Electoral Institutions and the National Provision of Local Public Goods[*]

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ABSTRACT

I explore the incentives under alternative electoral institutions for national politicians to efficiently provide local public goods. Using a career-concerns model which incorporates voter ideological heterogeneity and thus allows comparison of electoral–college and majoritarian elections at the national level, I show that the aggregation of votes across localities in both electoral–college and majoritarian elections results in a weakening of incentives to efficiently provide local public goods. However, this effect is not unambiguously larger for one electoral institution or the other. Rather, electoral institutions interact with voter preferences to determine incentives. Electoral–college elections provide particularly weak incentives for national politicians to efficiently provide local public goods when there is local ideological bias for the incumbent or challenger, while such bias tends to cancel out in majoritarian elections. Further, electoral–college and majoritarian elections encourage different allocations of effort by national politicians when voters differ across localities in the degree to which they value public–goods provision. When such differences are sharp, electoral–college elections result in better public–goods provision for localities whose voters value public goods less, and majoritarian elections result in better provision for localities whose voters value public goods more.

Should local public goods be provided by local or central governments? The traditional answer to this question is that in the absence of interjurisdictional externalities local public goods should be provided locally to promote better matching between citizen preferences and the level and type of public-goods provision (Oates 1972, Musgrave 1959, Tiebout 1956), to encourage experimentation by local jurisdictions (Osborne 1988), and to take advantage of the increased accountability which competition across jurisdictions may foster (Brennan and Buchanan 1980, Hoyt 1990, Rubinfeld 1987, Tiebout 1956, Weingast 1995). Following this recommendation, policy-makers in both the developed and developing world have devolved fiscal authority to local governments; fiscal decentralization has been "in vogue" (Oates 1999, p. 1120). Yet recent research has called into question both the presumption that governments are truly decentralizing (see, e.g., Rodden 2006), as well as the benefits of any decentralization which is taking place.[1] These mixed findings have spurred a reexamination of the advantages and disadvantages of fiscal decentralization.[2] However, this effort has been hampered by our poor understanding of the incentives of *national* politicians to efficiently provide local public goods. In this paper I help to fill this gap by examining the national provision of local public goods under alternative electoral institutions.

I take up this question by building on recent work by Seabright (1996) and Persson and Tabellini (2000, ch. 9) which compares the provision of local public goods by national and local politicians. As I discuss in more detail below, both Seabright (1996) and Persson and Tabellini (2000) implicitly treat national elections as electoral-college elections, where the outcome is determined by the number of localities won. In contrast, I explore the national provision of local public goods under alternative electoral institutions. My approach suggests that the incentives of national politicians to efficiently provide local public goods depend on the nature of national electoral institutions and the interaction of those institutions with voter preferences.

As in Persson and Tabellini (2000), I model the electoral control of politicians in a "career-concerns" framework (Holmstrom 1982), where an incumbent politician exerts effort in an attempt to appear more competent to her constituents.[3] (In contrast, Seabright (1996) uses a retrospective-voting model of the type first proposed by Barro (1973) and Ferejohn (1986).) My model differs primarily in assuming that voters are heterogeneous within localities, with continuously distributed "ideological" preferences over the incumbent and the challenger. This assumption, first employed

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[1]   A burgeoning literature examines the empirical relationship between decentralization and the quality of local governance (typically, the absence of corruption). Representative works include Treisman (2000), Fisman and Gatti (2002), Enikolopov and Zhuravskaya (2003), Bohara, Mitchell, and Mittendorff (2004), Gerring and Thacker (2004), and Gurgur and Shah (2005). No unambiguous relationship emerges from this investigation.

[2]   Wibbels (2005), Rodden (forthcoming), and Bednar (2006) provide extensive reviews of the literature.

[3]   Other applications of the career-concerns framework to politics include Lohmann (1998), Alesina and Tabellini (2003), Patty, Johns, and Skinner (2004), Alt and Lassen (forthcoming), Ashworth (2005), and Ashworth and Bueno de Mesquita (2006).

in the form here by Lindbeck and Weibull (1987) and Dixit and Londregan (1996), and subsequently adopted in many models of political competition, has two advantages in the present context. First, as in other career-concerns (or more generally, agency) models which incorporate some version of ideological heterogeneity (see, e.g., Alt and Lassen forthcoming, Ashworth and Bueno de Mesquita 2006, Besley 2006), explicitly modeling ideological preferences highlights the impact of ideological bias on an incumbent politician's incentive to seek reelection. Second, and more central to the modeling approach in this paper, the assumption that voters have continuously distributed ideological preferences implies that an incumbent's vote share is a continuous function of her perceived competence. In contrast, when voters are homogeneous, an incumbent always receives either all or none of the vote, depending on voters' (collective) perception of her competence.

The advantage of this formulation becomes apparent when considering national elections, where the vote share in different localities must somehow be "added up" to determine the national election winner. When the incumbent in a national election always receives either all or none of the vote in any locality, as is the case when voters within a locality are homogeneous, the winner of the national election is implicitly determined by the number of localities won, as in electoral-college elections. My alternative assumption that voters within a locality have heterogeneous preferences permits me to explicitly model national majoritarian as well as national electoral-college elections. The model thus provides a comparison of the national provision of local public goods under alternative national electoral institutions. As I discuss in the concluding section, the same framework may be used to analyze any environment where an incumbent politician must allocate effort across tasks.

Three predictions follow from my analysis. First, the aggregation of votes across localities in both electoral-college and majoritarian elections results in a weakening of incentives to efficiently provide local public goods; properly interpreted, previous models were only able to identify this effect in electoral-college elections. Second, electoral-college elections provide particularly weak incentives when there is local ideological bias for the incumbent or challenger, while such bias tends to cancel out in majoritarian elections. Third, electoral-college and majoritarian elections encourage different allocations of effort by national politicians when voters differ across localities in the degree to which they value public-goods provision: electoral-college elections encourage effort in localities whose voters particularly value public-goods provision in *absolute* terms, while majoritarian elections encourage effort in localities whose voters particularly value public-goods provision in *relative* terms. When differences across localities in the degree to which voters value public goods provision are sharp, electoral-college elections thus result in better public-goods provision for localities whose voters value public goods less, and majoritarian elections result in better provision for localities whose voters value public goods more.

While no other work of which I am aware directly compares the incentives of national politicians to efficiently provide local public goods under alternative electoral institutions, other research has addressed related issues. Hindricks and Lockwood (2005) build on the model by Persson and Tabellini cited above to consider the impact of decentralization on

the selection (rather than incentive) effect of elections, while Besley (2006, ch. 3) explores electoral accountability by national and local politicians in the context of a more general model of political accountability. Myerson (2006) also compares electoral accountability in centralized and decentralized systems, but focuses instead on the role of decentralization in creating incentives to build good reputations in immature democracies. Finally, Lockwood (2002) and Besley and Coate (2003) compare fiscal centralization and decentralization under the assumption that funding for public goods in centralized systems is allocated by legislatures (see also Inman and Rubenfeld 1997). My focus on the incentives of national politicians to efficiently provide those goods once funding has been allocated should be viewed as complementary to this analysis.

