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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. Instead, it is shown that the existence of rent extraction by delegates alone suffices to make cooperative centralisation more likely through representative democracy. In the non-cooperative case, 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.

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1. Introduction

In the literature on fiscal federalism, a variety of theoretical reasons for the decentalisation (or symmetrically: against the centralisation) of economic policies is offered. The literature concerned with the costs and benefits of decentalised 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 for a population with heterogeneous preferences across regions 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 consumption of public goods and the costs that arise due to heterogeneous preferences.

The problem becomes more complicated in the face of regional public goods with 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 provide a Pareto improvement depending on which effect is dominant (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 startegically 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. And 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. Moreover, direct

democracy is used by voters as an instrument to veto collusive centralisation that benefits representatives.

The argument will proceed as follows: In Section 2, we lay out the relevance of the issue discussed here and locate it into the broader context of the related literature. Section 3 introduces the model and its core assumptions. In Section 4, we derive the ideal policies for the median voter and for the representative under different political institutions, and in Section 5, we show that 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, Section 6 draws some conlcusions.

2. Centralisation and institutions: Why is it an issue?

In the model by Redoano and Scharf, the difference between representative and direct democracy is made by the instrument of strategic delegation which is only available under the former, but not under the latter type of instituions for collective decision-making. Successful strategic delegation requires that the true preferences of candidates for office are common knowledge. Only then can it be safely assumed that candidates can 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 ultimately exclude political control problems from their analysis. In this class of cititzen-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 federalism in that respect. 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 ideas 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. Experience appears to suggest that, ultimately, we know relatively little about which political measures a candidate indeed honestly prefers, and which he would implement if he had sufficient constitutional and post-constitutional leeway. 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 mere existence of rent extraction by representatives suffices to make citizens relatively reluctant to centralise political competencies. If they have direct-democratic control mechanisms, then a centralization of competencies occurs less often compared to an institutional framework in which centralisation decisions are made by consenting representatives. In this sense, our paper hints at the fact that making decisions to centralise contingent on the consent of a majority of voters in an obligatory referendum should also be considered as a part of a constitution that is designed 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. (2006) 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 centralize 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 with two regions is introduced where different local public goods are supplied in two jurisdictions and where intrajurisdictional utility-spillovers do occur. Suppose that, partially resembling the specifications of Besley and Coate (2000) as well as Dur and Roelfesma (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 a spillover parameter signifying for instance geographical proximity between the two regions, and γ^* will later denote that level of threshold 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 inverval $(0, \bar{\lambda}]$ 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 an 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 could, however, principally 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 Section 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.

Both regions are inhibited by an equal number of n individuals. Also, the technologies of public goods provision are identical in both regions and public goods are financed by lump sum taxes such that each individual has to give up one unit of the private good in

order to allow the provision of one unit of a local public good. In other words, regions are completely identical as far as the technicalities of public good provision are concerned, with the only qualification that different kinds of public goods are supplied in the two regions. For example, region i might supply a publicly funded theatre that can also be visited by citizens of j, while j supplies a public park that is also visited by citizens of i.

Finally, we 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 σg_i 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 $\sigma = 0$). As will become clear later, the possibility of rent-extraction plays a crucial role for the 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 yields 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 can, however, not 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 can do no better than to calculate the representative outcomes with $E(\lambda^r) = 1$.

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 $\partial b(g_i)/\partial g_i = 1$ 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 $\partial b(g_i)/\partial g_i = \sigma/\lambda^r$ 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, the actual extent of which will depend on influences not formally considered here, such as the likelihood and severity of ex post punishment via retrospective voting. 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-barelling 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. This does of course 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.

Under all centralised regimes, a simple cost-sharing rule is assumed, which arranges that the total costs of public good provision are divided equally between both jurisdictions. 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 $\partial b(g_i)/\partial g_i = \sigma/2$. 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 $\partial b(g_i)/\partial g_i = 1/2$ and $\partial b(g_j)/\partial g_j =$

$1/2\gamma$. 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 $\gamma < 1$.

