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Federalism and Accountability with Distorted Election Choices

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Abstract

This study analyzes the interaction between distorted election choices and the architecture of government with a focus on the implications for the accountability of politicians. Contrasting centralized with decentralized political systems, it is shown that centralization is likely to result in *higher* accountability if election choices are subject to small random distortions. Furthermore, equity and efficiency arguments for uniform policies in centralized systems are derived as these are likely to result in the better overall performance of politicians and in more equal performance across regions.

Keywords: accountability, federalism, decentralization, retrospective voting

JEL classification codes: H73, D72

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1 Introduction

In a decentralized democratic political system, politicians are accountable to their local electorate. In a centralized system, a politician is accountable to the electorate of all jurisdictions he is governing. This difference triggers the question of whether the level of accountability will be higher under a centralized or under a decentralized system. In general, an individual jurisdiction is less likely to be pivotal in changing the outcome of centralized elections in a multi-jurisdiction setting. Seabright (1996) and Persson and Tabellini (2000, chapter 9) have built a strong argument on this insight that decentralization is likely to increase accountability. The present analysis shows that this argument can be reversed if election choices are randomly distorted, at least as long as the random factors are relatively unimportant. With electoral uncertainty, accountability can be *higher* under a centralized regime.

The analysis uses a simple framework of retrospective voting. Election and re-election of politicians is considered as a repeated game with the possibility of tacit collusion and credible trigger strategies that retrospectively punish politicians who do not behave accountably.[1] Moreover, an additional factor to this relationship between the electorate and the politician is added: bad luck. Random factors play a major role for the re-election chances of an incumbent politician, even if (s)he has performed well. Examples of such random factors are natural or economic events outside the control and responsibility of the incumbent politician, political scandals, the appearance of the opposition candidate, etc. Such random factors generate a possibly small, but positive, probability that accountable politicians will not be re-elected and reduce the maximum accountability of politicians that can be sustained, since the exogenous threat of being voted out of office makes misbehaving more attractive. To induce accountable behavior, higher rents need to be left

[1] There is considerable empirical evidence on the role of retrospective voting, see, for instance, Norpoth (1996), Lewis-Beck and Stegmaier (2000) and Kousser (2004).

to accountable politicians.

This insight is then used to ask how the degree of decentralization affects accountability. The analysis shows that a government that makes decisions for many regions and needs to be re-elected by a majority of regions can be induced to perform better and behave more in the interest of its constituency than separate, independent governments of many regions, provided that the probability of bad luck is sufficiently small. The intuition for this result is as follows. Each jurisdiction is less likely to be pivotal for re-election under the centralized regime than under the decentralized regime. Because each region has a lower impact on the overall re-election, distorted re-election in one particular region is less likely to cause a well-performing incumbent to be voted out of office. If the exogenous factors are relatively unimportant, formation of a winning majority becomes more likely as the number of jurisdictions increases. The pooling of random factors across jurisdictions in the centralized system has the potential to reduce the threat of being voted out of office "by mistake". This increases the benefits of staying in office, gives accordingly more leverage to voters, and increases the level of accountability.

The analysis also provides two arguments for uniform provision of public goods in the centralized system. First, uniformity may be desirable for reasons of interregional equity. In a centralized system, which allows for discriminatory treatment across regions, and with a voting rule that conditions on overall performance, accountability only depends on the aggregate level of public good provision and not on the regional distribution. Thus, some regions may end up with a lower provision level than under decentralization. Second, if regions condition their voting behavior only on the provision level in their own region, average accountability is typically reduced.

This study contributes to a growing literature which analyzes the implications of centralized and decentralized government structures for the conduct of government. Important aspects for this relationship are bench-marking and yardstick competition, see Besley and Case (1995) and Revelli and Tovmo

(2007), lobbying and rent-seeking, see Wärneryd (1998) and Cheikbossian (2008), state capture, see Bardhan and Mokherjee (2000), and the role of fiscal equalization, see Kotsogiannis and Schwager (2008). Several studies consider the relationship between decentralization and economic performance, typically measured by economic growth, see, among others, Davoudi and Zou (1998), and Thornton (2007). The study also relates to the literature on retrospective voting and accountability by Austen-Smith and Banks (1989) and Ferejohn (1986). However, these authors did not address the question of centralized versus decentralized electoral control or the possibility of distorted election choices, the novel aspects that drive my results. Wrede (2006) uses a two period retrospective voting model and shows that uniformity requirements in centralized systems increase accountability. His results are complementary to mine, but, as discussed in section 5, the underlying mechanisms are very different. Hindricks and Lockwood (2005) study accountability and decentralization with incentive and selection effects. My analysis only considers incentive effects of elections and does not address selection. Finally, the possibility that joint decisions can out-perform individual decisions in an environment where choices are subject to error has been formulated in the Condorcet jury theorem (CJT), see Ladha (1993). My theoretical framework results in a situation where the CJT logic can be fruitfully applied to analyze federal structures. Here, embedded in a model of retrospective voting, it is used to address the role of federal structures for accountability. To the best of my knowledge, the role that the CJT can play in the analysis of federal structures has not yet been illustrated in the literature.

The analysis proceeds as follows. The framework of infinitely repeated interaction between politicians and the electorate and distorted re-election choices is developed in section 2. It is applied to a fully decentralized government in section 3, and to centralized governance structures in sections 4 and 5. Section 4 studies uniform centralized policies, a restriction that is lifted in section 5. Section 6 extends the baseline model. Section 7 concludes.