MODEL

I analyze the incentives of national politicians to efficiently provide local public goods under both electoral-college and majoritarian elections. I focus here on a general formulation of the problem. The online appendix available at www.qjps.com shows how this environment can be expressed in terms of the division of tax revenues between public goods and "rents" retained by the politician.[4]

There are two periods, where period 1 is a pre-election period, and period 2 is a post-election period.[5] At issue is the provision of local public goods in two localities indexed $\lambda = a, b$, with provision of the public good for locality λ in period t denoted $g_{\lambda t}$. Each locality is populated by a continuum of voters of mass $\frac{1}{2}$, who care about public-goods production only in their own locality.[6] In particular, let voters in locality λ receive utility from provision of public goods at time t of $\alpha_\lambda g_{\lambda t}$, where the parameter α_λ captures the degree to which voters value public-goods provision relative to the "ideological" concerns I discuss below.

Public-goods provision is centralized, so decisions about local public-goods provision are made by a national politician. In period 1 this politician is the incumbent, who faces a challenger. Voters choose between the incumbent or challenger at the end of period 1, with the winner of the election then the politician responsible for public-goods production in period 2. Generic references below to the "politician" should be read as referring to the politician in power that period. I assume that there is an exogenous payoff $R > 0$ to holding power in each period.

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[4]   As I demonstrate in this appendix, the model easily incorporates environments in which there is redistribution across localities, so long as the distribution of tax revenue is set according to a fixed and publicly known formula so that voters may impute the competence of the politician in providing public goods for their locality.

[5]   Extending the model to an infinite horizon is a straightforward exercise (see, e.g., Persson and Tabellini 2000), albeit one that comes at some loss of transparency. The environment here is restricted to two periods for simplicity.

[6]   The role of spillovers across localities is an interesting question beyond the scope of this paper. For some preliminary analysis using the same analytical framework, see Gehlbach (2004).

Public-goods production in each period is an additive function of the politician's effort $e_{\lambda t}$ that period, and her competence θ_λ in producing those goods:

$$g_{\lambda t} = k_{\lambda t} + e_{\lambda t} + \theta_\lambda \tag{1}$$

where $k_{\lambda t} \in \mathbf{R}$ is an exogenous parameter known to all actors. While not technically necessary, $k_{\lambda t}$ may be defined to be sufficiently greater than zero to assure that public-goods provision is always positive, even when effort is zero and θ_λ takes on negative values. (The inclusion of the parameter $k_{\lambda t}$ facilitates interpretation of the model as applying to a rent-extraction environment, as in the online appendix available at www.qjps.com, as well as its extension to questions beyond the national provision of local public goods, as I discuss below in the concluding section.) Observe that both effort and competence are subscripted by λ: politicians make effort decisions separately for each locality, and have locality-specific competence. (For notational simplicity I do not subscript $e_{\lambda t}$ and θ_λ by the identity – incumbent or challenger – of the politician in power.) Neither effort nor competence, but only total public-goods production $g_{\lambda t}$, is observable by voters (who also know $k_{\lambda t}$). The incumbent's competence persists from period 1 to period 2 (θ_λ is not subscripted by t) so that voters have an incentive to return incumbents to office whom they perceive to be more competent. This in turn implies that incumbents have an incentive to exert effort to appear more competent and improve their chances of reelection.

The key analytical simplification of career-concerns models is the assumption that the incumbent knows no more about her competence than do the voters at the time she chooses her effort level. This assumption – which distinguishes "career-concerns" from signaling models – simplifies the analysis by eliminating the possibility of multiple equilibria, while retaining focus on the incumbent's incentive to exert effort. The proper interpretation is not that the incumbent does not know whether or not she is competent in general, but that at the time she exerts effort she does not know whether the political-economic environment will favor her particular skill set.

Summarizing, the timing of events is:

1. (Period 1) The incumbent chooses an effort level $e_{\lambda 1}$ (unobserved by voters) for each locality λ, where effort augments the production of local public goods.
2. (Period 1) The incumbent's competence (θ_a, θ_b) is realized (but not observed by voters), which together with the incumbent's effort decision determines the level of public-goods production $g_{\lambda 1}$ in period 1 (which is observed by voters) in each locality λ.
3. (Period 1) Voters choose whether or not to reelect the incumbent.
4. (Period 2) The politician in power in period 2 (either the incumbent or challenger) chooses an effort level $e_{\lambda 2}$ for each locality λ, which together with that politician's competence determines the level of public-goods production $g_{\lambda 2}$ in period 2 in each locality λ.

Formally, I define effort and competence as follows:

- Effort: In each locality λ and period t, the politician chooses $e_{\lambda t} \in [0, \bar{e}_\lambda]$.[7] Such effort is costly to the politician, where I assume a convex cost function $c(e_{\lambda t})$ with a) $c(0) = 0$, b) $\lim_{e_{\lambda t} \to 0} c'(e_{\lambda t}) = 0$, c) $c'(.) > 0$, and d) $c(.)$ "sufficiently convex" to assure an interior solution.[8]
- Competence: For every locality λ, the incumbent has unknown competence θ_λ in producing public goods, where θ_λ is constant across periods. I assume θ_λ to be independently and identically distributed across localities according to the density and distribution functions $f(.)$ and $F(.)$, respectively, where $f(.)$ is differentiable, single-peaked, and symmetric around $E(\theta_\lambda) = 0$ with support $[-s, s]$. If the incumbent politician is defeated, the challenger takes office, with $E(\theta_\lambda) = 0$.

Thus far the model is a standard career-concerns environment. To incorporate ideological preferences over the incumbent and challenger, let $\delta_{i\lambda}$ refer to the ideological preference of voter i in locality λ for the *challenger*, so that voter i supports the incumbent for reelection if:

$$E(\alpha_\lambda g_{\lambda 2} \mid \text{incumbent wins}) > \delta_{i\lambda} + E(\alpha_\lambda g_{\lambda 2} \mid \text{challenger wins}) \qquad (2)$$

In words, voter i in locality λ votes for the incumbent if his expected payoff from public-goods provision in period 2 under the incumbent is sufficiently great relative to his expected payoff from public-goods provision in period 2 under the challenger to offset any ideological preference for the challenger.

I assume that the distribution of ideological preferences in each locality is known to the incumbent *ex ante*. In particular, let $\delta_{i\lambda}$ be distributed independently across localities, and uniformly within a locality over the interval $\left[-\frac{1}{2\gamma} + \beta_\lambda, \frac{1}{2\gamma} + \beta_\lambda \right]$, where the parameters $\gamma > 0$ and $\beta_\lambda \in \mathbf{R}$ are common knowledge.[9] The parameter β_λ represents the degree of aggregate bias among voters in locality λ for the challenger over the incumbent. I assume that the distribution of $\delta_{i\lambda}$ is sufficiently wide (relative to the support of $f(.)$ and given the degree α_λ to which voters value public goods) for the incumbent's vote share in any locality to always fall strictly between zero and one. Together with the assumption that $f(.)$ has compact support, this eases analysis by allowing vote shares to be easily added up across localities when considering national majoritarian elections, albeit with a few complications because some realizations of $g_{\lambda t}$ lie off the equilibrium path, which would not be the case if θ_λ could take any value in $\mathbf{R}$.