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 centralized 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 under the very general assumptions made here on the utility function, a total median in all directions as proposed by Davis, DeGroot and Hinich (1972) will not generally exist. Nevertheless, the individual preferences remain single-peaked in the two-dimensional policy space and the individual utility-maximising quantities of g_i and g_j preferred by any voter rise strictly monotonously with λ. Therefore,

for this scenario we introduce the additional assumption that only proposals that reflect the sincere bliss point of at least one voter can be put on the regional ballot. In this case, the distribution of individual bliss points in the two-dimensional policy space generated by our individual maximisation problems is sufficient to ensure that no proposal can win a pairwise vote against a proposal that coincides with the median voter's bliss point. If a non-cooperative spending proposal is passed by a referendum, the median voter on the regional level will choose

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

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

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

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

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.** Presuming that the status quo is a decentralised setting and that we are interested in processes of centralisation, the crucial question is to see under which conditions the electorate or representatives are inclined to agree to a centralisation of public spending. Comparing 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

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

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

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

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

Proof. Eq. (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 $\sigma/2$. 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 the 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

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

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 $\gamma \in [0,1]$.

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 which jurisdiction decides on the central level, so that $v(p,1)$ is independent of p. But if we plot the values of $v(p,\gamma) \forall \gamma \in (0,1]$ in γ, then we see that this curve rotates to the southeast with declining p 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 decisons 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

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

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

Proposition 1. For any arbitrarily small level of rent-extraction, i.e. for any $\sigma \in [0, 1]$, cooperative centralisation will be strictly preferred by representatives for a level of spillovers $\gamma_3^* < \gamma_1^*$. Contrary to direct democracy, decision-making by representatives also ensures that even with very high levels of rent extraction, there is a level of spillovers for which centralisation is preferred.

Proof. See the appendix.

The intuition behind this result is that the deviation from her political bliss point with rising levels of rent-extraction is strictly smaller for a representative, compared to the median voter. If the possibility to extract rents from the supply of public goods increases, like the voter the representative is faced with the problem of an oversupply, due to the fact that the representative from the other jurisdiction is also allowed to implement his ideal policy. But this problem is attenuated, as the representative's own ideal policy increases with a decline of σ, while the reference point of the median voter remains fixed, independent of σ. With the strict concavity of the valuation function for public

goods, this effect is reinforced: The higher the level of rent extraction and the preferred quantities of the public goods, the lower is the utility differential that the representative faces in a centralised regime, compared against her ideal point. The cost-sharing rule under centralisation offers the opportunity to consume larger quantities of the public goods. This, however, becomes more interesting the more the interests of individuals in i and j become aligned by increasing spillovers. When a threshold level of spillovers is reached, centralisation is preferred – and this level is reached earlier for representatives who, besides the effect already discussed, also benefit from a lower relative price for public goods.

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 Section 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 legitlature, 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

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

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 alluring *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

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

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

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

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 release 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, instruments to manipulate p are available such as the purposeful shaping of constituencies (Gilligan und Matsusaka, 1999 and 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

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

which leads to

Proposition 3. For any $\sigma \leq \hat{\sigma}$ where $\hat{\sigma} \not< 1/2$ the median voter will never approve of 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

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

Due to the first order conditions from Section 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 mere existence of rents that can be extracted from holding political office suffices to make 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-a-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 alluring 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 Section 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

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

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

which is always true, since with $\partial b(g_i)/\partial g_i = 1/2$ 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 (12) necessarily assumes a higher value than 1/2. If $\gamma = 0$, (9) collapses to

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

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

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

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 $z \in (1, \infty]$, (17) 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

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

denote the expected benefits and

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

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 first order conditions, is necessarily positive. On the other hand,

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

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

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

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

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

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 $\gamma = 1$, the left hand side of the inequality assumes the same value for any $p \in [0,1]$. Therefore, the argument that has been made for $p = 1, \gamma = 1$ is also valid for $p \in [0,1], \gamma = 1$. $\square$

Proof of **Proposition 1**. Taking into consideration that, due to the symmetry assumptions, $g_i^C = g_j^C$ and $g_i^{Dr} = g_j^{Dr}$, (10) can be written as

$$\frac{b(g_i^C) - b(g_i^{Dr})}{g_i^C - g_i^{Dr}} > \frac{\sigma}{1+\gamma}. \tag{25}$$

