^C\right) - b\left(g_i^{Dm}\right)\right](1 + \gamma) > \left[g^C - g^{Dm}\right] \tag{25}$$

and that the right hand side of this condition assumes an extremely high value for low levels of σ, due to $\partial g^C/\partial\sigma < 0$ and $\partial g^{Dm}/\partial\sigma = 0$. The left hand side also increases with $\sigma \to 0$, but it does so at a lower rate than the right hand side, due to the concavity of $b(g)$, and with the first-order conditions for voters and representatives ensuring that we are always on the right branch of the utility function, with $b'(g) < 1$. Even with $\gamma = 1$, the right hand side will therefore assume a value larger than the left hand side for sufficiently low σ. There must exist an interval $(0, \tilde{\sigma})$ with $\tilde{\sigma} > 0$ where the median voter will never consent to centralisation.

The representative will consent to centralisation if

$$\left[b\left(g^C\right) - b\left(g_i^{Dr}\right)\right](1 + \gamma) > \sigma\left[g^C - g_i^{Dr}\right] \tag{26}$$

which can be rewritten as

$$\beta(\sigma) \equiv \frac{b\left(g^C\right) - b\left(g_i^{Dr}\right)}{g^C - g_i^{Dr}} > \frac{\sigma}{1+\gamma}. \tag{27}$$

The left-hand side is the slope of the secant on $b(g)$ between g^C and g_i^{Dr}. We know from the first-order conditions of the representative that $\frac{\sigma}{2} < \beta\sigma < \sigma$ so that for sufficiently high values of γ, we have $\alpha(\sigma) > \frac{\sigma}{1+\gamma}$ regardless how small σ becomes. Moreover, both conditions hold for all admissible values of σ, which implies that in the interval $(0, \tilde{\sigma})$ representatives will consent to centralization, conditional on a sufficiently high value of γ, while voters never consent.

Step 2 Suppose that $\sigma = 1$. Then, $g^{Dr} = g^{Dm}$ and (25) and (26) become completely equivalent. Let $\alpha(\sigma) \equiv (b(g^C) - b(g^{Dm}))/(g^C - g^{Dm})$. Then

$$\frac{1}{2} < \alpha(\sigma) = \beta(\sigma) < 1 \tag{28}$$

for $\sigma = 1$. Both representatives and voters behave completely similarly, and there must exist a common $0 < \tilde{\gamma}^* < 1$ where for all $\gamma > \tilde{\gamma}^*, \alpha(1) = \beta(1) > 1/(1 + \gamma)$ and both consent to centralisation.

Step 3 Let σ decline from $\sigma = 1$. Then, as seen in Step 1, the left hand side of (25) increases at a lower rate than the right hand side with holding γ constant. Both increase strictly monotonously. The threshold level of spillovers γ_1^* where for all $\gamma > \gamma_1^*$ the voters prefer centralization thus increases monotonously from $\tilde{\gamma}^*$ with σ declining, until $\tilde{\sigma}$ is reached and centralization is always rejected.

Step 4 Solving the representative's condition $\beta(\sigma) > \sigma/(1 + \gamma)$ for the spillover level, we find that $\gamma = (\sigma/\beta(\sigma)) - 1$ is the value of γ where the representative is just indifferent between both regimes. Differentiating for σ we get

$$\frac{\partial \gamma}{\partial \sigma} = \frac{\beta\sigma - \sigma\beta_\sigma(\sigma)}{\beta(\sigma)^2} \tag{29}$$

with

$$\beta_\sigma(\sigma) = \frac{\left[\frac{b'(g^C)}{2b''(g^C)} - \frac{b'(g^C)}{b''(g^C)}\right]\left(g^C - g^{Dr}\right) - \left[\frac{1}{2b''(g^C)} - \frac{1}{b''(g^{Dr})}\right]\left(b(g^C) - b(g^{Dr})\right)}{\left(g^C - g^{Dr}\right)^2} \tag{30}$$

where $g_\sigma^C = 1/2b''(g^C)$ and $g_\sigma^{Dr} = 1/b''(g^{Dr})$ have been found by implicit differentiation of the first-order conditions of the representative. We know that $\beta_\sigma(\sigma) > 0$, because $g_\sigma^C < 0$ and $g_\sigma^{Dr} < 0$, which moves us into the steeper part of the $b(g)$ with increasing σ and lets $\beta(\sigma)$ increase. With $\sigma \to 1$, the difference $g^C - g^{Dr}$ declines and at the same time, the difference $b(g^C) - b(g^{Dr})$ may increase, since we are moving into the steeper branch of the utility function. Generally, $\beta_\sigma(\sigma)$ can assume a

sufficiently high value to render $\partial\gamma/\partial\sigma < 0$ near $\sigma = 1$, but its value declines with declining values of σ.