2 The Framework

Consider a single political jurisdiction and let there be an infinite sequence of periods, $t = 0, 1, 2, ...$. In each period t, a player is the incumbent politician at the beginning of the period. This player has an exogenously given budget that is normalized and equal to 1 in each period and allocates this budget between two purposes. One purpose is useful from the perspective of the voters and can be seen as a publicly provided good. The amount spend on this good is $g_t \in [0, 1]$. The other purpose can be thought of as simple diversion of public revenue for goods and activities that the politician likes and that do not benefit the voters at all.

Let there be one single voter in the region. In a given period t he has to decide whether to re-elect the incumbent politician. If the politician is re-elected in t, he becomes the incumbent in period $t + 1$. If not, then a new politician is chosen. The old politician disappears and receives an exogenous payoff in all future periods that is equal to 0. The new politician inherits all information that the previous politician had and he has the same preferences. He is chosen from a set of politicians who do not belong to the set of voters and cannot make any payoff relevant choice unless they have been elected. The voter observes g_t and knows all previous choices $g_0, ..., g_{t-1}$ when voting at t. Both the voter and any incumbent politician also know the election choices and election outcomes in previous periods.

Voting outcomes are based on two components. The first component is called *election choice.* Election choices in period $t \in \{0, 1, ...\}$ are denoted e_t, with $e_t \in \{0, 1\}$ and can be interpreted as referring to whether the voter plans to re-elect (1), or not re-elect (0) an incumbent politician in period t. Further, the re-election is disturbed by possible other factors. More precisely, let the choice of $e_t = 0$ always lead to a change in office and to the appointment of a new politician. However, if the voter chooses $e_t = 1$, the effective election outcome is $\theta_t e_t$, where θ_t is a random variable with $\theta_t \in \{0, 1\}$

and $prob(\theta_t = 0) \equiv q$, for all periods t. Intuitively, θ_t may reflect the fact that, with some probability, the election outcome is dominated by an issue other than the politician's public provision decision, where I assume that, whether or not this other issue becomes relevant, is not under the control of the active players in the game. Examples for this could be events like a media scandal based on true or faked evidence of things that happened a long time ago, or an extreme popularity bonus for a rival politician.[2] For simplicity, θ_t is assumed to be stochastically independent across all periods, and θ_t also becomes observable at the very end of period t for the voter and the politician. The assumption of a one-sided distortion is for simplicity only. Section 6 extends the results to situations of two-sided noise, in which also an unaccountable politician may be be re-elected "by mistake".

A pure strategy of the voter in period t is a sequence of mappings $e_{t+i} : H^{t+i} \times [0,1] \rightarrow \{0,1\}$, where H^{t+i} is the set of possible histories h^{t+i} at period $t+i$, $i = 0, 1, ...$, with a history described as $h^t = ((g_0, ..., g_{t-1}), (e_0, ..., e_{t-1}), (\theta_0, ..., \theta_{t-1}))$, and the interval $[0,1]$ is the set of possible public good provision g_{t+i}. Note that the history implicitly also tells what the sequence of politicians is, and how many of them have been in office for how long, and recall that any new incumbent is identical with any other politician in all respects except for the time period when elected into office. The incumbent at t also observed the history of public provisions, election outcomes and random disturbances described by h^t. A pure strategy for the incumbent is a sequence of mappings $g_{t+i} : H^{t+i} \rightarrow [0,1]$ for $i = 0, 1, ...$

The payoff for the voter depends only on the series of public good outcomes, and the voter's period payoff is g_t. Accordingly, the value of the

[2]It should be stressed that the shock is to the voting decision. It may represent events entirely unrelated to the candidates under consideration, or, if related to the candidates, the shock can be interpreted as how a potential event is *perceived* by the voters. Note that the nature of the shock is closely related to the corresponding correlation structure in multi-jurisdiction settings as the ones considered in sections 4 and 5.

objective function of a voter at period t is

$$V_t = \sum_{i=0}^{\infty} \delta^i g_{t+i} \tag{1}$$

where δ is an exogenous and time invariant discount factor $\delta \in (0,1)$. Similarly, the payoff for the politician for a given infinite series of pairs of outcomes (g_t, e_t) equals the discounted sum of resources $1 - g_{t+i}$ which he used for purposes that are useful only to himself. Accordingly, for a politician who is in power in period t, the present value of his overall payoff is

$$\Pi_t = (1 - g_t) + \delta(1 - g_{t+1})p_t + \delta^2(1 - g_{t+2})p_t p_{t+1} + ...,$$

where p_t denotes the re-election probability in period t. In what follows and throughout the paper, I only consider stationary equilibria in pure strategies in the infinitely repeated game with complete information. Stationarity is defined here by the property that the equilibrium path of $g_t = g^*$ is constant over time. I focus on the class of equilibria in which the voter chooses a simple trigger strategy which is characterized by the property that he punishes the politician if $g_t \neq g^*$ and always re-elects a politician in a period in which $g_t = g^*$. This is justified because these strategies are also maximum punishment strategies. The following holds:

Proposition 1 *Any public good level $g^* \leq (1-q)\delta$ can be sustained as a stationary equilibrium choice of incumbent politicians in the voting-appropriation game in which the voter applies a simple trigger strategy. In this class of equilibria, the politician is re-elected in each period with probability $(1-q)$ and a politician stays in office for $\frac{1}{q}$ periods on average in such equilibria. The equilibrium in this class that maximizes the voter's payoff has $g^* = (1-q)\delta$.*

Proof. Consider the following candidate equilibrium. The voter follows a simple trigger strategy: he re-elects the politician in period t, if and only if, $g_t = g^* \leq (1-q)\delta$, and does not re-elect the incumbent politician but appoints

a new politician in all other cases. Any incumbent politician always chooses $g_t = g^*$. The one stage deviation principle applies here.[3] It is therefore sufficient to confirm that this behavior is superior to one-stage deviations for both players. Consider first the incumbent politician. If he deviates in period t and chooses some $g_t \neq g^*$, he receives a period payoff that is equal to $1 - g_t$. However, he is not re-elected, and has a period payoff of zero in all future periods. Hence, the maximum the politician can obtain by deviating from g^* in period t is obtained for a choice $1 - g_t = 1$. A necessary and sufficient condition for optimality of non-deviation therefore is

$$1 \leq (1 - g) + \sum_{i=1}^{\infty} \delta^i (1 - q)^i (1 - g) \tag{2}$$

and this can be transformed into $g \leq (1 - q)\delta$.