Let $\alpha(\sigma)$ denote the slope of the secant between g_i^C and g_i^{Dm} in the direct democracy case (i.e., the left hand side of (8)), and $\beta(\sigma)$ denote the slope of the secant between g_i^C and g_i^{Dr} in the case of representative democracy. Then, under direct democracy, centralisation

will be preferred for any

$$\gamma > \frac{1}{\alpha(\sigma)} - 1 = \gamma_1^* \quad \text{with} \quad \alpha \in \left(\frac{\sigma}{2}, 1\right) \tag{26}$$

whereas in a representative democracy,

$$\gamma > \frac{\sigma}{\beta(\sigma)} - 1 = \gamma_3^* \quad \text{with} \quad \beta \in \left(\frac{\sigma}{2}, \sigma\right) \tag{27}$$

warrants centralisation. With $\sigma = 1$, the first order conditions for the public goods levels are identical and so are the threshold spillover levels, $\gamma_3^* = \gamma_1^*$. For the threshold spillover levels from where centralisation is preferred, we know that $\gamma_1^* > \gamma_3^*$ holds if

$$\frac{1}{\alpha(\sigma)} - 1 > \frac{\sigma}{\beta(\sigma)} - 1 \tag{28}$$

$$\Rightarrow \beta(\sigma) > \sigma\alpha(\sigma). \tag{29}$$

From the concavity of $b(\cdot)$ and the first-order-conditions derived in Section 3, it follows that both $\alpha(\sigma)$ and $\beta(\sigma)$ are concave on $\sigma \in [0, 1]$. The right hand side of (29), however, is strictly convex due to the multiplication of $\alpha(\sigma)$ and σ. Assuming $\sigma = 1$, we get $\alpha(1) = \beta(1)$ due to the completely similar incentive structure for voter and representative, which implies $g_i^{Dm} = g_i^{Dr}$. Suppose, on the other hand, that $\sigma \to 0$. This implies extremely high public good supplies $g^C \to \infty$ and, again due to the strict concavity of $b(\cdot)$, $\alpha(\sigma), \beta(\sigma) \to 0$, which trivially also implies $\sigma\alpha(\sigma) \to 0$. From this, it necessarily follows that there is no value $\sigma \in [0, 1]$ for which (29) does not hold.

The second part of Proposition 1 is straightforward and follows from (25). The left hand side is strictly greater than $\sigma/2$, while the right hand side converges from above to $\sigma/2$ if $\gamma \to 1$. Therefore, there has to exist some, possibly high, spillover level for which equation (25) holds. $\square$

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

$$\frac{b(g_i^{Nr} - b(g_i^{Dr})}{g_i^{Nr} - g_i^{Dr}} > \frac{\sigma}{2} \tag{30}$$

which is always true due to the first order conditions derived in Section 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

$$\frac{b(g_i^{Nr} - b(g_i^{Dr})}{g_i^{Nr} - g_i^{Dr}} > 1 - \left(1 - \frac{\sigma}{2}\right) \frac{z}{z-1} \quad \text{with} \quad z > 1. \tag{31}$$

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

$$\begin{aligned} v(p = 1, \gamma) &= b(g_i^{Nr}) - b(g_i^{Dr}) + \gamma \left[b(g_j^{Nr}) - b(g_j^{Dr})\right] && (32) \\ w(\gamma) &= \sigma \left[\frac{1}{2}(g_i^{Nr} + gNr_j) - g^{Dr}\right] && (33) \\ \frac{\partial v}{\partial \gamma} &= b(g_j^{Nr}) - b(g_j^{Dr}) + \frac{\sigma}{2} \frac{\partial g_j^{Nr}}{\partial \gamma} && (34) \\ \frac{dw}{d\gamma} &= \frac{\sigma}{2} \frac{\partial g_j^{Nr}}{\partial \gamma} && (35) \end{aligned}$$

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

$$v(p = 1, \hat{\gamma}) > w(\hat{\gamma}) \tag{36}$$

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

$$\frac{b(g_i^{Nr}) - b(g_i^{Dr})}{g_i^{Nr} - g_i^{Dr}} > \frac{\sigma}{2} \tag{37}$$

which again is always the case due to the values of the first order conditions derived in Section 3. Therefore, for $p = 1$ we have $v > w$ for any admissable 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 $p \in [0, 1], \gamma = 1$. $\square$

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