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[7] The upper bound on possible effort is technically unnecessary in this general setup, but is included for conformity with the rent-extraction environment defined in the online appendix available at www.qjps.com.

[8] More precisely, I assume that $c(.)$ is sufficiently convex for the incumbent's period-1 maximization problem to be solved by the $e_{\lambda 1}$ which satisfies the equilibrium condition $e_{\lambda 1} = \tilde{e}_{\lambda 1}$.

[9] Thus, in contrast to many models of electoral competition, electoral uncertainty in this model results not from uncertainty about the distribution of ideological preferences, but from the assumption that the random variable θ_λ is realized only after the incumbent chooses her effort level in period 1.

EQUILIBRIUM

In this section I explore equilibrium behavior under alternative assumptions about the nature of national electoral institutions and the distribution of voters' preferences. I begin by deriving the equilibrium level of effort under electoral-college and majoritarian elections when there is no local ideological bias, i.e. $\beta_\lambda = 0$ for all λ. I use these results to compare the basic weakening of incentives to efficiently provide local public goods which results from the aggregation of votes across localities in national electoral-college and majoritarian elections, focusing on the case where voters do not differ across localities in the degree to which they value public goods relative to other concerns. I then relax these assumptions to examine the interaction of electoral institutions and voter preferences. My solution concept is "weak sequential equilibrium," which combines the notion of sequential rationality with the requirement that players' beliefs on the equilibrium path be updated according to Bayes' rule (see, e.g., Myerson 1991, Osborne 2004).[10] Throughout I restrict attention to equilibria in pure strategies.

Aggregation of Votes and the Weakening of Incentives in National Elections

The question of the model is the relationship between national electoral institutions and the equilibrium level of effort by the incumbent in period 1, which depends on the mapping from effort to reelection probability. I begin by deriving the share of votes for the incumbent in each locality λ as a function of the perceived competence of the incumbent. I then aggregate votes across localities separately for electoral-college and majoritarian elections to derive the incumbent's reelection probability as a function of her effort choice $e_{\lambda 1}$.

Consider the outcome in period 2. Without the discipline of an upcoming election, whoever is in power (incumbent or challenger from period 1) chooses $e_{\lambda 2} = 0$. Following Equation 1, period-2 public-goods production is therefore determined entirely by the competence of the politician in power after the election and by the exogenous variable $k_{\lambda 2}$, i.e. $g_{\lambda 2} = (k_{\lambda 2} + \theta_\lambda)$. Consequently, voters have an interest in returning competent incumbents to power.

In particular, given voters' expectation that $g_{\lambda 2} = (k_{\lambda 2} + \theta_\lambda)$, Inequality 2 giving the condition for voter i in locality λ to vote to reelect the incumbent in period 1 reduces to:

$$E(\alpha_\lambda(k_{\lambda 2} + \theta_\lambda) \mid \text{incumbent wins}) > \delta_{i\lambda} + E(\alpha_\lambda(k_{\lambda 2} + \theta_\lambda) \mid \text{challenger wins}) \quad (3)$$

$$\alpha_\lambda E(\theta_\lambda \mid \text{incumbent wins}) > \delta_{i\lambda} \quad (4)$$

where I use the assumption that $E(\theta_\lambda) = 0$ for the challenger. Establish notation such that variables with tildes refer to voters' *beliefs* about the competence of and effort expended by the incumbent. Thus, $\tilde{\theta}_\lambda$ refers to the value of θ_λ imputed by voters based on observed public-goods production $g_{\lambda 1}$ and their beliefs about what action has been taken by the

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[10] Note that the similar solution concept "perfect Bayesian equilibrium," often employed in signaling games, is not defined for games with unobserved actions such as the model in this paper. See, e.g., Osborne and Rubenstein (1994, Section 12.3).

incumbent, $\tilde{e}_{\lambda 1}$ (with the specific function to be derived shortly). Then Inequality 4 can be rewritten as:

$$\delta_{i\lambda} < \alpha_\lambda \tilde{\theta}_\lambda \tag{5}$$

Given that $\delta_{i\lambda}$ is uniformly distributed on $\left[-\frac{1}{2\gamma}, \frac{1}{2\gamma}\right]$ (recall that for now the assumption is that local ideological bias $\beta_\lambda = 0$ for all λ), this implies that the share of voters in locality λ who support the incumbent can be written as a function of the imputed competence of the incumbent:

$$\frac{1}{2} + \gamma \alpha_\lambda \tilde{\theta}_\lambda \tag{6}$$

The relationship between Expression 6 and the incumbent's probability of winning depends on whether national elections operate according to an electoral-college or majoritarian rule. Consider first *electoral-college elections*, where the winner of the national election is the candidate who wins a majority of localities. (I assume that ties are decided by an equal-probability rule.) The probability that the incumbent wins in any locality λ is the probability that Expression 6 is greater than $\frac{1}{2}$, or $\Pr(\tilde{\theta}_\lambda > 0)$. I next show how this may be expressed as a function of $e_{\lambda 1}$.

On the equilibrium path (i.e. for $g_{\lambda 1} \in [k_{\lambda 1} + e_{\lambda 1} - s, k_{\lambda 1} + e_{\lambda 1} + s]$, which are those realizations of $g_{\lambda 1}$ which occur with positive probability given the incumbent's effort choice), voters update their beliefs about the incumbent's competence based on their observation of public-goods production $g_{\lambda 1}$, their beliefs about the effort expended by the incumbent $\tilde{e}_{\lambda 1}$, and their knowledge of the exogenous parameter $k_{\lambda 1}$:

$$\tilde{\theta}_\lambda = g_{\lambda 1} - k_{\lambda 1} - \tilde{e}_{\lambda 1} \tag{7}$$

Plugging in $g_{\lambda 1} = (k_{\lambda 1} + e_{\lambda 1} + \theta_\lambda)$ gives an expression for voters' estimates of the incumbent's competence which is increasing in the difference between the incumbent's actual effort level and that expected of her:

$$\tilde{\theta}_\lambda = \theta_\lambda + (e_{\lambda 1} - \tilde{e}_{\lambda 1}) \tag{8}$$

Off the equilibrium path the solution concept weak sequential equilibrium imposes no restrictions on beliefs. To rule out implausible equilibria supported by beliefs that low-competence types produce impossibly high levels of public-goods, or vice-versa, I make the following assumption:

Assumption 1 *For observations off the equilibrium path, i.e. for $g_{\lambda 1} \notin [k_{\lambda 1} + e_{\lambda 1} - s, k_{\lambda 1} + e_{\lambda 1} + s]$, voters have the following beliefs about the type they are facing:*

$$\tilde{\theta}_\lambda = s \text{ if } g_{\lambda 1} > k_{\lambda 1} + e_{\lambda 1} + s \tag{9}$$

$$\tilde{\theta}_\lambda = -s \text{ if } g_{\lambda 1} < k_{\lambda 1} + e_{\lambda 1} - s \tag{10}$$