Consider now one stage deviations for the voter in period t. Given the assumed equilibrium play in periods $t+i$, the voter is fully indifferent whether to re-elect the politician in period t or to appoint another politician, regardless of the observed g_t. Accordingly, a deviation from the candidate equilibrium choice in period t is not profitable for the voter. Together with the optimality of $g_t = g^*$ for the politician, this shows that the candidate equilibrium is indeed an equilibrium.

Condition (2) also shows that $g^* = (1 - q)\delta$ determines the smallest amount repeatedly appropriated by the incumbent in this class of equilibria. The equilibrium re-election probability $(1 - q)$ follows from the equilibrium strategies, and the average duration a politician in office is obtained using the equilibrium election strategies as $1 + (1 - q) + (1 - q)^2 + ... = \frac{1}{q}$. ■

Proposition 1 characterizes a natural class of equilibria that relates closely to simple trigger-strategy equilibria in games of price wars, such as in Green and Porter (1984). Politicians are not re-elected in the equilibrium for reasons

[3] This principle applies, since the game is an infinite horizon game with observed actions in which future payoffs are discounted and per-period payoffs are bounded, cf. Fudenberg and Tirole (1993, p.108-110).

of exogenous noise, despite the fact that the player who is punished does not deviate from the stationary collusive action. The risk of "being punished" without having deviated from the collusive equilibrium action reduces the payoff for both the politician and the voter. The equilibrium amount of resources allocated to public provision of potentially useful goods is smaller than in the absence of the possibility of a negative disturbance of the election outcome, $\theta_t = 0$. Hence, the risk of $\theta_t = 0$ reduces accountability in the equilibrium. This is evident from

$$\frac{\partial g^*}{\partial q} = -\delta < 0. \tag{3}$$

3 Fully decentralized governance

Consider first a country that is fully decentralized. It consists of n independent regions j. In each region, the governance structure has the format that has just been described, with a given period budget of size 1, one incumbent politician in each period who chooses $g_{jt} \in [0, 1]$ in period t, one voter who chooses e_{jt} in period t, and a random disturbance of the election outcome. Assume that the random disturbance factors θ_{jt} that transform e_{jt} into the election outcome $\theta_{jt}e_{jt}$ are stochastically independent not only across periods, but also across regions.[4] Applying Proposition 1 to this structure gives:

Proposition 2 *Maximum accountability in the fully decentralized country in a stationary equilibrium with simple trigger strategies by voters is described by* $g_{jt} = g^* = \delta(1 - q)$. *The average number of periods in which a politician stays in office is* $1/q$.

Note that many of my assumptions about full decentralization closely correspond to Oates' (1972) and Tiebout's (1956) ideas about fiscal federalism. The correspondence principle applies: the tax revenue is generated within a

[4] Section 6 discusses how the results are effected if shocks are correlated between regions.

region and expended for purposes that only benefit the citizens in this region, and there are no interregional fiscal externalities in terms of taxes or public goods. Also, the decision maker is elected by the constituency in this region. Further, the single-voter assumption captures a regional structure with a homogenous constituency which may be the result of self-selection into homogenous regions, or the outcome of a suitable definition of regions. An extension of the analysis to a situation with multiple voters is discussed in section 6.

4 Centralized governance with uniform provision

Consider now a country in which the n regions are governed by one single politician who is the incumbent of a centralized government who is re-elected by voters from all regions. Assume that there is one voter/vote from each region. The intuitive meaning of this assumption is that we consider regions that are homogenous inside, however, where there is heterogeneity between regions.[5] To avoid discussion of ties, let n be an uneven number of regions.

The central politician must allocate a budget of size n in each period. The politician chooses a *uniform* g_{jt} for all regions, so that $g_{jt} = g_{kt} \equiv g_t$ holds for all $j, k = 1, ..., n$. Imposing uniformity of public provision resembles the classic assumption made by Oates (1972). The provision decision is followed by the choice of e_{jt} in each region. Depending on this choice and the outcomes of θ_{jt}, the election outcome from region j is $e_{jt}\theta_{jt}$.

As there are n voters, one in each region, with centralized provision, the history at period t when the incumbent politician makes his decision is

[5] The assumption may correspond more or less adequately to actual centralized government and its (re-)election. For the US presidency elections, the correspondence may be quite close, as the system turns all votes from a state into a single vote either for one or the other candidate.

