Electoral accountability in a country with two-tiered government

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Abstract

In democracies, elections are the primary mechanism for making politicians act in voters' interests. Voters' ability to ensure that politicians act in their interests is weakened when a second level of government is added, resulting in more resources being diverted to political rents. With two levels of government, the political rents can be reduced by voters increasing the beneficial public expenditures they require for reelecting incumbents. Both these results work for higher taxes with two levels of government than with one. The results also show that voters can strengthen their power by holding politicians also liable for decisions made by the other level of government. When the incumbent at one level acts as a Stackelberg leader with respect to the other, there is no risk of this leading to Leviathan policies on the part of the incumbents.

Keywords: moral hazard; separation of powers; Stackelberg; transparency; voting theory

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1 Introduction

As noted by Seabright (1996), political constitutions are incomplete contracts that leave room for abuse of power. In democracies, voters can discipline politicians by threatening to vote them out of office if they abuse their power and reward good politicians by reelecting them. The general purpose of this paper is to address voters' ability to discipline politicians when there are two levels of government and when the incumbent at one level acts as a Stackelberg leader with respect to the incumbent at the other.

In countries with multi-tiered governments, decisions made by one level of government often affect governments at other levels. Tax bases commonly overlap and responsibilities can intersect or be closely related. Examples of the latter are shared responsibilities for redistribution, infrastructure, and environmental protection between, for example, federal and state governments in the United States. In such situations, voters may be unable to accurately distinguish the consequences of the decisions made by one level of government from the consequences of decisions made by the other. In addition, when governments are affected by each others' decisions, it is often reasonable to assume that one level of government acts as a Stackelberg leader relative to the other. The relative size of the governments is one reason why a higher level of government is commonly assumed to act as a Stackelberg leader relative to lower-level governments (Keen and Kotsogiannis, 2003). It is also possible that a lower-level government may act as a Stackelberg leader relative a higher-level government, when the higher-level government is relatively weak (e.g., because the lower-level government already had commitments to certain policies when the higher level was formed). One example is that of the individual member states of the European Union, which often are considered to be Stackelberg leaders relative to the federal level (see, e.g., Caplan and Silva, 1999; and Aronsson, Jonsson, and Sjögren, 2006). In this paper, the higher-level government is treated as a Stackelberg leader relative to the lower-level government, but, as discussed below, the results apply equally well to situations where the roles are reversed.

In the model presented in this paper, the two levels of government provide one good each and finance their expenditures with taxes. The goods are inputs in a production function and voters observe the output, but are generally assumed not to observe the input levels. The latter assumption is made in order to mimic situations where voters are unable to accurately distinguish between the efforts of different governments.

The governments are assumed to be controlled by politicians motivated solely by self-interest who choose their policies to maximize the discounted value of their rents. This Leviathan view of politicians may not perfectly depict reality, but as long as politicians – like other humans – are partly driven by self-interest, this assumption allows us to study some interesting aspects of voters' electoral control. To focus on moral hazard, I neglect adverse selection issues by assuming that all politicians are identical.

The source of the rents is the fact that political constitutions are incomplete contracts, meaning that politicians in power can choose policies with discretion.[1] To make selfish politicians restrain from Leviathan policies, voters allow them rents while in office and promise them reappointment if they behave. These rents, which can be resources politicians divert to their private consumption, more broadly capture conflict of interests between voters and their representatives, for example, voters may favor a different composition of government spending than do politicians.

This paper relates to Persson, Roland, and Tabellini (1997) and even closer to Wrede (2002), authors who analyzed the behavior of selfish politicians in countries with two government bodies and compared the outcomes to those of unitary countries. While Persson et al. (1997) looked at the separation of powers between the executive and legislative branches of government and focused on the role of checks and balances in, for example, budget processes, Wrede, as I do, studied the separation of powers between *levels* of government and focused on the effects of different voting strategies, but assumed that the incumbents act as Nash competitors towards each other. Persson et al. (1997) and Wrede (2002) found that when two government bodies can commit resources without requiring approval from each other, the total political rent is higher than with only one government body. Another of Wrede's main findings is that voters can strengthen their power by introducing reciprocal liability, which reduces the independence of the governments, but that there is a risk of reciprocal liability leading to permanent Leviathan policy. Reciprocal liability is created

[1] Persson, Roland, and Tabellini (1997) demonstrated that information asymmetries concerning the state of nature can also be a source of rents. In the model used in the present paper, however, there is no such uncertainty.

by letting the incumbents' reelection probabilities also depend on the decisions of their counterparts at the other level of government.

The results of this paper indicate that the total tax rate is higher with two government bodies than with one. This is because the total political rent is higher with two government bodies – as demonstrated previously by Persson et al. (1997) and Wrede (2002) – and because voters will want to reduce public consumption by less than one unit when total rent is increased by one unit. The results also demonstrate that, with two government bodies, voters can reduce the resources diverted to political rents by increasing the beneficial public expenditures they require for reelecting incumbents. This means that, for a given level of the total political rent, voters will choose higher public expenditures and thus higher taxes, which increases the difference between the total tax rate in two and one-government countries.

Other novel results depend on the assumption of Stackelberg leadership: among other matters, these results describe differences in voters' marginal costs for expenditures by the Stackelberg leader and expenditures by the follower, and how voters are affected if the Stackelberg leader is able to give an intergovernmental transfer to the follower. In addition, unlike the situation described by Wrede (2002), the results show that, with Stackelberg leadership, there is no risk of reciprocal liability leading to permanent Leviathan policy.

Three retrospective voting strategies are considered in the present paper. Barro (1973) and Ferejohn (1986) demonstrated theoretically that voters can prevent governments from myopically behaving as Leviathans by using retrospective voting strategies. Many scholars have also found empirical support for voters employing retrospective voting strategies and for this affecting incumbents' decisions (see, e.g., Besley and Case, 1995; and Lewis-Beck, 1998).

Like Wrede, I consider one voting strategy with full reciprocal liability, meaning that voters reelect either the incumbents at both levels or none of the incumbents, and contrast this solution to that obtained when voters evaluate the performance of both incumbents entirely separately. Besides these two extreme strategies, I also consider a voting strategy with partial reciprocal liability. Here, voters are assumed to hold incumbents at both levels jointly responsible for the output produced, but not to hold the incumbent at each level responsible for the tax determined and collected by the incumbent at the other level. When voters have too little information to evaluate politicians separately, for example, because that the division of responsibilities between levels of government is unclear to the voters, some degree of reciprocal liability is unavoidable. For example, in Sweden, where local governments provide basic care to the elderly while regional governments are responsible for providing more advanced medical care, voters apparently sometimes do not know which politicians to blame when healthcare to the elderly is deemed inadequate, and that some voters therefore employ voting strategies with partial reciprocal liability.

In the next section, I set up the model and analyze the benchmark policy decisions of voters and the incumbent in a unitary country. Section 3 presents the solutions achieved using the different voting strategies in a two-tiered-government country. First, the voting strategy with no reciprocal liability is analyzed (subsection 3.1), then that with partial reciprocal liability (subsection 3.2), and finally that with full reciprocal liability (subsection 3.3). In section 4, I discuss how voters are affected if the Stackelberg leader is able to give an intergovernmental transfer to the incumbent at the other level. Finally, in section 5 the paper's conclusions are presented.

2 The model and the unitary state benchmark

An infinite series of independent periods are considered. Since the conditions in all periods are the same, no time index is used. The federation consists of two levels of government, called the federal and state levels. Following Wrede (2002), horizontal division of the country is neglected in order to focus on the common-pool problem, which arises when a government body can independently commit public expenditures without requiring approval from other government bodies.

The instantaneous utility function of the voters is written $U = u(c) + \varphi(q)$, where c is private consumption and q is the output produced by the publicly provided inputs. Preferences are identical and both sub-utility functions are increasing in their arguments and strictly concave. Assuming identical preferences allows us to neglect that elections also serve to aggregate preferences.

The production function, $q = q(y, Y)$, indicates that the output is a function of the input provided by the state government, y, and of the input provided by the federal government, Y. The function is increasing in both arguments, strictly concave and symmetric with respect to y and Y in the sense that for

$y = Y$, $\frac{\partial q}{\partial y} = \frac{\partial q}{\partial Y}$ and that for $y < Y$, $\frac{\partial q}{\partial y} > \frac{\partial q}{\partial Y}$ and vice versa. For example, the inputs can be basic and medical care, which produce health, or environmental legislation and environmental monitoring, which together affect environmental quality.

Input y is assumed to be provided exclusively by the state government and Y is assumed to be exclusively provided by the federal government. These assumptions are made in order to focus on a situation when voters have difficulties separating the actions of two levels of government. For simplicity, the units are chosen so that the unit costs of y and Y are both 1.

Each level of government is assumed to finance its expenditures using a tax and to balance its budget in each period. For simplicity, I follow Persson et al. (1997) by assuming that the tax base is exogenously given and normalize it to one. Individuals have no access to capital markets, so they consume all their income. The individuals' budget constraint can thus be written $1 - t - T = c$, where t and T are the tax rates imposed by the state and federal governments, respectively.

The politicians are assumed to be infinitely lived and to choose their policies in order to maximize the discounted value of their rents. Ferejohn (1986) provides one rationale for assuming infinitely lived politicians, namely, that competitors for office can be thought of as political parties that last indefinitely and manage to solve their internal incentive problems.

Voters are assumed to employ simple retrospective voting strategies based on cutoff levels for the tax rates and the output (or on y and Y) and are assumed never to reelect politicians who are voted out of office.[2] Following Persson et al. (1997) and Wrede (2002), I restrict the analysis to strategies based on the outcomes in the current period and not in any previous period. The advantage of such strategies is that they are simple enough to be plausible; as noted by Persson et al. (1997), such voting strategies can be seen as a simple convention adopted by voters and suggested by social norms. In addition, in this model, where there is no uncertainty regarding the state of the economy and where all politicians are identical, voters would not benefit from basing their strategies on outcomes in previous periods.