Together with Equation 8, this assumption implies that voters have the following beliefs about the type they are facing (where I substitute $\tilde{e}_{\lambda 1} = e_{\lambda 1}$ into the possible

realizations of $g_{\lambda 1}$ because voters' beliefs about the incumbent's effort choice are correct in equilibrium):

$$
\begin{aligned}
\tilde{\theta}_\lambda &= -s \text{ if } g_{\lambda 1} < k_{\lambda 1} + \tilde{e}_{\lambda 1} - s \\
&= \theta_\lambda + (e_{\lambda 1} - \tilde{e}_{\lambda 1}) \text{ if } g_{\lambda 1} \in [k_{\lambda 1} + \tilde{e}_{\lambda 1} - s, k_{\lambda 1} + \tilde{e}_{\lambda 1} + s] \quad (11) \\
&= s \text{ if } g_{\lambda 1} > k_{\lambda 1} + \tilde{e}_{\lambda 1} + s
\end{aligned}
$$

Thus, $\Pr(\tilde{\theta}_\lambda > 0)$, which is the probability that the incumbent wins in locality λ, is the probability that $[\theta_\lambda + (e_{\lambda 1} - \tilde{e}_{\lambda 1})] > 0$, or:[11]

$$
\Pr(\tilde{\theta}_\lambda > 0) = \Pr(\theta_\lambda + e_{\lambda 1} - \tilde{e}_{\lambda 1} > 0) = \Pr(\theta_\lambda > \tilde{e}_{\lambda 1} - e_{\lambda 1}) = 1 - F(\tilde{e}_{\lambda 1} - e_{\lambda 1}) \quad (12)
$$

With this expression for the probability the incumbent wins in locality λ, the probability that the incumbent wins an electoral–college election, given that θ_λ is independently distributed across localities, is:

$$
\Pr(\text{incumbent wins} \mid e_{a1}, e_{b1}) = p_a p_b + \frac{1}{2} p_a (1 - p_b) + \frac{1}{2}(1 - p_a) p_b \quad (13)
$$

where $p_\lambda \equiv [1 - F(\tilde{e}_{\lambda 1} - e_{\lambda 1})]$. Differentiating Equation 13 with respect to any $e_{\lambda 1}$, and applying the equilibrium condition $\tilde{e}_{\lambda 1} = e_{\lambda 1}$ for all λ, gives the marginal probability of winning when voters correctly anticipate the incumbent's effort choice as:

$$
f(0)[1 - F(0)] + \frac{1}{2} f(0) F(0) - \frac{1}{2} f(0) [1 - F(0)] = \frac{1}{2} f(0) \quad (14)
$$

Multiplying by R and setting this equal to the derivative of the cost function gives the equilibrium level of effort.[12]

Proposition 1   *With national electoral-college elections, the unique pure-strategy equilibrium consistent with Assumption 1 when local ideological bias $\beta_\lambda = 0$ for $\lambda = a, b$ has effort in period 1 defined by:*

$$
c'(e_{\lambda 1}) = \frac{1}{2} f(0) \cdot R \quad (15)
$$

Proof: See above.   ∎

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[11] In particular, note that $g_{\lambda 1} > (k_{\lambda 1} + \tilde{e}_{\lambda 1} + s)$ can be expressed as $(\theta_\lambda + e_{\lambda 1} - \tilde{e}_{\lambda 1}) > s > 0$. Since in this case $\tilde{\theta}_\lambda = s > 0$, $\tilde{\theta}_\lambda > 0$ if and only if $(\theta_\lambda + e_{\lambda 1} - \tilde{e}_{\lambda 1}) > 0$.

[12] Note that the identical effort choice is made in equilibrium if there are three localities rather than two. To see this, observe that when there are three localities the probability that the incumbent wins is $p_a p_b + p_a p_c + p_b p_c - 2 p_a p_b p_c$, where as above $p_\lambda \equiv [1 - F(\tilde{e}_{\lambda 1} - e_{\lambda 1})]$. Differentiating this expression with respect to any $e_{\lambda 1}$ and applying the equilibrium condition $\tilde{e}_{\lambda 1} = e_{\lambda 1}$ for all λ gives a marginal probability of winning of $2 f(0)[1 - F(0)] F(0)$. With the assumption that $f(.)$ is symmetric around $E(\theta_\lambda) = 0$, which implies $F(0) = \frac{1}{2}$, this simplifies to $\frac{1}{2} f(0)$.

Proposition 1 shows that the incumbent chooses effort in period 1 by setting the marginal cost of effort equal to its marginal benefit, where the marginal benefit is the product of the marginal increase in her reelection probability when voters correctly anticipate her effort choice, and of her payoff from reelection. As in all career-concerns models, the incumbent ultimately provides effort not because doing so fools voters into thinking her more competent – as with any Nash equilibrium, voters correctly anticipate her strategy, and so can correctly impute her competence – but because to do otherwise would convince voters that she is less competent than is in fact the case.

In particular, note that the equilibrium level of effort in electoral-college elections is less than that provided by local politicians responsible for public-goods provision in a decentralized system, which given that the probability of winning in any locality λ is $[1 - F(\tilde{e}_{\lambda 1} - e_{\lambda 1})]$ can be derived as:

$$c'(e_{\lambda 1}) = f(0) \cdot R \qquad (16)$$

The intermediate aggregation of votes through an electoral-college mechanism accounts for this difference in incentives, essentially turning a national election into a series of local elections. The result in any particular local election matters only if that locality is pivotal, which happens with probability less than one. Since effort may thus be wasted on a population that does not matter for the election outcome, the incumbent chooses to provide less effort than would a local politician.[13]

Seabright (1996) and Persson and Tabellini (2000) derive a similar result, using a Barro/Ferejohn retrospective-voting model and a career-concerns model with no voter ideological heterogeneity, respectively. However, they interpret this conclusion as applying to national elections generally, rather than only to those national elections in which votes are aggregated through an intermediate institution like the U.S. Electoral College. Other authors have tied the pivotal-locality mechanism to the Electoral College in particular (e.g., Bueno de Mesquita et al. 2003, ch. 10, Lizzeri and Persico 2001), but have not addressed the question of whether national majoritarian elections suffer any qualitatively similar disfunction. In fact, there may also be a weakening of incentives resulting from the aggregation of votes across localities in national majoritarian elections, but for a different reason and with either larger or smaller impact than in electoral-college elections.

To see this, I derive the incumbent's effort level in period 1 when there are *national majoritarian elections*. With the share of voters in each locality supporting reelection given by Expression 6, and with a population of mass $\frac{1}{2}$ in each locality, the total vote received by the incumbent in a national majoritarian election is:

$$\frac{1}{2} + \frac{\gamma}{2}(\alpha_a \tilde{\theta}_a + \alpha_b \tilde{\theta}_b) \qquad (17)$$

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[13] As the rent-extraction environment in the online appendix available at www.qjps.com demonstrates, this effect would be at least partially offset if the exogenous payoff *R* from reelection were greater for national politicians in a centralized system than for local politicians in a decentralized system.