$h^t = ((g_0, g_1, ...g_{t-1}), (\mathbf{e}_0, \mathbf{e}_1, ...\mathbf{e}_{t-1}), (\boldsymbol{\theta}_0, \boldsymbol{\theta}_1, ...\boldsymbol{\theta}_{t-1}))$, where $\mathbf{e}_\tau$ denotes a vector $(e_{1\tau}, ...e_{n\tau})$, with $\tau = 0, 1, 2, ..., t-1$, and $\boldsymbol{\theta}_\tau$ denotes a vector $(\theta_{1\tau}, ...\theta_{n\tau})$ with $\tau = 0, 1, 2, ..., t-1$. Accordingly, a strategy for the incumbent politician in period t is a sequence of mappings $g_{t+i} : H^{t+i} \to [0, 1]$, where H^{t+i} is the set of all feasible histories in period $t+i, i = 0, 1, ...$. Similarly, a strategy for the voter in region j is a sequence of mappings $e_{jt+i} : H^{t+i} \times [0, 1] \to \{0, 1\}$. The objective of the voter in region j at period t is

$$V_{jt} = \sum_{i=0}^{\infty} \delta^i g_{t+i}.$$

The payoff of the incumbent in the centralized country with uniformity is

$$\Pi_t = n[(1 - g_t) + \delta(1 - g_{t+1})p_t + \delta^2(1 - g_{t+2})p_t p_{t+1} + ...].$$

The politician who governs the whole country is re-elected in period t if the majority of election outcomes $e_{jt}\theta_{jt}$ turns out to be favorable, i.e., if

$$\sum_{j=1}^{n} e_{jt}\theta_{jt} \geq \frac{n+1}{2}. \tag{4}$$

Now, the main proposition on the *centralized regime with uniformity* is:

Proposition 3 *Any public provision g^* can be sustained as a stationary equilibrium in the centralized economy in the uniformity regime for which the condition*

$$g^* \leq \delta \sum_{k=0}^{\frac{n-1}{2}} \binom{n}{k} (1-q)^{n-k} q^k$$

is fulfilled. In this class of equilibria, the incumbent politician is re-elected in a given period with probability $\sum_{k=0}^{\frac{n-1}{2}} \binom{n}{k}(1-q)^{n-k}q^k$. Maximum public provision that can be sustained in such an equilibrium is higher (lower) than public provision in the fully decentralized case if and only if $q < (>)\frac{1}{2}$.

Proof. Consider the following candidate equilibrium. The central politician always chooses

$$g^* = \delta \sum_{k=0}^{\frac{n-1}{2}} \binom{n}{k} (1-q)^{n-k} q^k.$$

For all regions j, the voter in region j chooses $e_{jt} = 1$ if $g_{jt} = g^*$ and $e_{jt} = 0$ otherwise. Again, the one-stage deviation principle applies and we therefore consider one stage deviations. For the politician, any deviation reduces his re-election probability to zero. The deviation that maximizes his payoff is $g_{jt} = 0$, which yields a payoff equal to n. This deviation is weakly inferior if

$$n \leq \frac{n(1-g^*)}{1-\delta\chi(n)}, \tag{5}$$

where

$$\chi(n) = prob(\sum_{j=1}^{n} \theta_{jt} \geq \frac{n+1}{2}) = \sum_{k=0}^{\frac{n-1}{2}} \binom{n}{k} (1-q)^{n-k} q^k. \tag{6}$$

Turn to the voter of region j. If the provision level is $g_{jt} = g^*$ in all regions, the candidate equilibrium choice is $e_{jt} = 1$. Deviating from this choice may still re-elect the same politician to the central government, or may elect a different politician into office but will not increase the voter's payoff. Similarly, if $g_{kt} \neq g^*$ in at least one region k, the candidate equilibrium action is $e_{jt} = 0$ for all voters in all regions. Again, deviating will not change the voter's payoff. This shows that the candidate equilibrium is, indeed, an equilibrium.

The maximum sustainable public provision in this stationary equilibrium is higher than in the decentralized equilibrium if the re-election probability is higher:

$$\sum_{k=0}^{\frac{n-1}{2}} \binom{n}{k} (1-q)^{n-k} q^k > 1-q. \tag{7}$$

This will be fulfilled if and only if $q < 1/2$, in line with the Condorcet jury theorem (CJT), see Ladha (1993) for a proof.[6] ■

Proposition 3 shows that, in the uniformity regime, a simple symmetric trigger strategy by all regions can sustain an equilibrium in which the politician's accountability is higher than in the decentralized equilibrium. This will be the case if random factors are relatively unimportant.

The intuition of the result is as follows. If random factors are relatively unimportant in each single region, an accountable incumbent is more likely to find support by a majority of regions in the centralized regime. The re-election uncertainty reduces in the aggregate. This lowers the probability that an accountable incumbent loses office in the future, and therefore, politicians can be made accountable with a lower fraction of private benefits in each term. Voters have more leverage to control politicians since holding holding office becomes more valuable for an incumbent in the centralized system. Note that this is not a scale effect: the result does not depend on the total amount of funds that are at the politician's disposal in each given period. The increase in the re-election probability under centralization may be regarded as a specific application of the CJT. The comparison of centralized with decentralized structures results in a situation where the CJT can be fruitfully applied, and, embedded in a model of retrospective voting, can be used to address the question of optimal federal structures for accountability. As a corollary, the following comparative static result also holds:

Proposition 4 *If $q < \frac{1}{2}$ then the maximum g^* increases in the number of*

[6] The CJT applies to a binary decision under uncertainty. It compares the outcome of an individual decision, where the correct alternative is chosen with some probability p, with the outcome of a group decision, with the individual probabilities of the group members to choose correctly also being equal to p. It states that, if the individual probability of each individual to choose correctly is larger than one half, (i) the majority decision of a group of such individuals will choose the correct decision with a higher probability than the individual. Moreover, (ii) the probability to choose correctly is increasing in group size and, (iii) asymptotically approaches one as $n \to \infty$, cf. Ladha (1993).

regions, and if $q > \frac{1}{2}$ then g^* decreases in the number of regions.

Proof. Accountability monotonously increases in the probability of winning. However, for $q < 1/2$ Ladha (1993) shows that the re-election probability is increasing in n. ■

Intuitively, as the number of regions increases, it becomes easier to form a majority combination of regions that are not affected by the potential random distortion of the re-election decision, if the probability of such a distortion is low. If it is high, it becomes less likely that such a majority will be formed as the number of regions increases.