[2] Wrede (2001) demonstrated that voters' ability to control politicians is greater if politicians who are ousted from office cannot expect reelection.

2.1 The solution in a unitary country

In a unitary country, both public goods are provided by a central government, that finances its expenditures using a single rate, τ. At the start of each period, p, the voters determine cutoff levels $\overline{\tau_0}$ and $\overline{q_0}$ and announce that they will reelect the incumbent if and only if $\tau \leq \overline{\tau_0}$ and $q \geq \overline{q_0}$; since $c = (1 - \tau)$, this is equivalent to determining cutoff levels for c and q. Next, the incumbent government makes its expenditure and tax decisions, knowing the voting rule. At the end of the period, the voters observe τ and q and determine whether or not to reappoint the incumbent government according to the announced voting rule. Following Persson et al. (1997) and Wrede (2002), I assume that voters are able to commit to voting rules. This is not a strong assumption: since all politicians are identical, voters are indifferent as to whether to reelect the incumbent government or elect an opposition, meaning that there is no cost to the voters associated with ousting politicians who do not meet the required cutoff levels.

The selfish incumbent's objective is to maximize the discounted value of all rents he will obtain. An incumbent who seeks reappointment will choose y and Y to maximize his rents, χ, subject to $\tau \leq \overline{\tau_0}$, $q \geq \overline{q_0}$, and the budget constraint $\tau - y - Y = \chi$. The incumbent will never set τ below $\overline{\tau_0}$ and never spend more on the inputs than necessary to exactly achieve $\overline{q_0}$. Thus, the incumbent's optimization problem can be simplified to

$$\underset{y,Y}{\text{Max}}\ \chi = \overline{\tau_0} - y - Y$$

subject to

$$q(y, Y) = \overline{q_0}.$$

Letting λ denote the Lagrangian multiplier, the first-order conditions are written

$$y \quad : \quad -1 + \lambda \frac{\partial q}{\partial y} = 0,$$

$$Y \quad : \quad -1 + \lambda \frac{\partial q}{\partial Y} = 0.$$

This tells us that the incumbent will choose an input combination where the marginal products of y and Y are equal, meaning that the output will be produced efficiently.

An incumbent who chooses to maximize immediate payoffs instead of fulfilling the reelection criteria would set $\tau = 1$, $y = Y = 0$ and obtain a payoff of

1. Since the incumbent would never be reelected by pursuing this tactic, it also follows that the discounted value of all payoffs to the incumbent would amount to 1. I assume that incumbents only deviate from the proposed policy if the present value of their rents thereby becomes strictly higher. To ensure that an incumbent adheres to the proposed policy, voters therefore set $\overline{\tau_0}$ and $\overline{q_0}$ so that the present value of the rents that an incumbent staying in office is guaranteed, also amounts to 1. Since all periods are identical, this means that an incumbent in each period must be given a rent of $\chi_0 = 1 - \delta$, where δ, $0 < \delta < 1$, is the discount factor.[3]

The voters will choose cutoff levels of $\overline{\tau_0}$ and $\overline{q_0}$ so that the marginal utility of private consumption equals the marginal utilities of each publicly provided good, i.e., so that $u' = \varphi' \frac{\partial q}{\partial y} = \varphi' \frac{\partial q}{\partial Y}$. Also the solution obtained when benevolent politicians in a unitary state choose τ, y, and Y is characterized by $u' = \varphi' \frac{\partial q}{\partial y} = \varphi' \frac{\partial q}{\partial Y}$, but since no resources are diverted to rents, the marginal utilities are lower in that situation.[4] In other words, both private consumption and input levels are lower when politicians divert rents, while the tax rate is higher.

3 Solutions in the case of a two-tier government

As mentioned in the Introduction, the federal incumbent is treated as a Stackelberg leader relative to the state incumbent. Since horizontal division of the country is neglected, this is the only principal difference between the two levels of government, meaning that the model can also be used to understand situations where the state incumbent acts as a Stackelberg leader. To highlight the principal difference between the situations for the two incumbents, in the following I call the state incumbent the “follower” and the federal incumbent the “leader”.

Following Wrede (2002), I assume that incumbents at both levels do not cooperate, that they maximize the discounted value of their rents, and that they have the same discount factor as the incumbent in the unitary nation.

[3] Note that the rent would be higher if the government could borrow, but lower if it were unable to collect all resources in the economy as taxes. The results of this paper would remain unchanged if the government could only collect a given fraction of the resources or if it could run up deficits, unless it could borrow so much that all resources in the economy were diverted to rents.

[4] See Appendix A for the derivation of these results.

When voters determine different cutoff levels for the two tax rates, both are assumed to be strictly below 1/2. Still, if the incumbents deviate from the proposed policies, we cannot rule out that the sum of the tax rates exceeds 1. Since the sum of the governments' tax revenues cannot exceed the tax base, which equals 1, I follow Persson et al. (1997) by assuming that if the total tax rate exceeds 1, the governments obtain tax revenues equal to 1/2 each. That is, the maximum tax revenues to the state and federal governments are $r = \max\{1 - T, 1/2\}$ and $R = \max\{1 - t, 1/2\}$, respectively.

3.1 Voting strategy 1, observable inputs and no reciprocal liability

When one incumbent is responsible for providing y while another is responsible for providing Y, it may matter whether the levels of y and Y are observable to the voters. To study this, the solution that would occur if voters observed y and Y and used this information to evaluate the incumbents separately is described in this subsection. In the following two subsections, solutions obtained when y and Y are unobservable to the voters are compared with this solution.

Under strategy 1, voters at the start of each period determine cutoff levels $\overline{t_1}$, $\overline{T_1}$, $\overline{y_1}$ and $\overline{Y_1}$ and announce that they will reelect the follower if and only if $t \le \overline{t_1}$ and $y \ge \overline{y_1}$ and the leader if and only if $T \le \overline{T_1}$ and $Y \ge \overline{Y}_1$. Next, the leader makes its expenditure and tax decisions, taking into account the possible reactions of the follower. Thereafter, the follower makes his expenditure and tax decisions, and at the end of the period the voters observe t, T, y, and Y and determine whether or not to reelect the politicians according to the announced voting rules.

The follower will either deviate from the proposed policy by choosing $t = r$ and $y = 0$ or seek reappointment by choosing $t = \overline{t_1}$ and $y = \overline{y_1}$.[5] If the follower would deviate, his payoff would equal $r = \max\{1 - T, 1/2\}$. Therefore, the follower will seek reappointment if and only if the discounted value of the rents he is allowed per period in office, x_1, is at least at large as r, that is, if

$$x_1 \equiv \overline{t_1} - \overline{y_1} \ge r(1 - \delta). \tag{1}$$

Condition (1) indicates that the follower will be more likely to seek reappoint-

[5] To be exact, if the follower deviates when $T \ge 1/2$, it does not matter what tax rate the follower chooses as long as it is at least 1/2.

ment the lower $\overline{y_1}$ and the higher $\overline{t_1}$ is, and – for values of T below 1/2 – the higher T is.

The situation of the leader is essentially the same as that of the follower. The leader can deviate from the proposed policy by choosing $T = R$ and $Y = 0$ and would then obtain a payoff of $R = \max\{1 - t, 1/2\}$. Therefore, the leader will seek reappointment if and only if the discounted value of the rents he is allowed per period in office, X_1, is at least at large as R, that is, if

$$X_1 \equiv \overline{T_1} - \overline{Y_1} \geq R(1 - \delta). \tag{2}$$

Condition (2) indicates that the leader will be more likely to seek reappointment the lower $\overline{Y_1}$ and the higher $\overline{T_1}$ is, and – for values of t below 1/2 – the higher t is.

In the equilibrium, the voters will determine the rents so that none of the incumbents prefers to deviate, which means that $y = \overline{y_1}$, $Y = \overline{Y_1}$, $t = \overline{t_1} = \overline{y_1} + x_1$, and $T = \overline{T_1} = \overline{Y_1} + X_1$. The rents can therefore be written as

$$x_1 = (1 - \overline{Y_1} - X_1)(1 - \delta), \tag{3}$$

$$X_1 = (1 - \overline{y_1} - x_1)(1 - \delta). \tag{4}$$

Solving for x_1 and X_1 gives

$$x_1 = \frac{[1 - \overline{Y_1} - (1 - \overline{y_1})(1 - \delta)](1 - \delta)}{2\delta - \delta^2}, \tag{5}$$

$$X_1 = \frac{[1 - \overline{y_1} - (1 - \overline{Y_1})(1 - \delta)](1 - \delta)}{2\delta - \delta^2}, \tag{6}$$

and

$$X_1^{Tot} = \frac{[2 - \overline{y_1} - \overline{Y_1}]}{2 - \delta}(1 - \delta). \tag{7}$$

Under this strategy, the follower will not react to the leader's decisions. For $Y = \overline{Y_1}$ and $T = \overline{T_1}$, the follower will obtain the same discounted rents by fulfilling the reappointment criteria as by deviating from them, and will then, by assumption, fulfill the reappointment criteria. If the leader, for some unfathomable reason, would deviate, the payoff the follower could obtain by deviating would be reduced, meaning that he would strongly prefer to seek reappointment. That the follower does not react to the leader's decisions under this strategy means that the game effectively becomes a Nash game, even though the leader makes decisions first, and the equilibrium can be described as a stable and unique Nash equilibrium.