Then the probability that the incumbent wins, which is the probability that her vote share is at least $\frac{1}{2}$, is

$$\Pr\left[\frac{1}{2} + \frac{\gamma}{2}(\alpha_a\tilde{\theta}_a + \alpha_b\tilde{\theta}_b) \geq \frac{1}{2}\right] = \Pr(\alpha_a\tilde{\theta}_a + \alpha_b\tilde{\theta}_b \geq 0) \tag{18}$$

In national majoritarian elections the incumbent's reelection probability is increasing in a weighted average of her perceived competence in producing public goods in each locality. The weights α_a and α_b capture the idea that perceived competence in producing public goods matters more in localities whose residents care more about public-goods production.

Before solving for the equilibrium level of effort in each locality in period 1, I introduce some notation:

$$\bar{f}(y) \equiv \int_{-\infty}^{\infty} f(y\theta_\lambda)f(\theta_\lambda)d\theta_\lambda \tag{19}$$

Note that $\bar{f}(y)$ is always greater than zero.

Proposition 2 *With national majoritarian elections, the unique pure-strategy equilibrium consistent with Assumption 1 when local ideological bias $\beta_\lambda = 0$ for $\lambda = a, b$ has effort in period 1 defined by:*

$$c'(e_{a1}) = \bar{f}\left(-\frac{\alpha_b}{\alpha_a}\right) \cdot R \tag{20}$$

$$c'(e_{b1}) = \bar{f}\left(-\frac{\alpha_a}{\alpha_b}\right) \cdot R \tag{21}$$

Proof: I derive the equilibrium level of effort in period 1 in locality a; the proof for locality b is analogous. The key to the proof is finding the derivative of $\Pr(\alpha_a\tilde{\theta}_a + \alpha_b\tilde{\theta}_b \geq 0)$ with respect to e_{a1}. To do so, I first express $\Pr(\alpha_a\tilde{\theta}_a + \alpha_b\tilde{\theta}_b \geq 0)$ in terms of e_{a1} by using Equation 11, which gives voters' beliefs about the type they are facing given observed public-goods production and beliefs about the effort level chosen by the incumbent.

It is convenient to express $\Pr(\alpha_a\tilde{\theta}_a + \alpha_b\tilde{\theta}_b \geq 0)$ in terms of e_{a1} for $e_{a1} \leq \tilde{e}_{a1}$ and $e_{a1} \geq \tilde{e}_{a1}$ separately. Consider first $e_{a1} \leq \tilde{e}_{a1}$. For given beliefs about the incumbent's choice of effort $\tilde{e}_{a1}$ in locality a and competence $\tilde{\theta}_b$ in locality b, $\Pr(\alpha_a\tilde{\theta}_a + \alpha_b\tilde{\theta}_b \geq 0)$ can be written as:

$$\int_{-s}^{-s+\tilde{e}_{a1}-e_{a1}} \mathbf{1}\left(s \leq \frac{\alpha_b}{\alpha_a}\tilde{\theta}_b\right)f(\theta_a)d\theta_a + \\ \int_{-s+\tilde{e}_{a1}-e_{a1}}^{s} \mathbf{1}\left(\theta_a \geq \tilde{e}_{a1} - e_{a1} - \frac{\alpha_b}{\alpha_a}\tilde{\theta}_b\right)f(\theta_a)d\theta_a \tag{22}$$

where $\mathbf{1}(.)$ is the indicator function, which takes a value of one if the statement is true, and zero otherwise. The first term of this expression represents observations of g_{a1} off the equilibrium path, i.e. $g_{a1} < (k_{a1} + \tilde{e}_{a1} - s)$, the second observations on the equilibrium

path. For $g_{a1} < (k_{a1} + \tilde{e}_{a1} - s)$, Equation 11 says that $\tilde{\theta}_a = -s$, so $(\alpha_a \tilde{\theta}_a + \alpha_b \tilde{\theta}_b) \geq 0$ for observations off the equilibrium path if and only if $s \leq \frac{\alpha_b}{\alpha_a} \tilde{\theta}_b$. In contrast, for observations on the equilibrium path, Equation 11 says that $\tilde{\theta}_a = (\theta_a + e_{a1} - \tilde{e}_{a1})$, implying that the incumbent politician wins if and only if $\theta_a \geq \left(\tilde{e}_{a1} - e_{a1} - \frac{\alpha_b}{\alpha_a} \tilde{\theta}_b \right)$.

Expression 22 holds for a given $\tilde{\theta}_b$, which is a random variable (because $\tilde{\theta}_b$ is a function of θ_b, which is a random variable). Integrating over all possible $\tilde{\theta}_b$ then gives $\Pr(\alpha_a \tilde{\theta}_a + \alpha_b \tilde{\theta}_b \geq 0)$ as a function only of the incumbent's effort choice and voters' beliefs about the incumbent's effort choice. To so integrate, I divide realizations of $\tilde{\theta}_b$ into two intervals:

- $\tilde{\theta}_b < \frac{\alpha_a}{\alpha_b} s$: For these realizations of $\tilde{\theta}_b$, the indicator function in the first term of Expression 22 takes a value of zero, while the statement in the second term is true only for $\theta_a \geq \left(\tilde{e}_{a1} - e_{a1} - \frac{\alpha_b}{\alpha_a} \tilde{\theta}_b \right)$.

- $\tilde{\theta}_b \geq \frac{\alpha_a}{\alpha_b} s$: For these realizations of $\tilde{\theta}_b$, the indicator function takes on a value of one for all realizations of θ_a in both the first and second terms in Expression 22, implying that the incumbent wins with probability equal to one.

Thus, Expression 22 can be rewritten as:

$$\int_{\tilde{\theta}_b < \frac{\alpha_a}{\alpha_b} s} \left[1 - F_a \left(\tilde{e}_{a1} - e_{a1} - \frac{\alpha_b}{\alpha_a} \tilde{\theta}_b \right) \right] f(\theta_b) d\theta_b + \int_{\tilde{\theta}_b \geq \frac{\alpha_a}{\alpha_b} s} 1 \cdot f(\theta_b) d\theta_b \qquad (23)$$

where for the sake of clarity I denote the distribution of θ_a as F_a. For realizations of $\tilde{\theta}_b$ sufficiently low, the probability of winning is strictly less than one. However, for high realizations of $\tilde{\theta}_b$, even very low competence θ_a cannot keep the incumbent from winning.