The function $\gamma_3^*(\sigma)$ for the representatives can therefore be concave with a unique maximum at some $\sigma < 1$. It can intersect with the function $\gamma_1^*(\sigma)$ of the voters, which declines monotonously on the interval $[\tilde{\sigma}, 1]$. Due to Step 2, both functions assume the same value again at $\sigma = 1$. If we denote the level of rent extraction where the intersection occurs as $\bar{\sigma} > \tilde{\sigma}$, then we can state that, depending on the characteristics of the utility function for the public good, there may be an interval $(\bar{\sigma}, 1)$ where the representatives are more reluctant to centralize than the citizens, while for any $\sigma \in (0, \bar{\sigma})$, representatives centralize for lower spillover levels than voters.   □

Proof of Lemma 4

The proof of Lemma 4 is largely analogous to the proof of *Lemma 2* given above. We will therefore give this proof in a more abbreviated form. Again, we start with the scenario where $p = 1, \gamma = 1$. We can then infer from (11) that

$$\frac{b\left(g_i^{Nr}\right) - b\left(g_i^{Dr}\right)}{g_i^{Nr} - g_i^{Dr}} > \frac{\sigma}{2} \tag{31}$$

which is always true due to the first-order conditions derived in Sect. 3 and the strict concavity of $b(\cdot)$.

For $p = 1, \gamma = 0$, we can analogously to the proof of Lemma 2 infer from (11) that

$$\frac{b\left(g_i^{Nr}\right) - b\left(g_i^{Dr}\right)}{g_i^{Nr} - g_i^{Dr}} > 1 - \left(1 - \frac{\sigma}{2}\right)\frac{z}{z-1} \quad \text{with } z > 1. \tag{32}$$

The right hand side never assumes a value larger than $\sigma/2$, so that, again, the inequality always holds. Thus, centralisation will always be preferred for extreme values of the spillover parameter with $p = 1$. For $\gamma \in (0, 1)$ the same complication may generally occur as in the direct-democratic case, which leads us to again write the expected benefits and costs of centralisation seperably. This leads us to

$$v(p = 1, \gamma) = b\left(g_i^{Nr}\right) - b\left(g_i^{Dr}\right) + \gamma\left[b\left(g_j^{Nr}\right) - b\left(g_j^{Dr}\right)\right] \tag{33}$$

$$w(\gamma) = \sigma\left[\frac{1}{2}\left(g_i^{Nr} + gNr_j\right) - g^{Dr}\right] \tag{34}$$

$$\frac{\partial v}{\partial\gamma} = b\left(g_j^{Nr}\right) - b\left(g_j^{Dr}\right) + \frac{\sigma}{2}\frac{\partial g_j^{Nr}}{\partial\gamma} \tag{35}$$

$$\frac{dw}{d\gamma} = \frac{\sigma}{2}\frac{\partial g_j^{Nr}}{\partial\gamma} \tag{36}$$

Looking for that $\hat{\gamma}$ where the slope of v and w are identical, we find by equating (34) and (35) that this is the case for $b(g_j^{Nr}) = b(g_j^{Dr})$ and from the first-order conditions, we find that this condition holds for a unique $\sigma/2\gamma = \sigma \Rightarrow \hat{\gamma} = 1/2$. Keeping in mind that for $\hat{\gamma}$, $g_j^{Nr} = g_j^{Dr}$, we can infer if

$$v(p = 1, \hat{\gamma}) > w(\hat{\gamma}) \tag{37}$$

holds and find out that this inequality holds, if and only if

$$\frac{b\left(g_i^{Nr}\right) - b\left(g_i^{Dr}\right)}{g_i^{Nr} - g_i^{Dr}} > \frac{\sigma}{2} \tag{38}$$

which again is always the case due to the values of the first-order conditions derived in Sect. 3. Therefore, for $p = 1$ we have $v > w$ for any admissible value of γ. A glance at (11) shows that for $\gamma = 1$, (11) analogously to (9) assumes the same value for any $p \in [0, 1]$, so that the argument that has been made for $p = 1$, $\gamma = 1$ is again also valid for $p \in [0, 1]$, $\gamma = 1$. □

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