Equations (3) and (4) tell us that the total political rent is larger under strategy 1 than in the unitary country. Since $\overline{t_1} = \overline{y_1} + x_1 < 1/2$ and $\overline{T_1} = \overline{Y_1} + X_1 < 1/2$, by assumption, equations (3) and (4) indicate that both x_1 and X_1 are strictly greater than $\chi_0/2$, which means that $X_1^{Tot} \equiv x_1 + X_1 > \chi_0 = (1-\delta)$.[6] Persson et al. (1997) and Wrede (2002) derived corresponding results. While the model here differs quite significantly from theirs, a feature common to all three models is that the government bodies can commit resources without requiring approval from each other.[7] This is known as a common-pool problem. That the total political rent is larger in such settings is because the incumbents are able to deviate independently and could therefore secure an immediate payoff larger than half the tax base. To avoid a Leviathan policy, voters have to guarantee political rents based on these "fallback payoffs", meaning that the total rent in the two-tier-government country must be allowed to be larger than in the unitary country.[8] That the total political rent is larger under strategy 1 means that voters are more strongly restricted than are voters in the unitary country, since the total political rent is larger under strategy 1, which makes them worse off.

Proposition 1 contains results describing the voters' incentives regarding their public expenditure choices, and the consequences of these for the total tax rate. Before turning to the proposition, let us define *voters' marginal cost for public expenditures* as the reduction in private consumption that voters have to accept in order to increase public expenditures by one unit.

Proposition 1 *Under strategy 1, (a) voters' marginal costs for public expenditures are below unity and (b) the total tax rate is higher than in the unitary state.*

To prove Proposition 1, let us analyze the voters' choice of cutoff levels. Using that $1 - \overline{y_1} - \overline{Y_1} - X_1^{Tot} = c$, the voters' optimization problem can be

[6] An alternative proof is that equation (7) indicates that $X_1^{Tot} > \chi_0$, if and only if $\overline{y_1} + \overline{Y_1} < \delta$. Note that $\overline{t_1} < 1/2$ and $\overline{T_1} < 1/2$ imply that $\overline{y_1} + \overline{Y_1} < \delta$, since $\overline{t_1} + \overline{T_1} = X_1^{Tot} + \overline{y_1} + \overline{Y_1} = 1 + \frac{\overline{y_1} + \overline{Y_1} - \delta}{2-\delta}$ can only be below one if $\overline{y_1} + \overline{Y_1} < \delta$.

[7] Persson et al. (1997) also demonstrated that separation of powers between government bodies can be beneficial to voters if both bodies are required to agree on public policy.

[8] The discussion here draws on Persson et al. (1997) and Wrede (2002).

written

$$\underset{\overline{Y_1},\overline{y_1}}{\text{Max}}\ V = u(1-\overline{y_1}-\overline{Y_1}-X_1^{Tot}) + \varphi(q(\overline{y_1},\overline{Y_1})),$$

where X_1^{Tot} is defined as in equation (7). The first-order conditions then become

$$\overline{y_1} \quad : \quad -u'\left[1-\frac{1-\delta}{2-\delta}\right] + \varphi'\frac{\partial q}{\partial \overline{y_1}} = 0, \tag{8}$$

$$\overline{Y_1} \quad : \quad -u'\left[1-\frac{1-\delta}{2-\delta}\right] + \varphi'\frac{\partial q}{\partial \overline{Y_1}} = 0. \tag{9}$$

The expressions in square brackets describe how much voters will have to reduce their private consumption in order to increase beneficial public expenditures by one unit. In other words, $1-\frac{1-\delta}{2-\delta}$ is the voters' marginal cost for public expenditures and, since $\delta < 1$, it is below unity, which proves (a). This result is explained by the fact that the incumbents' payoffs from deviating unilaterally, and thus their rents, depend on each others' tax rate. When beneficial public expenditures are increased, the tax rates must be increased as well. This reduces the payoffs of deviating unilaterally, so the rents can also be reduced. That voters' marginal costs for public expenditures are below unity in this case, while they were unity in the unitary country, works for higher public expenditures here than in the unitary country.[9]

To prove (b), first note that voters will reduce both public and private expenditures because more resources are being diverted to political rents. This means that $\frac{\partial(\overline{y}+\overline{Y})}{\partial X^{Tot}} > -1$, which, together with $X_1^{Tot} > \chi_0$, proves that the total tax rate will be higher under strategy 1 than in the unitary country, since both public expenditures and rents are financed with taxes. That voters' marginal costs for public expenditures are below unity here, while they were unity in the unitary country, means that the public expenditures will be larger here for a given level of total political rent. This means that under strategy 1, the public expenditures could actually be as large as, or even larger than, those in the unitary country, despite more resources being diverted to political rent, and

[9] We cannot generally conclude whether the voters' marginal cost for public expenditures would be below or above unity if the tax base were endogenous, since we then would have a counteracting effect. We can, however, conclude that, also with an endogenous tax base, voters' marginal cost for public expenditures would be lower with two levels of government than with one. The reason for this is the same as that for the exogenous tax base discussed above.

this increases the difference between the total tax rate here and in the unitary country.

The first-order conditions (8) and (9) also tell us that voters will choose $\overline{y_1}$ and $\overline{Y_1}$ so that $\frac{\partial q}{\partial \overline{y_1}} = \frac{\partial q}{\partial \overline{Y_1}}$, which, due to the symmetry of the production function, implies that $\overline{y_1} = \overline{Y_1}$. Equations (5) and (6) indicate that when $\overline{y_1} = \overline{Y_1}$, $x_1 = X_1$, which in turns means that $\overline{t_1} = \overline{T_1}$: the equilibrium under strategy 1 is symmetric.

3.2 Voting strategy 2, partial reciprocal liability

Here, I return to the assumption that y and Y are unobservable to the voters and therefore let the voters determine one cutoff level for q, instead of separate cutoff levels for Y and y. Thus, under strategy 2, the voters will reelect the follower if and only if $t \leq \overline{t_2}$ and $q \geq \overline{q_2}$, and the leader if and only if $T \leq \overline{T_2}$ and $q \geq \overline{q_2}$. The rents under this strategy are denoted x_2 and X_2.

The follower will either deviate from the proposed policy by choosing $t = r$ and $y = 0$ or seek reappointment by choosing $t = \overline{t_2}$ and $y = y_2^i$, where y_2^i denotes the minimum value of y required to achieve $\overline{q_2}$ for $Y = Y_2^i$. If the follower would deviate, his payoff would be $r = \max\{1 - T, 1/2\}$. Therefore, the follower will seek reappointment if and only if the discounted value of the rents he is allowed is at least at large as r, that is, if

$$x_2 \equiv \overline{t_2} - y_2^i(\overline{q_2}, Y_2^i) \geq r(1 - \delta). \tag{10}$$

Condition (10) indicates that the follower will be more likely to seek reappointment the lower $\overline{q_2}$ is and the higher Y_2^i and $\overline{t_2}$ are, and – for values of T below 1/2 – the higher T is.

Thus, for the follower, the decision context itself is unaffected by the changed strategy. He still observes the leader's decisions before making his own, and will still require a rent of $r(1-\delta)$ to seek reappointment. The value of this required rent, however, is affected by a changed decision context for the leader; unlike x_1, x_2 is directly affected by the leader's decisions, since y_2^i is a function of Y_2^i.

The leader chooses T_2 and Y_2 to maximize

$$\operatorname*{Max}_{T_2, Y_2} U_L = \sum_{p=0}^{\infty} \delta^p X_2$$

subject to the budget constraint

$$T_2 - Y_2 = X_2,$$

the voting rule $(\overline{T_2}, \overline{q_2})$, and the follower's reactions.

If the leader seeks reappointment, he prefers that the follower also seeks reappointment, since the value of Y required to achieve $\overline{q_2}$ is decreasing in y. The leader would therefore set $T = \overline{T_2}$ and $Y = Y_2^I$, where Y_2^I is the minimum value of Y for which the follower also seeks reappointment: so that $\overline{t_2} - y_2^I(\overline{q_2}, Y_2^I) = (1-T)(1-\delta)$.[10] Note that $Y_2^I(\overline{q_2}, \overline{t_2}, T)$ is increasing in $\overline{q_2}$, but decreasing in $\overline{t_2}$ and T since the follower is prepared to increase y when the tax rates are increased. This is because a higher $\overline{t_2}$ increases the follower's rent for a given y_2^I, and because a higher T reduces the follower's payoff from deviating.

If the leader does not seek reappointment, for reasonable values of δ and $\overline{q_2}$ he would still prefer that the follower seeks reappointment: if both deviate from the voting rule, both obtain a payoff equal to $1/2$, but if only the leader deviates, he could obtain a payoff of above $1/2$. To induce the follower to seek reappointment, the leader will set Y just high enough that the maximum amount the follower is prepared to spend on his input is just enough to achieve $\overline{q_2}$. Let us call these values of Y and y for Y_2^{II} and y_2^{II}. The rent the follower requires in order not to deviate is only $(1-\delta)/2$ when the leader deviates (since $T > 1/2$ for payoffs to the leader of above $1/2$), meaning that $y_2^{II} = \overline{t_2} - (1-\delta)/2$. Thus, if the leader chooses $Y = Y_2^{II}$ and $T = 1 - \overline{t_2}$, his payoff becomes $1 - Y_2^{II} - y_2^{II} - (1-\delta)/2$. This is above $1/2$ given that $Y_2^{II} + y_2^{II} < \delta/2$, which is assumed.

For the same reason as for $Y_2^I(\overline{q_2}, \overline{t_2}, T)$, $Y_2^{II}(\overline{q_2}, \overline{t_2})$ is increasing in $\overline{q_2}$ but decreasing in $\overline{t_2}$. It is, however, unaffected by marginal changes in T, since $T > 1/2$ when the leader deviates. Since the payoff that the follower could obtain by deviating is smaller when the leader also deviates, we know that $Y_2^{II} < Y_2^I$ and $y_2^I < y_2^{II}$. As I demonstrate in Appendix B, a sufficient condition for $Y_2^{II} > 0$ is that less than $2/3$ of the follower's tax revenues go to rents when he seeks reappointment, which is assumed.