Similarly, $\Pr(\alpha_a \tilde{\theta}_a + \alpha_b \tilde{\theta}_b \geq 0)$ can be expressed in terms of e_{a1} for $e_{a1} \geq \tilde{e}_{a1}$ as:

$$\int_{\tilde{\theta}_b < -\frac{\alpha_a}{\alpha_b} s} 0 \cdot f(\theta_b) d\theta_b + \int_{\tilde{\theta}_b \geq -\frac{\alpha_a}{\alpha_b} s} \left[1 - F_a \left(\tilde{e}_{a1} - e_{a1} - \frac{\alpha_b}{\alpha_a} \tilde{\theta}_b \right) \right] f(\theta_b) d\theta_b \qquad (24)$$

Taken together, Expressions 23 and 24 define a continuous, differentiable function of e_{a1}. Taking the derivative of this function and applying the equilibrium condition that $\tilde{e}_{a1} = e_{a1}$, as well as the equilibrium condition that $\tilde{\theta}_b = \theta_b$ (because $\tilde{\theta}_b = \theta_b + e_{b1} - \tilde{e}_{b1}$, and in equilibrium $\tilde{e}_{b1} = e_{b1}$) gives:

$$\frac{\partial \Pr(\alpha_a \tilde{\theta}_a + \alpha_b \tilde{\theta}_b \geq 0)}{\partial e_{a1}} = \int_{\theta_b \in \left[-\frac{\alpha_a}{\alpha_b} s, \frac{\alpha_a}{\alpha_b} s \right]} f \left(-\frac{\alpha_b}{\alpha_a} \theta_b \right) f(\theta_b) d\theta_b$$

$$= \int f \left(-\frac{\alpha_b}{\alpha_a} \theta_b \right) f(\theta_b) d\theta_b \qquad (25)$$

$$= \bar{f} \left(-\frac{\alpha_b}{\alpha_a} \theta_b \right)$$

where I use the fact that θ_a and θ_b are identically distributed and so have the same density function $f(.)$. The second equality follows from the assumption that $f(\theta_b)$ has support $[-s, s]$, so that:

- if $\frac{\alpha_b}{\alpha_a} \leq 1$, then $f\left(-\frac{\alpha_b}{\alpha_a}\theta_b\right) f(\theta_b) > 0$ for $\theta_b \in [-s, s] \subset \left[-\frac{\alpha_a}{\alpha_b}s, \frac{\alpha_a}{\alpha_b}s\right]$.
- if $\frac{\alpha_b}{\alpha_a} > 1$, then $f\left(-\frac{\alpha_b}{\alpha_a}\theta_b\right) f(\theta_b) > 0$ for $\theta_b \in \left[-\frac{\alpha_a}{\alpha_b}s, \frac{\alpha_a}{\alpha_b}s\right]$.

Thus, integrating over $\theta_b \in \left[-\frac{\alpha_a}{\alpha_b}s, \frac{\alpha_a}{\alpha_b}s\right]$ does not in any way limit the realizations of θ_b for which $f\left(-\frac{\alpha_b}{\alpha_a}\theta_b\right) f(\theta_b) > 0$, so without loss of generality I integrate over all possible θ_b. The third equality in Equation 25 makes use of the definition of $\bar{f}$. Multiplying by R and setting this equal to the derivative of the cost function defines the unique equilibrium level of effort. ∎

To focus attention on the effect of aggregation in national majoritarian elections, assume that $\alpha_a = \alpha_b$, so that competence in each locality has the same impact on the incumbent politician's reelection probability. Then the marginal reelection probability in equilibrium reduces to:

$$\bar{f}(-1) = \int_{-\infty}^{\infty} f(-\theta_\lambda) f(\theta_\lambda) d\theta_\lambda = \int_{-\infty}^{\infty} f(\theta_\lambda) f(\theta_\lambda) d\theta_\lambda \tag{26}$$

where the second equality follows from the assumption that θ_λ is distributed symmetrically around $E(\theta_\lambda) = 0$. When the distribution of θ_λ is uniform, this is $f(0)$, as in that case the "average density" of θ_λ is trivially the density when $\theta_\lambda = 0$. But then the expression that gives the equilibrium level of effort in national majoritarian elections is precisely that for local elections (Equation 16), and is greater than in national electoral-college elections (Equation 15).

That said, when the distribution of θ_λ is not uniform (as I assume), national majoritarian elections produce a weakening of incentives due to the aggregation of votes across localities, even though no *locality* is pivotal. To see this, note that when $\alpha_a = \alpha_b$, the level of effort in national majoritarian elections is less than that in local elections so long as:

$$\int_{-\infty}^{\infty} f(\theta_\lambda) f(\theta_\lambda) d\theta_\lambda < f(0) \tag{27}$$

i.e. when the "average density" of θ_λ is less than the density at $\theta_\lambda = 0$. Clearly, this is the case for any strictly single-peaked distribution of θ_λ symmetric around $E(\theta_\lambda) = 0$. Intuitively, with national majoritarian elections, effort in some locality λ is unlikely to affect the election outcome when the vote total elsewhere is so lopsided that it would take an overwhelming vote (and hence unlikely evaluation of the politicians's competence) in locality λ to offset it. To the extent this is possible, there is less incentive to exert effort than in local elections.

Nonetheless, this effect may be smaller than in electoral-college elections, where even a narrow victory in one locality may render effort in another meaningless. Formally,

the reduction in incentives to efficiently provide local public goods resulting from the aggregation of votes across localities is less in majoritarian than in electoral-college elections when $\alpha_a = \alpha_b$ so long as:

$$\int_{-\infty}^{\infty} f(\theta_\lambda) f(\theta_\lambda) d\theta_\lambda > \frac{1}{2} f(0) \qquad (28)$$

which is the case so long as there is sufficient density around $f(0)$.[14] I express this result as the following proposition.

Proposition 3 *Assume no local bias and identical populations, i.e. $\beta_\lambda = 0$ for all λ and $\alpha_a = \alpha_b$. Then the equilibrium level of effort by the incumbent in period 1 is greater in majoritarian elections than in electoral-college elections if and only if:*

$$\int_{-\infty}^{\infty} f(\theta_\lambda) f(\theta_\lambda) d\theta_\lambda > \frac{1}{2} f(0) \qquad (29)$$

Proof: See above. ∎

Interaction of Electoral Institutions and Voter Preferences

In modeling voters as ideologically heterogeneous, I have up to now assumed that voters in any locality are *on average* no more or less predisposed toward the incumbent than those in any other locality. Further, in comparing the basic effect of aggregation of votes across localities in Proposition 3 I restricted attention to the case where voters do not vary across localities in the degree to which they value public goods relative to other concerns. What happens when there is local ideological bias? And what are the implications for electoral accountability when voters in some localities, such as those which have experienced a recent national disaster, especially value public-goods provision? In this section I explore the interaction of electoral institutions and voter preferences in determining the allocation of effort by incumbent national politicians.

A reasonable conjecture is that voters may be biased within any given locality for or against a national candidate, but that from a national perspective there is no aggregate bias: the logic of political competition implies that candidates tend to be drawn from the center of the ideological spectrum in whichever electoral arena they compete. Formally, assume that $\beta_\lambda \neq 0$, but that $\beta_a + \beta_b = 0$. Given that $\delta_{i\lambda}$ is distributed uniformly on $\left[-\frac{1}{2\gamma} + \beta_\lambda, \frac{1}{2\gamma} + \beta_\lambda \right]$, this implies that the share of all voters in locality λ who support the incumbent for reelection is now:

$$\frac{1}{2} + \gamma \alpha_\lambda \tilde{\theta}_\lambda - \gamma \beta_\lambda \qquad (30)$$

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[14] To see that in principle this condition may be violated, observe that the (Dirac) delta function – which through a Fourier transform may be approximated by a differentiable function – satisfies $\lim_{x \to 0} f(x) = \infty$ and $\int_{-\infty}^{\infty} f(x) dx = 1$, with the latter expression implying that $\int_{-\infty}^{\infty} f(x) f(x) dx$ is finite.