One could think of many more complex strategies applied by voters to further increase the accountability of the incumbent politician, since credible threats that imply stronger punishment can, generally, sustain higher levels of accountability. However, this is not necessary. The most the incumbent can hurt the electorate is to provide no public goods at all and then be replaced. On the other hand, there is no stronger punishment for voters than to send the politician home. Thus, the considered Nash threats already have the maximum possible punishment and, hence, no other credible threat exists that could increase accountability.

5 Centralized system with non-uniform provision

Consider now the centralized *discriminatory regime*: the incumbent in period t receives a budget of size n and can choose $\mathbf{g}_t = (g_{1t}, g_{2t}, ..., g_{nt})$ with $g_{jt} \in [0, n]$ for all $j = 1, 2, ...n$, and $\Sigma_{j=1}^{n} g_{jt} \leq n$, for all periods t. Note that this allows the central incumbent to increase the provision level in individual regions above unity. The history of the game at period t when the incumbent politician makes the provision decision is $h^t = ((\mathbf{g}_0, \mathbf{g}_1, ...\mathbf{g}_{t-1}), (\mathbf{e}_0, \mathbf{e}_1, ...\mathbf{e}_{t-1}), (\boldsymbol{\theta}_0, \boldsymbol{\theta}_1, ...\boldsymbol{\theta}_{t-1}))$, where $\mathbf{g}_\tau = (g_{1\tau}, g_{2\tau}, ...g_{n\tau})$,

$\mathbf{e}_\tau = (e_{1\tau}, e_{2\tau}, ...e_{n\tau})$, and $\boldsymbol{\theta}_\tau = (\theta_{1\tau}, \theta_{2\tau}, ...\theta_{n\tau})$, for $\tau = 0, 1, ...t-1$. The incumbent's payoff is now

$$\Pi_t = \sum_{j=1}^{n}(1 - g_{jt}) + \delta p_t \sum_{j=1}^{n}(1 - g_{jt+1}) + \delta^2 p_t p_{t+1} \sum_{j=1}^{n}(1 - g_{jt+2}) + ...$$

A strategy for the politician is a sequence of mappings $\mathbf{g}_{t+i} : H^{t+i} \to \Gamma^n, \Gamma^n = \left\{(g_1, g_2, ..., g_n) \middle| g_j \in [0, n], \sum_{j=1}^{n} g_j \leq n\right\}$. A strategy for the voter in region j is a sequence of mappings $e_{jt+i} : H^{t+i} \times \Gamma^n \to \{0, 1\}$. Consider again the maximum accountability that can be achieved in a stationary equilibrium in pure strategies:

Proposition 5 *Any public provision* $\mathbf{g} = (g_1, g_2, ...g_n)$ *can be sustained as a stationary equilibrium in the centralized economy for which the condition*

$$\Sigma_{j=1}^{n} g_j \leq n\delta \sum_{k=0}^{\frac{n-1}{2}} \binom{n}{k} (1-q)^{n-k} q^k \tag{8}$$

is fulfilled. In this class of equilibria the politician is re-elected in any given period with probability $\sum_{i=0}^{i=\frac{n-1}{2}} \binom{n}{i}(1-q)^{n-i}q^i$*, and maximum public provision* $\sum_{j=1}^{n} g_j^*$ *is higher (lower) than public provision in the fully decentralized case if* $q < (>)\frac{1}{2}$.

Proof. Consider the following candidate equilibrium. The central politician always chooses $\mathbf{g}^*$ with

$$\Sigma_{j=1}^{n} g_j^* = n\delta \sum_{k=0}^{\frac{n-1}{2}} \binom{n}{k} (1-q)^{n-k} q^k.$$

For all regions j, the voter in region j chooses $e_{jt} = 1$ if $\Sigma_{j=1}^{n} g_{jt} = \Sigma_{j=1}^{n} g_i^*$ and $e_{jt} = 0$ otherwise. Again, the one-stage deviation principle applies. For the politician, any deviation in period t reduces his re-election probability to zero. The deviation that maximizes his payoff is $\Sigma_{j=1}^{n} g_{it} = 0$. This choice yields a payoff equal to n, and this deviation is weakly inferior if

$$n \leq \frac{n - \Sigma_{j=1}^{n} g_j^*}{1 - \delta\chi(n)}, \tag{9}$$

where $\chi(n)$ is again given by (6). Comparing the numerator of (9) with (5) shows that ng^* is simply replaced by $\Sigma_{j=1}^n g_j^*$. Also, (9) implies (8).

Turn to the voter of region j. If the overall provision is described by $\Sigma_{j=1}^n g_j^*$, the candidate equilibrium choice is $e_{jt} = 1$. Deviating from this choice may still re-elect the same politician to the central government, or may elect a different politician into office. But this deviation does not change the voter's payoff. Similarly, if $\Sigma_{j=1}^n g_{jt} \neq \Sigma_{j=1}^n g_j^*$, the candidate equilibrium action is to vote $e_{jt} = 0$ for all voters in all regions. Again, deviating will not change the payoff. This shows that the candidate equilibrium is, indeed, an equilibrium.