This means that the leader will seek reappointment if and only if

$$X_2 \equiv \overline{T_2} - Y_2^I(\overline{q_2}, \overline{t_2}, \overline{T_2}) \geq \left[1 - Y_2^{II}(\overline{q_2}, \overline{t_2}) - y_2^{II}(\overline{t_2}) - (1-\delta)/2\right](1-\delta). \quad (11)$$

[10] Since $\overline{T_2} < 1/2$, $r = 1 - T$ when the leader seeks reappointment.

Rational voters will set $\overline{t_2}$, $\overline{T_2}$, and $\overline{q_2}$ so that both incumbents seek reappointment. Using that r in (10) then equals $1 - Y_2^I - X_2$ and substituting for X_2, the rents can be written

$$x_2 = \left[1 - Y_2^I(\overline{q_2}, \overline{t_2}, \overline{T_2}) - \left[1 - Y_2^{II}(\overline{q_2}, \overline{t_2}) - y_2^{II}(\overline{t_2}) - (1-\delta)/2\right](1-\delta)\right](1-\delta), \tag{12}$$

$$X_2 = \left[1 - Y_2^{II}(\overline{q_2}, \overline{t_2}) - y_2^{II}(\overline{t_2}) - (1-\delta)/2\right](1-\delta) \tag{13}$$

and

$$X_2^{Tot} = x_2 + X_2 = \left[\begin{array}{c} 1 - Y_2^I(\overline{q_2}, \overline{t_2}, \overline{T_2}) \\ +\delta\left[1 - Y_2^{II}(\overline{q_2}, \overline{t_2}) - y_2^{II}(\overline{t_2}) - (1-\delta)/2\right] \end{array}\right](1-\delta). \tag{14}$$

Note the asymmetry between (12) and (13): the leader's rent is affected by the total expenditures required to achieve $\overline{q_2}$ if he deviates, while the follower's rent is affected, besides the rent to the leader, by only Y_2^I.

Proposition 2 describes the equilibrium under strategy 2 and compares it with the equilibrium under strategy 1.

Proposition 2 *Under strategy 2, (a) voters' marginal costs for public expenditures are below unity, (b) the output is produced inefficiently, and (c) voters are better off than under strategy 1.*

Appendix C gives the proofs to (a) and (b). The intuition for (a) is the same as under strategy 1: when voters increase the beneficial public expenditures by increasing the cutoff levels, the payoff of deviating unilaterally, and thus the required rents, is reduced. This means that the voters' marginal costs for y_2^I and Y_2^I ($1 + \frac{\partial X_2^{Tot}}{\partial y_2^I}$ and $1 + \frac{\partial X_2^{Tot}}{\partial Y_2^I}$, respectively) are below unity.

By studying (14) we directly see the main reason for (b): Y_2^I, but not y_2^I, has a direct negative effect on the total political rent, working for that the voters' marginal cost for Y becomes lower than that for y. A counteracting effect occurs if $Y_2^{II} < y_2^{II}$ (and thus $\frac{\partial q}{\partial y_2^{II}} < \frac{\partial q}{\partial Y_2^{II}}$). Then, if the voters reduce y_2^I/Y_2^I for a given $\overline{q_2}$ – which they can do by reducing $\overline{t_2/T_2}$ – a deviating leader will not have to increase Y_2^{II} as much as y_2^{II} is reduced. This increases the leader's rent and works for higher total political rent. As demonstrated in Appendix C, this latter effect is dominated by the former effect in the optimal solution, meaning that the voters' marginal cost for Y is lower than that for y. Voters will therefore choose their cutoff levels so that $\frac{\partial q}{\partial Y_2^I} < \frac{\partial q}{\partial y_2^I}$ and the output will be produced inefficiently with $y_2^I < Y_2^I$.

Voters have enough instruments to choose an effective production: they can, for example, reduce Y and increase y by reducing $\overline{T}$ and increasing $\bar{t}$. Despite this, voters will choose an inefficient input combination in order to reduce the total political rent. This result stems from two characteristics of the model: (i) that one incumbent acts as a Stackelberg leader relative to the other and (ii) that the Stackelberg leader's decisions will affect whether or not the follower is reelected.

To prove (c), it is helpful to use that $y_2^{II} + (1-\delta)/2 = y_2^I + x_2 = \overline{t_2}$, which allows the rents to be written as

$$x_2 = \frac{[1 - Y_2^I - (1 - Y_2^{II} - y_2^I)(1-\delta)](1-\delta)}{2\delta - \delta^2}, \tag{15}$$

$$X_2 = \frac{[1 - Y_2^{II} - y_2^I - (1 - Y_2^I)(1-\delta)](1-\delta)}{2\delta - \delta^2} \tag{16}$$

and

$$X_2^{Tot} = x_2 + X_2 = \frac{2 - y_2^I - Y_2^I - Y_2^{II}}{2-\delta}(1-\delta). \tag{17}$$

Comparing (17) with (7), we see that for given levels of y and Y the total political rent under strategy 2 is less than under strategy 1, since $Y_2^{II} > 0$. This means that voters are less restricted under strategy 2 and thus better off.

That voters were worse off under strategy 1 than under strategy 2 might seem surprising, since they had more information under strategy 1. The explanation, of course, is not the difference in information itself, but that voters were assumed to use their additional information under strategy 1 to evaluate the incumbents separately. As Wrede (2002) demonstrated, it may be in the voters' interests to enforce reciprocal liability, which are created when the reelection probabilities of both incumbents also depend on each others' policies. Basing the reappointment decision on q, instead of on y and Y, in fact induces reciprocal liability, even though stronger forms of reciprocal liability are possible. The reason why voters are better off if they enforce reciprocal liability is that this reduces the leader's possibility to deviate unilaterally and thus the payoff he would obtain by deviating. This, in turn, means that the rent that voters must guarantee the leader can be reduced. For given levels of y and Y, the follower's rent must be increased by $(1-\delta)$ times the reduction in the leader's rent, meaning that the total political rent is reduced by δ times the reduction in the leader's rent. Thus, voters benefit from enforcing reciprocal liability.

Sufficient conditions for voters to choose cutoff values so that the total political rent is indeed lower here than under strategy 1 are that voters' marginal costs for y and Y, respectively, are lower (or equally high) under strategy 2 than under strategy 1. Appendix D proves that the condition for Y holds. This is because an increase in Y_2^I not only reduces x_2, but also reduces X_2, since a higher Y_2^I means higher $\overline{q_2}$ for a given y_2^I and thus a higher Y_2^{II} (see equations 12 and 13). Appendix D demonstrates that the voters' marginal cost for y will be lower under strategy 2 than under strategy 1, if the production function is not too flat with respect to y and if the discount factor is not too low; more precisely if $\frac{\partial q}{\partial y_2^I}\left[2\delta - \delta^2\right] > \frac{\partial q}{\partial y_2^{II}}$.

Voters will both spend more on private consumption and require higher public expenditures if the total required rent is reduced, all else being equal. Thus, if $X_2^{Tot} \leq X_1^{Tot}$ and if voters' marginal cost also for y is indeed lower under strategy 2, voters will choose higher public expenditures than under strategy 1. Since $Y_2^{II} > 0$, equations (17) and (7) tell us that $X_2^{Tot} < X_1^{Tot}$ for $\left(y_2^I + Y_2^I\right) \geq \left(y_1^I + Y_1^I\right)$. Therefore, if voters' marginal cost for y is also lower (or equally high) under strategy 2 than under strategy 1, voters will require higher public expenditures under strategy 2 and the total political rent will be lower than under strategy 1.

One might ask whether the leader benefits from being a Stackelberg leader with respect to the other incumbent. Often, being a Stackelberg leader is advantageous, but in some situations it is a disadvantage to be forced to show one's cards before the other player determines his strategy. Let us start by considering whether the leader is better off than the follower. Comparing equations (15) and (16), we see that $y_2^I < Y_2^I$ works for $x_2 < X_2$, but that Y_2^{II} has a counteracting effect. Equations (15) and (16) give

$$X_2 - x_2 = \frac{\left(Y_2^I - Y_2^{II} - y_2^I\right)(1-\delta)}{\delta}. \tag{18}$$

Equation (18) demonstrates that $X_2 > x_2$ if and only if $Y_2^I > \left(Y_2^{II} + y_2^I\right)$, which may or may not be true. Thus, the Stackelberg leader does not necessarily obtain a higher rent than the follower does. This also means that the leader does not necessarily obtain a higher rent than he would if the two incumbents instead acted as Nash competitors towards each other. Then, both incumbents would obtain rents equal to the rents under strategy 1. If, as seems likely, the total rent is lower under strategy 2 than under strategy 1, a necessary condition for $X_2 > X_1$ is that the leader obtain a higher share of the total rent under strategy 2, but as just demonstrated, this is not necessarily the case.

3.3 Voting strategy 3, full reciprocal liability

Let us now consider full reciprocal liability, meaning that voters follow strategy 3 and reelect both incumbents if $t_3+T_3 \leq \overline{\tau_3}$ and $q_3 \geq \overline{q_3}$, and reelect none if either of these conditions is not fulfilled. Thus, under this strategy the incumbents are liable for each others' expenditure decisions, as under strategy 2, and also for each others' tax decisions. The rents under this strategy are denoted x_3 and X_3, and t_3, T_3, y_3, and Y_3 denote the levels of taxes and expenditures determined by the incumbents.

As under strategies 1 and 2, the follower can deviate from the proposed policy by setting $t = r$ and $y = 0$, which would give a payoff of $r = \max\{1 - T, 1/2\}$. The follower will therefore seek reappointment if and only if

$$x_3 \equiv \overline{\tau_3} - T_3^i - y_3(\overline{q_3}, Y_3^i) \geq r(1-\delta). \tag{19}$$

where $y_3^i(\overline{q_3}, Y_3^i)$ denotes the minimum value of y required to achieve $\overline{q_3}$ for $Y = Y_3^i$.