How is the incentive for the incumbent to exert effort in electoral-college elections affected by the assumption of local ideological bias? Given Expression 30, the probability that the incumbent wins locality λ is:

$$\Pr\left(\frac{1}{2} + \gamma\alpha_\lambda\tilde{\theta}_\lambda - \gamma\beta_\lambda \geq \frac{1}{2}\right) = \Pr\left(\tilde{\theta}_\lambda \geq \frac{\beta_\lambda}{\alpha_\lambda}\right) \tag{31}$$

so that equilibrium effort by the national incumbent in locality λ is given by:

$$c'(e_{\lambda 1}) = \frac{1}{2} f\left(\frac{\beta_\lambda}{\alpha_\lambda}\right) \cdot R \tag{32}$$

With $f(.)$ single-peaked around $E(\theta_\lambda) = 0$, effort in period 1 is less, the greater the bias of voters in locality λ, i.e. the greater is $|\beta_\lambda|$. Intuitively, when the incumbent is likely to win or lose a locality in any event, there is little incentive for her to exert effort to try to increase her reelection probability.[15]

In contrast, when $\beta_a + \beta_b = 0$ local ideological bias cancels out in national majoritarian elections. To see this, sum Expression 30 across localities to derive the vote total for the incumbent as:

$$\frac{1}{2} + \frac{\gamma}{2}(\alpha_a\tilde{\theta}_a + \alpha_b\tilde{\theta}_b) - \frac{\gamma}{2}(\beta_a + \beta_b) \tag{33}$$

With $\beta_a + \beta_b = 0$, Expression 33 reduces to Expression 17, so that the equilibrium level of effort by the incumbent is the same as when there is no local ideological bias.[16]

Proposition 4 *Assume $\beta_a + \beta_b = 0$. Then the equilibrium level of effort by the incumbent in period 1 is declining in $|\beta_\lambda|$ for electoral-college elections, but is constant in $|\beta_\lambda|$ for majoritarian elections.*

Proof: See above. ∎

What determines the degree to which local ideological bias blunts the incentives of national politicians in electoral-college elections? As Equation 32 shows, for a given level of local ideological bias $|\beta_\lambda|$, there is a smaller reduction in incentives to efficiently provide local public goods when voters in locality λ place a greater value α_λ on local public-goods production. Intuitively, when voters in a locality care more about public goods, then the incumbent's incentive to ignore a locality because its voters are on average biased for or

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[15] This result has obvious parallels in the literature on the U.S. Electoral College, where it is often argued that candidate *platforms* (not effort) are skewed toward the preferences of voters in "swing states," i.e., large states whose voters are on average neither Republican nor Democratic, and which therefore have a high likelihood of tipping the electoral-college vote towards one candidate or the other (e.g., Edwards III 2004, Strömberg 2002). In a career-concerns context, Ashworth and Bueno de Mesquita (2006) show that ideological bias can reduce the incentive to exert effort, but do not consider the role of electoral institutions in determining the presence or absence of this effect.

[16] Besley (2006, ch. 3) argues that local ideological bias may average out at the national level, but does not compare the effect across electoral institutions.

against her is minimized. Conversely, the incentive for national politicians running in electoral-college elections to efficiently provide local public goods is greater when voters in a locality especially value public goods relative to other, ideological concerns, but only when when voters in that locality are biased for or against the candidate.

Proposition 5   *With national electoral-college elections, period-1 effort by the incumbent in locality λ is increasing in α_λ if $\beta_\lambda \neq 0$.*

Proof: See above.   ■

Since local ideological bias tends to average out in national majoritarian elections, one might suspect that the degree to which voters value public-goods production would have no impact on electoral accountability in such systems. But national politicians elected through majoritarian elections have a different incentive to favor localities whose voters especially value public-goods provision. With voters in one locality substitutes for those in another, the incumbent politician allocates effort across localities to pick up votes most efficiently. This is done by concentrating on those localities whose voters are *relatively* sensitive to public-goods production.

Proposition 6   *With national majoritarian elections and no average local ideological bias ($\beta_a + \beta_b = 0$), period-1 effort by the incumbent in locality a is increasing in $\frac{\alpha_a}{\alpha_b}$, and period-1 effort in locality b is decreasing in $\frac{\alpha_a}{\alpha_b}$.*

Proof: I derive the result for period-1 effort in locality *a*; the derivation for locality *b* is analogous. Begin by recalling that the incentives in national majoritarian elections when average local ideological bias $\beta_a + \beta_b = 0$ are identical to those when local ideological bias $\beta_\lambda = 0$. Proposition 2 thus defines period-1 effort in locality *a* implicitly by:

$$c'(e_{a1}) = \bar{f}\left(-\frac{\alpha_b}{\alpha_a}\right) \cdot R \tag{34}$$

I must show that $\frac{\partial \bar{f}(y)}{\partial \left(\frac{\alpha_a}{\alpha_b}\right)} > 0$. Recall from the discussion following Equation 25 that:

1. if $\frac{\alpha_b}{\alpha_a} \leq 1$, then $\bar{f}\left(-\frac{\alpha_b}{\alpha_a}\right) = \int_{\theta_b \in [-s,s]} f\left(-\frac{\alpha_b}{\alpha_a}\theta_b\right) f(\theta_b) d\theta_b$
2. if $\frac{\alpha_b}{\alpha_a} > 1$, then $\bar{f}\left(-\frac{\alpha_b}{\alpha_a}\right) = \int_{\theta_b \in \left[-\frac{\alpha_a}{\alpha_b}s, \frac{\alpha_a}{\alpha_b}s\right]} f\left(-\frac{\alpha_b}{\alpha_a}\theta_b\right) f(\theta_b) d\theta_b$

Using Leibnitz's rule to differentiate the expression in Item 1 by $\frac{\alpha_a}{\alpha_b}$ gives:

$$\int_{\theta_b \in [-s,s]} \left(\frac{\alpha_b}{\alpha_a}\right)^2 \theta_b f'\left(-\frac{\alpha_b}{\alpha_a}\theta_b\right) f(\theta_b) d\theta_b = \left(\frac{\alpha_b}{\alpha_a}\right)^2 \\ \times \int_{\theta_b \in [-s,s]} \theta_b f'\left(-\frac{\alpha_b}{\alpha_a}\theta_b\right) f(\theta_b) d\theta_b \tag{35}$$

which is greater than zero because by assumption $f(.)$ is single-peaked and symmetric around zero, so that for θ_b to the left of zero, $\theta_b < 0$ and $f'\left(-\frac{\alpha_b}{\alpha_a}\theta_b\right) \leq 0$, while to the right of zero the opposite is the case.