Parallel to the argument in the proof of proposition 3, one can show that aggregate public provision that can be sustained in this stationary equilibrium is higher than in the decentralized equilibrium if $q < 1/2$. ■

The proof of Proposition 5 follows lines parallel to the proof of Proposition 3. The voters in region j know the full history of the game, and not only the public provision in their own region, and their trigger strategy depends on the provision that takes place in all regions. This makes the voters in the discriminatory regime as powerful as in the uniformity regime and yields the same amount of accountability. In particular, the same uniform stationary equilibrium that maximizes accountability in the uniformity regime remains sustainable in the discriminatory regime. The strategies of regions depend on the full set of public provisions that take place in all regions, and in the equilibrium for which the total sum of public provisions is largest, this total sum is the same in both the uniformity and the discriminatory regimes. It is not feasible for the incumbent politician to increase the sum that he can appropriate over and above $n - \Sigma_{j=1}^n g_j^*$, for instance, by selecting only some subset of regions and basing his re-election on preferential treatment of these regions. Note also that Proposition 5 does not state that g_j^* is uniform in the equilibrium with maximum accountability. Maximum accountability is an aggregate measure, and may go along with uneven public provisions

across regions. A constitutional uniformity requirement could therefore well be based on considerations of interregional equity.

The assumption that the voter of region j uses a strategy that depends not only on the public provision experienced in region j but also on the public provision in all other regions may be natural in the uniformity regime, as the provisions are identical in all regions by construction. It is a stronger assumption in the context of the discriminatory regime. It is therefore important to assess how a weaker assumption may reduce the maximum accountability that can be obtained by infinitely repeated interaction. I focus on the case in which the voter in each region can condition his own voting decision on the history of provisions in his region only, and I sustain the assumption of complete information,[7] the additional restriction on voters' strategies being mappings $e_{jt+i} : H_j^{t+i} \times [0,n] \rightarrow \{0,1\}$, $i = 0,1,...$, that are constant with respect to all components of h_j^{t+i} except for the values of $g_{j0}, g_{j1}, ...g_{jt+i}$.

Suppose a stationary equilibrium exists and is characterized by a provision vector $\mathbf{g}_t = \mathbf{g}$. Suppose that the voter in each region applies the following strategy: $e_{jt} = 1$ if $g_{jt} = g_j$, and $e_{jt} = 0$ otherwise. Assume that the regions are numbered in a way such that $0 \leq g_1 \leq g_2 \leq ... \leq g_n$. What would be the best stationary reply for an incumbent in period 0? Note, first, that any vector $(\hat{g}_1, ..., \hat{g}_n)$ with components $\hat{g}_j \notin \{0, g_j\}$ is suboptimal, as it is dominated by replacing $\hat{g}_j$ with 0 in this vector. Next, note that any vector $\hat{\mathbf{g}}$, that has $\hat{g}_j = 0$ and $\hat{g}_{j+i} = g_{j+i} > 0$, $i = 1, ..., n-j$, unless $g_j = g_{j+1} ... = g_n$ is suboptimal, as it is dominated by a vector that has $\hat{g}_j = g_j$ and $\hat{g}_{j+i} = 0$ and that is identical with $\hat{\mathbf{g}}$ along all other components. Further, any vector that has a positive number of strictly positive components with this number being smaller than $\frac{n+1}{2}$ is also suboptimal, as it is strictly dominated by $\hat{\mathbf{g}} = \mathbf{0}$. In short, the optimal stationary reply to the stationary strategies of the voters must be either $\hat{\mathbf{g}} = \mathbf{0}$, or a vector of provisions that is positive only

[7] Accounting for incomplete information yields a rather different framework with type dependent histories, Bayesian updating and belief formation.

in its $n-m \geq (n+1)/2$ components and provides exactly $\hat{g}_j = g_{ij}$ in these components. In the latter case, the re-election probability of the politician depends on the choice of this vector, and is equal to

$$\chi(n-m) \equiv \sum_{k=0}^{\frac{n-1}{2}-m} \binom{n-m}{k} (1-q)^{(n-m)-k} q^k. \tag{10}$$

The incumbent's optimal reply is a provision vector $(g_1, g_2, ..., g_{n-m}, 0, ..., 0)$ such that m is

$$m^{DC}(\mathbf{g}) \equiv \arg \max_{m \in \{0,1,...,\frac{n-1}{2}\}} \Pi(m), \text{ where } \Pi(m) = \frac{n - \Sigma_{j=1}^{n-m} g_j}{1 - \delta\chi(n-m)}.$$

We can now use this insight to show the following proposition:

Proposition 6 *Let $q < 1/2$, and let ng^* be the maximum provision that can be sustained in a stationary equilibrium with uniform provision and unconstrained trigger strategies. The maximum provision that can be sustained as a stationary equilibrium with discriminatory provision and strategies that condition only on current provision in the voter's own region (short: DC-equilibrium) is at most ng^*, and, for n sufficiently large, is smaller than ng^*.*

Proof. The first part of the proof follows from Proposition 5. Suppose a higher value of total provision than ng^* could be implemented. For this stationary equilibrium to be (weakly) superior to a choice of $g_j = 0$ for all $j = 1, ..., n$, the re-election probability of the politician had to be higher than in the equilibrium in Proposition 5, but this is incompatible with $e_{jt} = 1$ for all j and all t in the equilibrium in Proposition 5.

For the second part of the proposition note first that any DC-equilibrium must also fulfill the condition

$$n \leq \frac{n - \Sigma_{j=1}^{n-m^{DC}} g_j^{DC}}{1 - \delta\chi(n - m^{DC})}. \tag{11}$$

Compare the maximum $\sum_{i=1}^{i=n-m^{DC}} g_i^{DC}$ that fulfills (11) for any given m^{DC}. Note that this maximum is equal to ng^* for $m^{DC} = 0$, and strictly smaller for all $m^{DC} > 0$, as $\chi(n - m^{DC})$ is strictly decreasing in m^{DC}. It is therefore sufficient to show that $\mathbf{g} = (g_1, ..., g_n)$ with $\sum_{i=1}^{i=n-m} g_i = ng^*$ and $m = 0$ is not a DC-equilibrium if n is sufficiently large.