Leaders seeking reappointment had no choice under strategy 1, but under strategy 2 they chose Y_2^I to maximize their rents. Under strategy 3, a leader seeking reappointment chooses T_3 and Y_3 to maximize his rents, $X_3 \equiv T_3 - Y_3$, subject to the follower's selection constraint, $\overline{\tau_3} - T_3 - y_3(\overline{q_3}, Y_3) - (1-T_3)(1-\delta) \geq 0$ and the voting rule. The first-order conditions become

$$T_3 \quad : \quad 1 - \lambda_3 \left[1 - (1-\delta)\right] = 0, \tag{20}$$

$$Y_3 \quad : \quad -1 - \lambda_3 \frac{\partial y_{3v}}{\partial Y_{3v}} = 0, \tag{21}$$

where λ_3 denotes the Lagrangian multiplier for the follower's selection constraint and where $\frac{\partial y_3}{\partial Y_3} \equiv -\frac{\partial q/\partial Y_3}{\partial q/\partial y_3}$. Combining the first-order conditions gives $\delta = \frac{\partial q/\partial Y_3}{\partial q/\partial y_3}$, which demonstrates that the leader chooses T_3 and Y_3 so that $y_3 > Y_3$. By choosing this inefficient input combination, the leader reduces the payoff that the follower could obtain by deviating, and thus the rents he must be given.

Full reciprocal liability eliminates the leader's possibility to deviate independently: if the leader chooses a higher tax or lower expenditures than is in accordance with the follower's selection constraint, it is in the follower's interests to maximize his immediate payoff. Both incumbents will then obtain a payoff of 1/2. Therefore, it is sufficient that the voters guarantee the leader a rent of $X_3 = (1-\delta)/2$. Rational voters choose $\overline{\tau_3}$ and $\overline{q_3}$ so that both incumbents seek reappointment. Thus, the rents can be written

$$x_3 = [1 - Y_3 - (1-\delta)/2]\,(1-\delta), \tag{22}$$

$$X_3 = (1-\delta)/2 \tag{23}$$

and

$$X_3^{Tot} = x_3 + X_3 = [1 - Y_3 + \delta/2]\,(1-\delta). \tag{24}$$

When writing the leader's optimization problem and the expression for x_3 above, I used that T_3 must be strictly below 1/2 since $\overline{\tau_3} < 1$. To understand why, note that in a situation where the leader choose between values of T_3 above 1/2, x_3 would equal $(1-\delta)/2$ and the follower's selection constraint would read $\overline{\tau_3} - T_3 - y_3(\overline{q_3}, Y_3) - (1-\delta)/2 \geq 0$. The first order condition for T_3 would then become $1 - \lambda_3 = 0$, which, combined with equation (21), would give $\frac{\partial y_{3v}}{\partial Y_{3v}} = 1$ and $y_3 = Y_3$. With $x_3 = X_3 = (1-\delta)/2$, this means that $t_3 = T_3$, but this is impossible when $T_3 \geq 1/2$, given that $\overline{\tau_3} < 1$, which proves that $T_3 < 1/2$.

Looking at (23) and (22), we see that $x_3 > X_3$, since $T_3 = Y_3 + (1-\delta)/2 < 1/2$. Actually, X_3 is less than the rent the leader would obtain if the two incumbents acted as Nash competitors towards each other: then the leader would obtain a rent equal to what he obtained under strategy 1, $X_1 = (1 - \overline{y_1} - x_1)(1-\delta)$, which is above 1/2 since $\overline{t_1} = \overline{y_1} + x_1 < 1/2$. Thus, under full reciprocal liability an incumbent is clearly hurt by being a Stackelberg leader.

Proposition 3 describes the equilibrium under strategy 3 and compares it with the equilibriums under strategies 1 and 2.

Proposition 3 *Under strategy 3, (a) voters' marginal costs for public expenditures of the leader are below unity, while their costs for public expenditures of the follower are unity, (b) the output is produced inefficiently, and (c) the voters are better off than under both strategies 1 or 2.*

To prove (a), note that voters' marginal costs for public expenditures just are one, plus the effect that a marginal increase in the expenditures has on the total political rent, described in (24). Therefore, we see that the voters' marginal cost is δ for Y, but that it is unity for y, since the leader's payoff from deviating is fixed at $(1-\delta)/2$ and hence unaffected by the follower's tax and expenditure decisions.

Result (b) was proved above by combining the leader's first-order conditions, (20) and (21). Note that while the inefficient input combination was chosen by the voters under strategy 2, it is chosen by the leader under strategy 3. This difference is because two policy variables are generally insufficient to enable voters to choose the input combination they prefer. However, that voters' marginal costs for public expenditures are δ for Y and unity for y implies that they, like the leader, prefer an input combination described by $\delta = \frac{\partial q/\partial Y_3}{\partial q/\partial y_3}$. That the leader's and the voters' interests coincide in this matter is because y and Y do not affect the leader's payoff from deviating under full reciprocal liability. Thus, both the leader's and voters' preferences concerning input combinations are results of the same wish to minimize the sum of x_3, y, and Y, for a given level of $\overline{q_3}$.

That the leader and voters prefer the same input combination for a given level of $\overline{q_3}$ means that the voters are not restricted by the fact that, under strategy 3, they are unable to choose the ratio y/Y, by choosing separate cutoff levels for t and T (or for y and Y). In other words, under full reciprocal liability, it does not matter whether the voters decide on two, three or four cutoff levels; the important thing is that they reelect either none or both of the incumbents. The voters' marginal costs for public expenditures derived above are, however, arguably more interesting in with three or four cutoff levels, since the input combination is then a function of the voters' marginal costs.

To prove (c), first note that the leader is worse off under strategy 3 than under strategies 1 or 2, since both X_1 and X_2 are above $(1-\delta)/2$ (as discussed in previous subsections), while $X_3 = (1-\delta)/2$. In addition, note that under all three voting strategies, the follower's rent and the total political rent can be written $x = [1-Y-X](1-\delta)$ and $X^{Tot} = X + [1-Y-X](1-\delta) = \delta X + [1-Y](1-\delta)$. Therefore, if X is reduced by one unit and Y is left unchanged, the total political rent is reduced by δ even though the follower's rent is increased by $(1-\delta)$. This tells us that, for a fixed level of Y, the total political rent is lower under strategy 3 than under strategies 1 or 2. Since under all strategies voters can obtain the level of Y that they prefer, voters are less strongly restricted and better off under strategy 3 than under the other two strategies.

From the discussion in the paragraph above, we see that a sufficient condition for the total political rent to be smaller under strategy 3 than under strategies 1 or 2 is that voters will choose the cutoff levels so that $Y_3 \geq Y_1$ and $Y_3 \geq Y_2$. From equation (8) and the proof of Proposition 3 (a), we know that the voters marginal cost for Y is lower under strategy 3 than under strategy 1 since

$$\left(1 - \frac{1-\delta}{2-\delta}\right) - \delta = (1-\delta)[1 - \frac{1}{2-\delta}] > 0.$$

Since Y (as well as y) is higher the lower the total political rent, this proves that $Y_3 > Y_1$ and that $X_3^{Tot} < X_1^{Tot}$, unless $\frac{\partial^2 q}{\partial y \partial Y} > 0$ and $y_3 > y_1$. As discussed in Appendix D, given the assumptions made, we cannot prove that the marginal cost of Y is lower under strategy 3 than under strategy 2, and we therefore cannot conclude whether or not $Y_3 > Y_2$ or whether or not $X_3^{Tot} < X_2^{Tot}$ even if we would assume that $\frac{\partial^2 q}{\partial y \partial Y} \leq 0$.

Propositions 2 and 3 have demonstrated that voters in an economic federation can strengthen their ability to discipline the incumbents by introducing partial reciprocal liability, and even more so by introducing full reciprocal liability. Still, total rents and taxes are higher than in the unitary country even under strategies 2 and 3. That total rents are higher is proved by the fact that the t_2, T_2, and T_3 are all below 1/2, which gives $x_2 > (1-\delta)/2$, $X_2 > (1-\delta)/2$ and thus $X_2^{Tot} > \chi_0$, and $x_3 > (1-\delta)/2$ and thus $X_3^{Tot} > \chi_0$. An alternative assumption that would give $X_2^{Tot} > \chi_0$ is that $y_2^I + Y_2^I + Y_2^{II} < \delta$. Since the total political rent is larger than in the unitary country, voters are more strongly restricted and therefore worse off than voters in the unitary country.

That the total tax rates are higher under strategies 2 and 3 than in the unitary country is because the total political rent is higher and public expenditures are reduced by less than one unit when the total political rent is increased by one unit. That voters' marginal costs for public expenditures are weakly lower under strategies 2 and 3 than in the unitary country increases the differences between the total tax rates under these strategies and the tax rate in the unitary country.

4 Intergovernmental transfers

In this section, I briefly describe how voters are affected if the leader is able to give an intergovernmental transfer, s, to the follower. With the intergovernmental transfer, under all strategies, the leader will choose s, T, and Y to maximize

$$\underset{T,Y,s}{\text{Max}}\, U_L = \sum_{p=0}^{\infty} \delta^p X$$

subject the budget constraint

$$T - s - Y = X,$$

the voting rule, and the follower's reactions. Voters will take into account possible effects that the leader's new instrument has on the leader's and follower's decisions, when determining the cutoff values. Proposition 4 describes how voters are affected if the leader is allowed to decide s.

Proposition 4 *Under all strategies, (a) voters are hurt if the leader is able to decide on a transfer that is allowed to be negative. Under strategies 1 and 3, (b) voters are not affected by whether or not the leader is able to decide on a positive transfer to the follower, but under strategy 2, (c) the outcome is affected negatively from the voters' perspective if* $y_2^{II} < Y_2^{II}$ *when* $s = 0$.