Differentiating the expression in Item 2 by $\frac{\alpha_a}{\alpha_b}$ gives:

$$\left(\frac{\alpha_b}{\alpha_a}\right)^2 \int_{\theta_b \in \left[-\frac{\alpha_a}{\alpha_b}s, \frac{\alpha_a}{\alpha_b}s\right]} \theta_b f'\left(-\frac{\alpha_b}{\alpha_a}\theta_b\right) f(\theta_b)d\theta_b + sf(-s)f\left(\frac{\alpha_a}{\alpha_b}s\right) \\ + sf(s)f\left(-\frac{\alpha_a}{\alpha_b}s\right) \tag{36}$$

the first term of which is positive by the argument of the previous paragraph, and the second and third terms of which are clearly positive. ∎

Thus, national electoral-college elections reward those localities whose voters particularly value public-goods provision in *absolute* terms (but only when there is local ideological bias), while national majoritarian elections reward those localities whose voters particularly value public-goods provision in *relative* terms. To see the striking difference this may produce in the incentives of national politicians to efficiently provide local public goods, consider the incumbent's period-1 effort in each locality as α_a, the value voters in locality a place on public-goods provision, becomes arbitrarily large.[17] Then Equation 32, which defines e_{a1} implicitly for electoral-college elections, approaches:

$$c'(e_{a1}) = \frac{1}{2}f(0) \cdot R \tag{37}$$

which is the equilibrium level of effort with no local ideological bias; there is no impact on public-goods provision in locality b.[18] In contrast, with majoritarian elections, period-1 effort in locality a approaches that defined by:

$$c'(e_{a1}) = \bar{f}(0) \cdot R \tag{38}$$

$$= \int f(0)f(\theta_b)d\theta_b \cdot R = f(0) \cdot R \int f(\theta_b)d\theta_b = f(0) \cdot R$$

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[17] Note that we must still assume that the distribution of $\delta_{i\lambda}$ is sufficiently wide to assure that the incumbent's vote share in any locality falls strictly between zero and one. However, this is immaterial to the results, as the parameter γ which determines the width of the interval on which $\delta_{i\lambda}$ is distributed drops out of the expression giving the probability the incumbent wins.

[18] With three localities, the degree to which voters value public-goods provision in one locality may affect the probability that other localities are pivotal, and hence the incentives to efficiently provide local public goods in those localities. However, the qualitative results reported here continue to hold. To see this, observe that with three localities the marginal increase in reelection probability in equilibrium in locality b is $f\left(\frac{\beta_b}{\alpha_b}\right)\left[F\left(\frac{\beta_a}{\alpha_a}\right) + F\left(\frac{\beta_c}{\alpha_c}\right) - 2F\left(\frac{\beta_a}{\alpha_a}\right)F\left(\frac{\beta_c}{\alpha_c}\right)\right]$, which may be increasing or decreasing in α_a. However, as α_a becomes arbitrarily large, this expression reduces to $f\left(\frac{\beta_b}{\alpha_b}\right)\left[\frac{1}{2} + F\left(\frac{\beta_c}{\alpha_c}\right) - 2\left(\frac{1}{2}\right)F\left(\frac{\beta_c}{\alpha_c}\right)\right] = \frac{1}{2}f\left(\frac{\beta_b}{\alpha_b}\right)$, reinforcing the message that with electoral-college elections politicians do not have an incentive to shift all their effort to some locality where voters especially value public-goods provision.

which is the benchmark level of public-goods provision in *local* elections, while period-1 effort in locality *b* approaches zero:

$$\lim_{\alpha_a \to \infty} \bar{f}\left(-\frac{\alpha_a}{\alpha_b}\right) \cdot R = \lim_{\alpha_a \to \infty} \int f\left(-\frac{\alpha_a}{\alpha_b}\theta_a\right) f(\theta_a)d\theta_a \cdot R \tag{39}$$

$$= \int 0 f(\theta_a)d\theta_a \cdot R = 0$$

(The second equality follows from the assumption that $f(.)$ has compact support.) Comparing these expressions gives the final proposition.

Proposition 7 *Without loss of generality, assume α_a to be arbitrarily large. Then public-goods provision in locality a is higher with majoritarian elections, and public-goods provision in locality b is higher with electoral-college elections.*

Proof: See above.   ∎

CONCLUSION

What is the role of electoral institutions in determining the incentives for national politicians to provide local public goods? The theoretical analysis in this paper suggests that neither electoral-college nor majoritarian elections unambiguously provide better incentives for national politicians to efficiently produce local public goods. Rather, electoral institutions interact with voter preferences to encourage or discourage electoral accountability. The aggregation of votes across localities in both electoral-college and majoritarian elections results in weaker incentives to efficiently provide local public goods than in local elections, with this effect possibly greater for electoral-college elections. (Proposition 3 gives the precise condition.) In electoral-college elections, incentives will be particularly weak when there is local ideological bias for the incumbent or challenger; in contrast, any local ideological bias is immaterial in majoritarian elections so long as voters are on average unbiased across localities. Finally, from the perspective of any particular locality either electoral-college or majoritarian elections may be preferable when localities differ in the degree to which they value public goods over other, ideological concerns: localities whose voters especially value public goods will be better off with majoritarian elections, while other localities will be better off with electoral-college elections.

From a modeling perspective an additional contribution of this paper is to show how the assumption of voter ideological heterogeneity allows one to easily model the career concerns of an incumbent politician running in a majoritarian election and acting in multiple policy arenas. Here the application is to a national politician responsible for public-goods provision in multiple localities, but in principle the model applies to any environment in which government performance in multiple policy arenas takes the form here. Many details of the political environment can be captured in the weights which in equilibrium determine the allocation of effort across competing tasks. While in this

model these weights are defined explicitly as the relative value voters in different localities place on public-goods provision, the weights can more generally be any function of the parameters of the model so long as they are derived in the process of "adding up" the incumbent's vote across voter groups.[19] As Proposition 6 shows, the impact of changes in the political environment can then be determined.

One implication of the results here is that the debate in the United States over the merits of the U.S. Electoral College may have relevance beyond the question of allocation of resources and adoption of campaign platforms by presidential candidates. Since electoral institutions influence the incentives of national politicians to efficiently provide local public goods, any change in electoral institutions has the potential to influence the relative merits of fiscal centralization or decentralization. For example, a move from an electoral-college system to a majoritarian system would make fiscal decentralization relatively less attractive for states whose populations are on average biased for or against one party, since those states fare especially poorly when public-goods provision is centralized and national elections operate according to an electoral-college principle. Similarly, the decentralization of public-goods provision would become relatively less attractive to states whose voters especially care about public-goods provision – for example, those that are vulnerable to natural disasters – since those states do particularly well under majoritarian voting when public-goods provision is centralized.

More generally, this paper highlights the fact that fiscal decentralization has distributional consequences. Advocates of decentralization should be sensitive to the fact that certain jurisdictions within a country may be doing relatively well under the status quo of centralized public-goods provision. If there are other costs to decentralization – for example, if the payoff from reelection is less for local politicians, thus blunting the incentive to refrain from rent seeking while in office – then fiscal decentralization could result in worse public-goods provision for those localities which were favored in a centralized system. Indeed, it is possible that some of the negative outcomes from decentralization which have been observed are the result of these distributional effects, a subject for future investigation.

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[19] Voter groups need not be synonymous with policy arenas, as is the case in this paper. In particular, although the model provides a closed-form solution for only two policy arenas, there can be arbitrarily many voter groups.

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