Suppose $g = (g_1, ..., g_n)$ is a provision vector that can be sustained as a DC-equilibrium with $\Sigma_{j=1}^{n-m^{DC}} g_j = ng^*$ and $m^{DC} = 0$. Then, by appropriately numbering of regions in ascending order of provisions, it holds that $g_n \geq g^*$. Consider the incumbent politician who chooses between provisions $\mathbf{g}$ and $\check{\mathbf{g}} = (g_1, g_2, ..., g_{n-1}, 0)$. The respective payoffs are

$$\Pi(n) = \frac{n - ng^*}{1 - \delta\chi(n)}$$

and

$$\check{\Pi}(n-1) \geq \frac{n - (n-1)g^*}{1 - \delta\chi(n-1)}. \tag{12}$$

The right-hand side in (12) is higher than $\Pi(n)$ if

$$g^* > \frac{n\delta[\chi(n-1) - \chi(n)]}{[1 - \delta\chi(n) + n\delta[\chi(n) - \chi(n-1)]]}.$$

Note that $\lim_{n\to\infty}\{\chi(n-1)\} = \lim_{n\to\infty}\{\chi(n)\} = 1$ and, hence,

$$\lim_{n\to\infty}\{\frac{n\delta[\chi(n-1) - \chi(n)]}{[1 - \delta\chi(n) + n\delta[\chi(n) - \chi(n-1)]]}\} = 0,$$

but, if $q < 1/2$, $\lim_{n\to\infty} g^*(n) = \delta > 0$, Accordingly, for sufficiently large n, the incumbent politician prefers $\check{\mathbf{g}}$ to $\mathbf{g}$. ■

Thus, for sufficiently large n, the aggregate level of accountability that can be sustained in a symmetric equilibrium is lower in the discriminatory provision equilibrium than in situations in which each region conditions its strategy on the incumbent's track record in all regions. Intuitively, since regions only condition their behavior on their local provision levels, the regions as a whole lose leverage against the incumbent. The incumbent, in turn, does

not depend on all regions to build a nationwide majority, but can consider dropping some regions altogether, and still find a majority of favorite votes under this setting.

This last finding can be related to the result derived by Ferejohn (1986) on the relationship between an incumbent politician and a non-homogenous electorate and the results of Wrede (2006) who makes an argument in favor of uniform provision in a federal system. Both authors find that the competition between multiple voters can result in a total loss of accountability, which, applied to the context with homogenous regions, would even imply zero provision levels for all regions. It is important to note, however, that the underlying mechanism in their approaches is very different. In my framework the levels of g_j or $\mathbf{g}$ which voters find acceptable or not are given from the outset and are not the outcome of a bidding process between voters/regions. The politician does not have the option of approaching the different voters and negotiating these levels. If the politician does have this option as in Wrede (2006) and Ferejohn (1986), given that he needs only a simple majority of votes, he can stage a competition between the voters and "buy" a given number of votes $m < n$. As there are more voters than needed, Bertrand competition can unfold and may result in very low levels of g_j. Whether this type of bargaining can take place is an empirical matter, and is not an option in my framework. If this option is introduced, it gives a further reason for lower accountability of centralized non-uniform governance structures. This reason adds to, but is different from, the reason concentrated on here.

Finally, one would like to compare accountability under the centralized regime with strategies conditioned on regional provision histories to the decentralized regime of section 3. It follows directly from proposition 6 that aggregate provision can be higher under the former regime than under decentralization, if all regions are being served. On the other hand, if the incumbent finds it optimal not to serve all regions it is easy to construct examples in which aggregate accountability will be lower than under decen-

tralization. Thus, in general it cannot be unambiguously determined which of the two regimes will dominate the other in terms of aggregate accountability. The relative advantage of one regime over the other depends on the given parameters and on the distributions of the g_j across regions.[8]

To sum up the ranking of regimes, aggregate accountability is highest under centralized provision with strategies that condition on the entire provision history across all regions. This holds for uniform and non-uniform provision requirements. Provision levels are lower under decentralization and centralized, non-uniform provision, if regions condition their voting behavior on regional histories only, provided that the number of regions is sufficiently large. The latter two regimes cannot be unambiguously ranked in general.

6 Extensions

The analysis has deliberately used a very simplified framework to bring out the key mechanism at work. However, in order to be sure that the results are valid more generally it is useful to consider modifications to some of the simplifying assumptions. For brevity and clarity, the discussion of possible extensions centers around the comparison of the fully decentralized regime with centralized regime with uniform provision. The most interesting extensions are the possibility of two-sided noise to the election decision, multiple voters within regions, and correlated shocks.

Two sided noise: The analysis considered the case in which a shock

[8] Not serving certain regions is likely to occur if the g_j are very unequal across regions. In this case, it is likely to be optimal for the incumbent not to serve the high g_j regions, and, in this case, aggregate accountability is likely to be below the level under decentralization, because average provision levels in the other regions will be low. On the other hand, with $n \to \infty$, and $g_j = g^*$ for all $j = 1, 2, ..., n$, for accountability to be higher under decentralization requires $nq < m$. However, for $q \uparrow 1/2$ this would require $m \geq n/2$ which cannot be optimal. Thus, under this constellation, accountability can be lower under decentralization.

occurs only to the decision not to re-elect an accountable politician. Assume now that an accountable politician is re-elected with certainty, but that, with probability lower than one half, there may be a shock to the decision not to re-elect an unaccountable politician, such that an unaccountable politician wins another term. This possibility makes unaccountability more attractive for an incumbent since, with some probability, he will be re-elected despite his unaccountable behavior. Accordingly, to induce accountability, larger rents need to be left to accountable politicians. However, pooling the votes from different regions under the centralized regime will make it more unlikely that an unaccountable politician will stay in office. Thus, also in this case, accountability will be higher under centralization. As a consequence, with two sided noise, where accountable politicians may be voted out of office by mistake and unaccountable politicians may also be erroneously confirmed in office, and where the probability of these errors is relatively small, the argument in favor of centralized provision can be made *a fortiori*, since pooling the votes reduces both sources of re-election uncertainty and thus increases maximum sustainable accountability.