Result (a) is explained by that if s is allowed to be negative, the leader is able to circumvent the fact that he will only access half the tax base directly if the total tax rate exceeds one. A negative transfer in this case means that the leader could demand a transfer from the follower. If the leader can also secure this if he deviates, the leader could under all strategies guarantee himself a payoff of unity by setting $T \geq 1/2$, $s = -1/2$, and $Y = 0$ and would therefore require a rent of $1 - \delta$ in order not to do so. The increases in the leader's rent also imply increases in the total political rents under all strategies, which in turn means that voters become more restricted and hence worse off.

To see (b), first note that under strategy 1, the leader has no incentive to transfer resources to the follower, since the incumbents are evaluated separately by the voters. Thus, the leader's opportunity to decide on a positive transfer does not change the outcome under this strategy.

Under strategy 3, the leader is able to distribute the total tax revenues $\overline{\tau_3}$ equally freely with and without s. What matters to the leader is $T - s$, not the individual level of T or s. Thus, under strategy 3, s is a superfluous instrument for the leader. This means that the levels of y, Y, x, and X will not be affected by the leader's ability to transfer resources either under strategy 3, which proves (b).

To see (c), note that if the cutoff levels are such that $y_2^{II} < Y_2^{II}$ when $s = 0$, a deviating leader would reduce Y_2^{II} and increase y_2^{II} by increasing s until $y_2^{II} = Y_2^{II}$. This would reduce the total expenditures required to fulfill $\overline{q_2}$ without increasing the rent the follower requires, since the follower's payoff from deviating simultaneously with the leader is fixed at 1/2. This would increase the payoff the leader could obtain by deviating and thus the rent he requires in order not to deviate. This means that if the leader is able to transfer resources to the follower, the total political rent for the input combination preferred by the voters without a transfer is increased, making the voters worse off.

Under strategy 2, voters would realize that with a transfer they cannot increase $y_2^{II} + Y_2^{II}$, for a given $\overline{q_2}$, by altering the input combination. The voters' only remaining reason to choose an inefficient input combination is then to contain the follower's rent. In Appendix E, I demonstrate that, as under strategy 3, voters will therefore choose an input combination described by $\delta = \frac{\partial q/\partial Y}{\partial q/\partial y}$. Still, the solutions under strategies 2 and 3 also differ with intergovernmental transfers, since the leader's rent is higher under strategy 2.

The reason why voters can be hurt by allowing the leader to transfer resources to the follower under strategy 2, but not under strategies 1 or 3, is that it is only under strategy 2 that both the leader and the voters can affect the leaders rent by altering the input combination: this can be done by the leader if s is allowed and $y_2^{II} < Y_2^{II}$ when $s = 0$, and otherwise by the voters.

To conclude, in the special cases where voters enforce no or full reciprocal liability, allowing the leader to decide on a positive intergovernmental transfer will not hurt the voters, but with *partial* reciprocal liability, this might increase the leader's rent and the total political rent and thus make the voters worse off. Under all strategies, allowing the leader to decide on a negative intergovernmental transfer will increase the leader's rent and the total political rent and thus leave the voters worse off.

5 Discussion

This paper addresses voters' ability to discipline selfish politicians. The focus is on a country with two levels of government, where the incumbent at one level acts as a Stackelberg leader relative to the incumbent at the other and where voters are unable to evaluate the performance of the incumbents separately.

Simple retrospective voting strategies are considered.

As demonstrated previously by Persson et al. (1997) and Wrede (2002), I found that, compared with a situation with only one government body, more resources are diverted to political rents and voters are worse off when two government bodies can commit resources independently. Since public expenditures are reduced by less than one unit when the total political rent is increased by one unit, the higher political rent also means that the total tax rate is higher in two-tier-government countries than in unitary countries. The results of this paper also demonstrate that voters in two-tier-government countries have incentives to increase the beneficial public expenditures they require for reelecting incumbents, since this reduces the resources diverted to political rents. This incentive increases the differences between the total tax rates in two-tier-government countries and the tax rate in a unitary country.

As in Wrede (2002), the present results demonstrate that voters can strengthen their power by introducing reciprocal liability, that is, also holding politicians accountable for the decisions of politicians at the other level of government. In fact, the present results provide stronger arguments for reciprocal liability than do those of Wrede. Unlike the situation described by Wrede, where incumbents act as Nash competitors towards each other, when one incumbent acts as a Stackelberg leader, permanent Leviathan policy is not a potential equilibrium even under full reciprocal liability. This difference between a Nash and a Stackelberg game is easily understood: given that cutoff levels are set appropriately, the Stackelberg leader can induce the other incumbent not to deviate from the proposed policy and, knowing this, will have an incentive not to deviate himself. In addition, unlike in a Nash game, in a Stackelberg game it is unnecessary that incumbents determine taxes and expenditures more than once in each term in order to obtain positive effects of a reciprocal-liability strategy: in a Nash game two decision occasions per term are needed for an incumbent to be able to react to decisions made by the other incumbent, but in a Stackelberg game, the follower will react to the leader's decision even though both incumbents only make tax and expenditure decisions once each term.

The results demonstrate that, with reciprocal liability, the voters marginal cost for beneficial expenditures of the Stackelberg leader is lower than their marginal cost for beneficial expenditures of the follower. The reason is that when more resources are "tied up" by the Stackelberg leader, the follower requires lower rent in order not to deviate and take all the remaining resources. In addition, the results show that it is never in voters' interests to allow the Stackelberg leader to transfer resources to the follower. Without reciprocal liability, or with full reciprocal liability, the outcome will not be affected by the transfer as long as it is restricted to be weakly positive, but in the intermediate case with partial reciprocal liability, the outcome may be affected, making the voters worse off.

When voters are unable to evaluate the performance of the incumbents separately, some degree of reciprocal liability is unavoidable. One might argue that this can be seen as a positive effect of lack of transparency, since some voters likely do not realize the benefits of reciprocal liability. However, reciprocal liability and lack of transparency have serious downsides, not captured by this model. Topics for further research therefore include analyzing these issues when voters and politicians have heterogeneous preferences and when politicians differ in competence.

Appendix

A. Relationships between c, y, and Y in the unitary country

To facilitate later comparisons, I solve the voters' optimization problem as if they directly choose y and Y. This can be done, since the incumbent in the unitary state, like the voters, prefers cost-minimizing production. The voters can therefore achieve their preferred levels of y and Y by choosing $\overline{\tau_0}$ and $\overline{q_0}$. The voters' optimization problem can be expressed as

$$\underset{y,Y}{\text{Max}} \;\; V = u(1 - y - Y - (1 - \delta)) + \varphi(q(y, Y))$$

and the first order conditions become

$$y \;\; : \;\; -u' + \varphi' \frac{\partial q}{\partial y} = 0,$$

$$Y \;\; : \;\; -u' + \varphi' \frac{\partial q}{\partial Y} = 0.$$

These conditions indicate that voters will choose the cutoff levels so that the marginal utility of private consumption equals the marginal utility of each input.

In a unitary country, the only difference between the benevolent politicians' optimization problem and the voters' optimization problem with selfish politicians just described is that no resources are diverted to rents with benevolent politicians, meaning that the budget constraint becomes $c = 1 - y - Y$ instead of $c = 1 - y - Y - (1 - \delta)$.

B. Sufficient condition for $Y_2^{II} > 0$

In subsection 3.2, it is demonstrated that $y_2^I < Y_2^I$ for $Y_2^{II} > 0$. If Y_2^{II} were zero and if voters were unable to make Y_2^{II} positive by marginal adjustments in the cutoff levels, y_2^I would still be less than Y_2^I (see Appendix E). This implies that if $Y_2^{II} = 0$, $y_2^{II} > 2y_2^I$ (since $\frac{\partial q}{\partial y} < \frac{\partial q}{\partial Y}$ when $y > Y$) and that $Y_2^{II} > 0$ if $y_2^{II} \leq 2y_2^I$

Note that since $0 < \overline{T_2} < 1/2$, $(1-\delta)/2 < x_2 = (1-\overline{T_2})(1-\delta) < (1-\delta)$. In addition, note that for $y_2^{II} > 2y_2^I$

$$\frac{y_2^{II}}{y_2^I} \equiv \frac{\overline{t_2} - (1-\delta)/2}{\overline{t_2} - x_2} > 2.$$

Clearly, this condition is more likely to be fulfilled the larger x_2 is, but note that even if x_2 would equal $(1-\delta)$, the condition will only be fulfilled if $\frac{x_2}{\overline{t_2}} > \frac{2}{3}$, since $\overline{t_2} - x_2/2 > 2\overline{t_2} - 2x_2$ only if $\frac{3}{2}x_2 > \overline{t_2}$.

C. Proof of Proposition 2 (a) and (b)

To obtain expressions for voters' marginal costs for public expenditures, it is helpful to analyze the voters' optimal choice of cutoff levels $\overline{t_2}$, $\overline{T_2}$, and $\overline{q_2}$. This could be done by maximizing the voters' utility with respect to these cutoff levels, but since the leader will choose Y_2^I so that the follower seeks reappointment, the terms associated with the follower's budget constraint cancels out when the voters' optimization problem is solved in this manner. Therefore, it is more informative to solve the problem as if the voters directly chose y_2^I and Y_2^I.[11] This can be done since any combination of $\overline{t_2}$, $\overline{T_2}$, and $\overline{q_2}$ corresponds to a unique combination of y_2^I and Y_2^I: the voters can, for example, increase y and reduce Y by increasing $\overline{t}$ and reducing $\overline{T}$, and they can increase y_2^I and Y_2^I simultaneously by increasing $\overline{t_2}$, $\overline{T_2}$ and $\overline{q_2}$.

[11] This approach is inspired by the literature on optimal non-linear taxation (see, e.g., Stiglitz, 1982).

Using that $1 - y_2^I - Y_2^I - X_2^{Tot} = c$, the voters' optimization problem can be expressed as

$$\underset{Y_2^I, y_2^I}{\text{Max}} \; V = u(1 - y_2^I - Y_2^I - X_2^{Tot}) + \varphi(q(y_2^I, Y_2^I)),$$

where

$$X_2^{Tot} = \left[1 - Y_2^I + \delta \left[\begin{array}{c} 1 - Y_2^{II}(\overline{q_2}(Y_2^I, y_2^I), \overline{t_2}(Y_2^I, y_2^I)) \\ -y_2^{II}(\overline{t_2}(Y_2^I, y_2^I)) - (1-\delta)/2 \end{array} \right]\right](1-\delta). \tag{25}$$

Using that that $q \equiv \overline{q_2}$ in the optimal solution, the first order conditions can be written

$$y_2^I \quad : \quad -u'\left[1 + \frac{\partial X_2^{Tot}}{\partial y_2^I}\right] + \varphi' \frac{\partial q}{\partial y_2^I} = 0, \tag{26}$$

$$Y_2^I \quad : \quad -u'\left[1 + \frac{\partial X_2^{Tot}}{\partial Y_2^I}\right] + \varphi' \frac{\partial q}{\partial Y_2^I} = 0, \tag{27}$$

where

$$\frac{\partial X_2^{Tot}}{\partial y_2^I} = \left[-\delta \frac{\partial Y_2^{II}}{\partial \overline{q_2}} \frac{\partial q}{\partial y_2^I} - \delta \left(\frac{\partial Y_2^{II}}{\partial \overline{t_2}} + \frac{\partial y_2^{II}}{\partial \overline{t_2}} \right) \frac{\partial \overline{t_2}}{\partial y_2^I} \right](1-\delta), \tag{28}$$

$$\frac{\partial X_2^{Tot}}{\partial Y_2^I} = \left[-\delta \frac{\partial Y_2^{II}}{\partial \overline{q_2}} \frac{\partial q}{\partial Y_2^I} - \delta \left(\frac{\partial Y_2^{II}}{\partial \overline{t_2}} + \frac{\partial y_2^{II}}{\partial \overline{t_2}} \right) \frac{\partial \overline{t_2}}{\partial Y_2^I} - 1 \right](1-\delta). \tag{29}$$

Using (12) and that $\overline{t_2} = y_2^I + x_2$ gives

$$\overline{t_2} = y_2^I + \left[1 - Y_2^I - \left[\begin{array}{c} 1 - Y_2^{II}(\overline{t_2}(Y_2^I, y_2^I), \overline{q_2}(Y_2^I, y_2^I)) \\ -y_2^{II}(\overline{t_2}(Y_2^I, y_2^I)) - (1-\delta)/2 \end{array} \right](1-\delta)\right](1-\delta), \tag{30}$$

$$\frac{d\overline{t_2}}{dy_2^I} = \frac{1 + \frac{\partial Y_2^{II}}{\partial \overline{q_2}} \frac{\partial q}{\partial y_2^I}(1-\delta)^2}{1 - (1-\delta)^2 \left(\frac{\partial Y_2^{II}}{\partial \overline{t_2}} + \frac{\partial y_2^{II}}{\partial \overline{t_2}} \right)} \tag{31}$$

and

$$\frac{d\overline{t_2}}{dY_2^I} = \frac{-(1-\delta) + \frac{\partial Y_2^{II}}{\partial \overline{q_2}} \frac{\partial q}{\partial Y_2^I}(1-\delta)^2}{1 - (1-\delta)^2 \left(\frac{\partial Y_2^{II}}{\partial \overline{t_2}} + \frac{\partial y_2^{II}}{\partial \overline{t_2}} \right)}. \tag{32}$$

Note that $1 + \frac{\partial X_2^{Tot}}{\partial y_2^I}$ and $1 + \frac{\partial X_2^{Tot}}{\partial Y_2^I}$ describe voters' marginal costs for public expenditures of the follower and the leader, respectively. Thus, to prove that the marginal costs are below unity, we must demonstrate that $\frac{\partial X_2^{Tot}}{\partial y_2^I}$ and $\frac{\partial X_2^{Tot}}{\partial Y_2^I}$ are negative. Let us start by discussing the terms $\frac{d\overline{t_2}}{dy_2^I}$ and $\frac{d\overline{t_2}}{dY_2^I}$ in (28) and (29), which are described in (31) and (32).

Since $\frac{\partial q}{\partial y_2^I} > 0$ and $\frac{\partial q}{\partial Y_2^I} > 0$ and since Y_2^{II} – the minimum value of Y sufficient to achieve $\overline{q_2}$, given the maximum value of y that the follower is prepared to accept without deviating when the leader deviates – is increasing in q_2, we know that $\frac{\partial Y_2^{II}}{\partial \overline{q_2}} \frac{\partial q}{\partial y_2^I} \equiv \frac{\partial q/\partial y_2^I}{\partial q/\partial Y_2^{II}}$ and $\frac{\partial Y_2^{II}}{\partial \overline{q_2}} \frac{\partial q}{\partial Y_2^I} \equiv \frac{\partial q/\partial Y_2^I}{\partial q/\partial Y_2^{II}}$ are both positive.

Since $y_2^{II} + (1-\delta)/2 = \overline{t_2}$, $\frac{\partial y_2^{II}}{\partial \overline{t_2}} = 1$. This means that Y_2^{II} can be reduced when $\overline{t_2}$ is increased, but the reduction in Y_2^{II} will be smaller than the increases in $\overline{t_2}$ and y_2^{II} if $Y_2^{II} < y_2^{II}$, which is the case unless Y_2^I is too large relative to y_2^I, since $Y_2^{II} < Y_2^I$ while $y_2^{II} > y_2^I$. Thus, if $Y_2^{II} < y_2^{II}$, $\left(\frac{\partial Y_2^{II}}{\partial \overline{t_2}} + \frac{\partial y_2^{II}}{\partial \overline{t_2}}\right) > 0$.

Note that since $\frac{\partial Y_2^{II}}{\partial \overline{t_2}} < 0$ and since $\frac{\partial y_2^{II}}{\partial \overline{t_2}} = 1$, $\left(\frac{\partial Y_2^{II}}{\partial \overline{t_2}} + \frac{\partial y_2^{II}}{\partial \overline{t_2}}\right) < 1$ for all values, which guarantees that the denominators of (32) and (31) are both positive. Since $Y_2^I > Y_2^{II}$, $\frac{\partial Y_2^{II}}{\partial \overline{q_2}} \frac{\partial q}{\partial Y_2^I} \equiv \frac{\partial q/\partial Y_2^I}{\partial q/\partial Y_2^{II}} < 1$, meaning that the numerator of (32) is negative and we therefore conclude that $\frac{d\overline{t_2}}{dY_2^I} < 0$. The reason for this is that the follower's rent is reduced when Y_2^I is increased (even though it is affected positively by the reduction in the leader's rent) and that $\overline{t_2}$ can therefore be reduced. Since $\frac{\partial Y_2^{II}}{\partial \overline{q_2}} \frac{\partial q}{\partial y_2^I} \equiv \frac{\partial q/\partial y_2^I}{\partial q/\partial Y_2^{II}} > 0$, the nominator of (31) is positive, which means that $\frac{d\overline{t_2}}{dy_2^I} > 0$: when y_2^I is increased, $\overline{t_2}$ must be increased, not only to cover the increased expenditures on y, but also to finance a slight increase in the follower's rent (caused by a reduction in the leader's rent).

Let us now discuss the sign of $\frac{dX_2^{Tot}}{dy_2^I}$ and then compare $\frac{dX_2^{Tot}}{dY_2^I}$ with $\frac{dX_2^{Tot}}{dy_2^I}$. We have already established that $\frac{\partial Y_2^{II}}{\partial \overline{q_2}} \frac{\partial q}{\partial y_2^I} > 0$, that $\left(\frac{\partial Y_2^{II}}{\partial \overline{t_2}} + \frac{\partial y_2^{II}}{\partial \overline{t_2}}\right) > 0$ if $Y_2^{II} < y_2^{II}$, and that $\frac{d\overline{t_2}}{dy_2^I} > 0$, and can therefore conclude that $\frac{dX_2^{Tot}}{dy_2^I} < 0$ if $Y_2^{II} < y_2^{II}$. To prove that $\frac{dX_2^{Tot}}{dy_2^I} < 0$ also if $Y_2^{II} > y_2^{II}$, define $A = \frac{\partial Y_2^{II}}{\partial \overline{q_2}} \frac{\partial q}{\partial y_2^I} \equiv \frac{\partial q/\partial y_2^I}{\partial q/\partial Y_2^{II}}$, $B = -\frac{\partial Y_2^{II}}{\partial \overline{t_2}}$, and note that since $\frac{\partial y_2^{II}}{\partial \overline{t_2}} = 1$, $\frac{\partial Y_2^{II}}{\partial \overline{t_2}} \equiv -\frac{\partial q/\partial y_2^{II}}{\partial q/\partial Y_2^{II}}$. Since $\frac{\partial^2 q}{\partial (y_2)^2} < 0$ and $y_2^I < y_2^{II}$, A must be larger than B.

Substituting for $\frac{d\overline{t_2}}{dy_2^I}$, using the short notation and that $\frac{\partial y_2^{II}}{\partial \overline{t_2}} = 1$, (28) can be written

$$\frac{\partial X_2^{Tot}}{\partial y_2^I} = \left[-A + (B-1)\frac{1 + A(1-\delta)^2}{1 + (1-\delta)^2 (B-1)}\right]\delta(1-\delta),$$

which after rearranging becomes

$$\frac{\partial X_2^{Tot}}{\partial y_2^I} = \left[\frac{-A + B - 1}{1 + (1-\delta)^2 (B-1)}\right]\delta(1-\delta). \tag{33}$$

The numerator is negative (since $A > B\delta$) and the denominator is positive (since $B > 0$). Therefore, we can conclude that $\frac{\partial X_2^{Tot}}{\partial y_2^I} < 0$ for all values of y_2^{II} and Y_2^{II}.