Multiple voters: The argument also prevails, if there are multiple voters in each region. If we assume that the shocks to the voting decision are uncorrelated across individuals within each region, and again occur with a relatively low probability (smaller than one half), the pooling of individual errors in the regional election, and the pooling of regional errors in the nationwide election will both reduce the possibility that an accountable politician will be voted out of office by mistake, and thus both will increase accountability. Again centralized uniform provision will result in higher accountability due to the additional reduction of the noise through the additional nationwide pooling of votes from the regions. In such a setting one may wonder what the relative effects on accountability of risk pooling within the region and of risk pooling between the regions are, and whether an optimal region size exists that maximizes accountability. The results of Boland et al. (1989)

imply that equilibrium re-election probability for an accountable politician, and thus maximum sustainable public good provision, will be highest in a situation where the votes are aggregated in a single election, i.e. where regions consist of a single individual.

Correlation between voters' election distortions: Another simplifying assumption for the result so far has been that the disturbance θ_{jt} that turns a positive re-election choice into the election outcome is idiosyncratic to the region. This simplification was mainly chosen for clarity and simplicity of exposition. It is natural to ask whether the results are robust to changes in this assumption. For positively correlated shocks between regions the general statistical results derived Boland et al. (1989) and Berg (1993) imply that, given that the probability of an individually distorted election choice is smaller that one half, the re-election probability for accountable politicians will also be increased under centralization compared to the fully decentralized setting, unless correlation is perfect. However, the higher the positive correlation the smaller is the increase in the re-election probability and the corresponding increase in sustainable public good provision relative to the decentralized setting. On the other hand, with negative correlation the positive effects of centralization on the re-election probability of accountable politicians is even compounded, cf. Berg (1993).[9] These results imply that, my results on relative accountability under the centralized and decentralized structures are qualitatively robust, but will quantitatively depend on the nature of the correlation.

To understand better the scope and intuition of the main mechanism increasing accountability consider a more general specification of the dis-

[9]Note that the correlation of the shocks is not only related to the nature of the shocks as remarked in footnote 3 but also to the heterogeneity of regions. Starting with Tiebout (1956), many scholars have pointed at the importance of sorting in federal systems, i.e. the possibility that people select themselves into different jurisdictions according to their preferences, values, income, age, etc. While such sorting is never perfect the differences between regions may affect the nature of the correlation structure.

turbance θ_{jt}, that allows for nationwide as well as regional influences on such a shock. In such a case, there is some, but not perfect, correlation across regions. Let $\theta_{tj} \equiv 1 - \mu_t - \varepsilon_{tj} + \mu_t \varepsilon_{tj}$, where $\mu_t \in \{0, 1\}$, with $prob\,(\mu_t = 1) = v$, represents the nationwide shock that is the same for all regions, and $\varepsilon_{tj} \in \{0, 1\}$, with $prob\,(\varepsilon_{tj} = 1) = z$, a local shock that is specific to a region and where these regional shocks $\varepsilon_{tl}, \varepsilon_{tk}, k \neq l$ are uncorrelated, and are also uncorrelated with μ_t. The situation analyzed above amounts to the situation in which $v = 0$ and $z = q$. Alternatively, the situation of perfectly correlated shocks across regions would result if there is only a nationwide shock, but no regional shock, i.e. $v > 0$ and $z = 0$. In this situation, there is no difference in maximum accountability between centralization and decentralization.

However, consider the intermediate case in which $v > 0$ and $z > 0$. A stationary equilibrium in the voting provision game exists in which the re-election probability of an accountable politician is equal to $(1 - v)(1 - z)$ under decentalization. Under the centralized regime, the re-election probability is $(1 - v)\chi(n)$, where now $\chi(n) = prob(\sum_{j=1}^{n}(1 - \varepsilon_{tj}) \geq \frac{n+1}{2})$. From this it is immediately clear that, by analogy to proposition (3), the re-election probability is higher under the centralized regime as long as $z < 1/2$. Thus, to induce the incumbent to behave accountable less resources need to be left to the incumbent. In line with the general results by Boland et al. (1989) and Berg (1993), the overall scope for increasing accountability is smaller if nationwide shocks are relatively more important and regional voting outcomes more closely correlated.

7 Conclusion

Random distortions of election choices reduce accountability. However, centralized political systems can provide a higher level of accountability if the random distortions are not dominating the re-election. The pooling of po-

tentially distorted votes in the centralized system increases the likelihood that accountable politicians are actually rewarded with an additional term in office and the politicians' rents per term in office can be reduced.

The analysis also provides arguments for uniform provision levels in centralized systems. First, if voters in each region base their retrospective voting on the provision level in all regions, the maximum level of public good provision that can be sustained is defined only in the aggregate, with potential distributional imbalances in the equilibrium. Thus, there is a good reason for uniform distribution for reasons of interregional equity. Second, if voters in each region base their retrospective voting only on the level of public good provision in their own region, the discriminatory regime can reduce accountability. Of course, in my setting, all regions were identical and there are therefore no inherent costs of uniform treatment of all regions. In reality, regions are likely to be asymmetric and therefore reasons may exist for having differentiated policies towards them. If such benefits are strong, decentralized systems may be preferable to avoid the potential negative effects of a centralized discriminatory regime on accountability.

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