The equations (28), (29), (31), and (32) give

$$\frac{\partial X_2^{Tot}}{\partial Y_2^I}-\frac{\partial X_2^{Tot}}{\partial y_2^I}=\begin{bmatrix} -\delta\frac{\partial Y_2^{II}}{\partial \overline{q_2}}\left(\frac{\partial q}{\partial Y_2^I}-\frac{\partial q}{\partial y_2^I}\right)-\delta\left(\frac{\partial Y_2^{II}}{\partial \overline{t_2}}+\frac{\partial y_2^{II}}{\partial \overline{t_2}}\right) \\ *\left(\frac{-(2-\delta)+\frac{\partial Y_2^{II}}{\partial \overline{q_2}}\left(\frac{\partial q}{\partial Y_2^I}-\frac{\partial q}{\partial y_2^I}\right)(1-\delta)^2}{1-(1-\delta)^2\left(\frac{\partial Y_2^{II}}{\partial \overline{t_2}}+\frac{\partial y_2^{II}}{\partial \overline{t_2}}\right)}\right)-1 \end{bmatrix}(1-\delta). \quad (34)$$

For $y_2^I = Y_2^I$, $\frac{\partial q}{\partial y_2^I}=\frac{\partial q}{\partial Y_2^I}$, which means that (34) can be simplified to

$$\frac{\partial X_2^{Tot}}{\partial Y_2^I}-\frac{\partial X_2^{Tot}}{\partial y_2^I}=\left[\frac{\left(\frac{\partial Y_2^{II}}{\partial \overline{t_2}}+\frac{\partial y_2^{II}}{\partial \overline{t_2}}\right)-1}{1-(1-\delta)^2\left(\frac{\partial Y_2^{II}}{\partial \overline{t_2}}+\frac{\partial y_2^{II}}{\partial \overline{t_2}}\right)}\right](1-\delta). \quad (35)$$

Since $\left(\frac{\partial Y_2^{II}}{\partial \overline{t_2}}+\frac{\partial y_2^{II}}{\partial \overline{t_2}}\right)<1$, (35) is clearly negative. Thus, if $y_2^I = Y_2^I$, voters' marginal cost would be higher for y than for Y, and the voters will therefore choose an input combination where $y_2^I < Y_2^I$. Looking at (34), we see that for $y_2^I < Y_2^I$ but $y_2^{II} > Y_2^{II}$, the two products in the square bracket both become positive. If y_2^I is sufficiently smaller than Y_2^I , $\frac{\partial X_2^{Tot}}{\partial Y_2^I}-\frac{\partial X_2^{Tot}}{\partial y_2^I}$ might be positive, but rational voters will never choose a solution where $\frac{\partial X_2^{Tot}}{\partial Y_2^I}-\frac{\partial X_2^{Tot}}{\partial y_2^I}$ is positive; the first order conditions (26) and (27) tell us that, since $\frac{\partial q}{\partial y_2^I}>\frac{\partial q}{\partial Y_2^I}$ when $y_2^I < Y_2^I$, voters will choose a solution where the marginal cost of y is higher than that of Y. This proves result (b) of Proposition 2, and, since $\frac{\partial X_2^{Tot}}{\partial y_2^I}<0$ for all values of y_2^{II} and Y_2^{II}, it also proves result (a) of that proposition.

D. Comparison of marginal costs and an alternative proof of Proposition 2 (a)

Using (17), $\frac{\partial X_2^{Tot}}{\partial Y_2^I}$ can be written as

$$\frac{\partial X_2^{Tot}}{\partial Y_2^I}=\frac{-\frac{\partial Y_2^{II}}{\partial \overline{q_2}}\frac{\partial q}{\partial Y_2^I}-\frac{\partial Y_2^{II}}{\partial \overline{t}_2^{II}}\frac{d\overline{t_2}}{dY_2^I}-1}{2-\delta}(1-\delta). \quad (36)$$

From above we know that $\frac{\partial Y_2^{II}}{\partial \overline{q_2}}\frac{\partial q}{\partial Y_2^I}>0$, $\frac{\partial Y_2^{II}}{\partial \overline{t_2}}<0$, and that $\frac{d\overline{t_2}}{dY_2^I}<0$. Therefore, we can conclude that $\frac{\partial X_2^{Tot}}{\partial Y_2^I}<-\frac{(1-\delta)}{2-\delta}$ and thus that the voters' marginal cost for Y under strategy 2, $1+\frac{\partial X_2^{Tot}}{\partial Y_2^I}$, is lower than their marginal cost under strategy 1, $1-\frac{(1-\delta)}{2-\delta}$.

Using (17), (31), and the short notation from Appendix C, $A=\frac{\partial Y_2^{II}}{\partial \overline{q_2}}\frac{\partial q}{\partial y_2^I}\equiv$

$\frac{\partial q/\partial y_2^I}{\partial q/\partial Y_2^{II}}$ and $B = -\frac{\partial Y_2^{II}}{\partial \overline{t_2}} \equiv \frac{\partial q/\partial y_2^{II}}{\partial q/\partial Y_2^{II}}$, $\frac{\partial X_2^{Tot}}{\partial y_2^I}$ can be written as

$$\frac{\partial X_2^{Tot}}{\partial y_2^I} = \frac{-A + B\frac{1+A(1-\delta)^2}{1+(1-\delta)^2(B-1)} - 1}{2-\delta}(1-\delta). \tag{37}$$

Rearranging gives

$$\frac{\partial X_2^{Tot}}{\partial y_2^I} = \frac{\frac{A[(1-\delta)^2-1]+B}{1+(1-\delta)^2(B-1)} - 1}{2-\delta}(1-\delta), \tag{38}$$

which demonstrates that $\frac{\partial X_2^{Tot}}{\partial y_2^I} < \frac{(1-\delta)}{2-\delta}$ only if $\left(A[(1-\delta)^2 - 1] + B\right) < 0$. Using the definitions of A and B and rearranging, we see that this holds only if $\frac{\partial q}{\partial y_2^I}\left[2\delta - \delta^2\right] > \frac{\partial q}{\partial y_2^{II}}$; for example, with a yearly discount rate of 5% and elections every fourth year, δ becomes 0.82 and the condition will be fulfilled if $\frac{\partial q}{\partial y_2^I}$ is 3% higher than $\frac{\partial q}{\partial y_2^{II}}$.

Equation (38) can be written as

$$\frac{\partial X_2^{Tot}}{\partial y_2^I} = \frac{(A-B+1)[(1-\delta)^2-1]}{2-\delta}(1-\delta), \tag{39}$$

which is negative since $A > B$. Together with equation (36), showing that $\frac{\partial X_2^{Tot}}{\partial Y_2^I} < 0$, this constitutes an alternative proof of Proposition 2 (a).

Let us now compare the voters' marginal costs for Y under strategies 2 and 3. From equations (27), (36), and the proof of Proposition 3 (a) we know that, compared with under strategy 2, the voters' marginal cost for Y is lower under strategy 3, than under strategy 2, only if

$$1 - \delta - \frac{\partial Y_2^{II}}{\partial \overline{q_2}}\frac{\partial q}{\partial Y_2^I} - \frac{\partial Y_2^{II}}{\partial y_2^{II}}\frac{\partial \overline{t_2}}{\partial Y_2^I} > 0. \tag{40}$$

From above we know that $0 < \frac{\partial Y_2^{II}}{\partial \overline{q_2}}\frac{\partial \overline{q_2}}{\partial Y_2^I} \equiv \frac{\partial q/\partial Y_2^I}{\partial q/\partial Y_2^{II}} < 1$ and that $0 < \frac{\partial Y_2^{II}}{\partial y_2^{II}}\frac{\partial y_2^{II}}{\partial Y_2^I}$, but without making further assumptions about the production function we can not conclude whether or not condition (40) holds. Therefore, we do not know whether Y_3 is below, equal to, or above Y_2, and even if we assume that $\frac{\partial^2 q}{\partial y \partial Y} \leq 0$, we cannot even rule out that Y_3 is so much lower than Y_2 that X_3^{Tot} becomes larger than X_2^{Tot}.

E. Derivation of results regarding intergovernmental grants

With an intergovernmental transfer (called strategy 2i), y_{2i}^{II} and Y_{2i}^{II} are not functions of $\overline{t_{2i}}$ if $y_{2i}^{II} < Y_{2i}^{II}$ when $s_{2i} = 0$, since the leader can then offset marginal changes in $\overline{t_{2i}}$ by altering s_{2i}. The voters' first order conditions (described in Appendix C for strategy 2) can thus be written

$$y_{2i}^{I} \quad : \quad -u'\left[1-\delta\frac{\partial Y_{2i}^{II}}{\partial \overline{q_{2i}}}\frac{\partial q}{\partial y_{2i}^{I}}(1-\delta)\right]+\varphi'\frac{\partial q}{\partial y_{2i}^{I}}=0, \tag{41}$$

$$Y_{2i}^{I} \quad : \quad -u'\left[1-\delta\frac{\partial Y_{2i}^{II}}{\partial \overline{q_{2i}}}\frac{\partial q}{\partial Y_{2i}^{I}}(1-\delta)-(1-\delta)\right]+\varphi'\frac{\partial q}{\partial Y_{2i}^{I}}=0. \tag{42}$$

Combining these conditions and rearranging shows that the solution is described by $\delta=\frac{\partial q/\partial Y_{2i}}{\partial q/\partial y_{2i}}$.

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