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Fiscal Federalism

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HOW DO LOCAL GOVERNMENTS DECIDE ON PUBLIC POLICY IN FISCAL FEDERALISM? TAX VS. EXPENDITURE OPTIMIZATION[*]

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ABSTRACT: Previous literature widely assumes that taxes are optimized in local public finance while expenditures adjust residually. This paper endogenizes the choice of the optimization variable. In particular, it analyzes how federal policy toward local governments influences the way local governments decide on public policy. Unlike the presumption, the paper shows that local governments may choose to optimize over expenditures. The result most notably prevails when federal policy subsidizes local taxation. The results offer a new perspective of the efficiency implications of federal policy toward local governments and, thereby, enable a more precise characterization of local government behaviour in fiscal federalism.

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1 Introduction

Models of local public finance predominantly take taxes as being optimized while expenditures are residually determined via the budget constraint. The view is one possible prescription of how governments decide on fiscal policy. In making budgetary decisions, governments may equally set expenditures optimally and let taxes adjust residually.[1] Given the two options, a natural question is why governments should prefer one or the other budgetary item as a policy variable. A potential strategic motive is that each item differently influences the amount of federal resources which flow to the jurisdiction. Incentives to attract federal transfers, either intended or unintended by federal policy, are widespread in local public finance. Besides responding to corrective grants to cash in on federal resources, local governments also adjust their taxes in order to receive more formulaic equalizing transfer payments (Smart, 1998, Buettner, 2006, and Egger et al., 2007). Similarly, local governments may well select inefficient local policies to lure more discretionary federal transfers to the local budget, e.g., as part of a bailout package (Wildasin, 1997, Qian and Roland, 1998, and Pettersson-Lidbom, 2008). Building on these insights, the goal of this paper is to analyze whether federal policy has a bearing on the choice of the policy variable in local public finance. That is, we set up a model where the choice of the policy variable is not imposed, but arises endogenously from the fundamentals of the fiscal architecture of the federation. In so doing, we consider a model of fiscal federalism in which local policies interact through a formula-based equalization scheme. Local governments levy a tax on local residents and use the proceeds along with federal transfers to provide a public good.

A presumption might be that expenditure and tax optimization yield identical policy outcomes since taxes and expenditures are inherently related via the budget constraint. This presumption holds true when local economies are fiscally independent, i.e., when there exists no fiscal interaction between policy choices by different local governments. The bias towards tax optimization in the existing literature is innocuous in such a fiscal environment. We show that the equivalence between tax and expenditure policy becomes invalid if local policies are linked via transfer programmes. Key to the result is that tax and expenditure policy have different effects on transfer payments and local governments thus strategically choose their

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[1]Throughout the paper we interchangeably refer to tax (expenditure) optimization as tax (expenditure) policy and to the optimization variable as policy variable.

policy variable in order to gain in transfers. In particular, when local taxation crowds out transfer payments, governments lure more transfers to their budgets by choosing taxes as the policy variable. Differently, when transfers rise with local taxes, governments opt for expenditure optimization in order to gain in transfer income.

The analysis allows for a more informed prediction as to the efficiency of pubic good provision in fiscal federalism. For instance, when transfers encourage local taxation, state governments optimize over expenditures and public good provision is more severely downward distorted than when taxes are optimized (as widely assumed in the literature). However, when transfers undermine taxing incentives, the efficiency prediction as perceived in the literature turns out to be consistent with the equilibrium analysis. The results are of relevance for the design of corrective policy. The prediction as to the magnitude of the inefficiency in local public finance generically differs in models with (exogenous) tax optimization and with an endogenous selection of policy variables, and so does the appropriate matching component of the Pigouvian grant.

While the notion that expenditure and tax policy have different implications for local public finance is well established in the literature, it lacks (to the best of our knowledge) an analysis of when local governments opt for one or the other type of policy setting. In particular, Wildasin (1988) and Bayindir-Upmann (1998) contrast expenditure and tax policy in the presence of capital mobility among jurisdictions. Hindriks (1999) compares transfer and tax competition when households are mobile. The papers do not endogenize the choice of policy instruments over which local governments compete in fiscal competition. More related to the present paper, Akai and Sato (2005) contrast expenditure and tax policy setting in a two-tier federal system in which the federal government provides transfers ex-post. The choice of the optimization variable is exogenous to the analysis.

Finally, the choice of optimization variable determines with which policy variable state governments commit toward other states' fiscal policy.[2] The endogenous choice of commitment relates the paper to the Industrial Organization literature on endogenous timing of moves, and hence commitment, in models of firm competition (e.g., Van Damme and Hurkens, 1999, and Caruana and Einav, 2008). Therein, the sequence of decisions is determined endogenously, while the choice of optimization variables is exogenous. In this paper

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[2]Optimizing over, e.g., the tax rate implies that other states perceive the tax rate to be held fixed, and thus to be pre-committed, when they choose their policy simultaneously.

it is reversed: the sequence of moves is exogenous while the choice of optimization variables (for state governments) is endogenous.[3] The paper is also related to the literature on price versus quantity competition between firms. The prediction is that firms prefer to compete with respect to quantities; see, e.g., Singh and Vives (1984) and Cheng (1985). Instead, this paper analyzes the role of interstate transfers for the type of public decision making.

The outline of the paper is as follows. Section 2 introduces a model of and Section 3 characterizes the choice of the policy variable by state governments. Section 4 summarizes and concludes.

2 Model

Consider two states which form a federation. The representative household in state i ($i = 1, 2$) derives utility from private consumption, c^i, leisure, l^i, and public consumption, g^i, according to the utility function $u^i(c, l, g)$ where $u^i_k > 0$ and $u^i_{kk} < 0$, $k = c, l, g$.[4] We assume that preferences are weakly separable in public consumption, g^i, and private consumption levels, c^i and l^i. The private budget constraint is

$$c^i = (1 - \tau^i)w^i L^i, \tag{1}$$

where $\tau^i \in [0, 1]$ is the wage tax rate levied by state government i, w^i denotes the wage rate and L^i is household labor supply in state i. The household has an time endowment of unity such that $L^i + l^i = 1$. The utility-maximizing labor supply is characterized by

$$u^i_c(1 - \tau^i)w^i - u^i_l = 0. \tag{2}$$

The first-order condition implicitly defines labor supply as a function of the net-of-tax wage rate $(1 - \tau^i)w^i$. In the sequel we assume that the substitution effect dominates the income effect such that $L^i_{(1-\tau^i)w^i} > 0$. The assumption implies that wage taxation shrinks the local tax base.

The representative firm in state i produces the numéraire output y^i using the linear

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[3]Note, the two types of commitment, i.e. the sequencing of moves and the choice of optimization variables, are not equivalent. The former relates to sequential games while the latter already exists in simultaneous move games. Also, with the former type it is the best response of players which determines the value of commitment. With the latter it is the residual variation of fiscal variables (determined by the budget constraint rather than first-order conditions) which is primarily decisive for the choice of the commitment strategy.

[4]Subscripts denote partial derivatives throughout.

technology $y^i = L^i$.[5] Markets are perfectly competitive and profit maximization implies $w^i = 1$.

State governments finance public expenditures $\{g^i\}_{i=1,2}$ by locally collected wage taxes $\{T^i = \tau^i L^i\}_{i=1,2}$ and interstate transfers $\{z^i\}_{i=1,2}$

$$g^i = T^i + z^i. \tag{3}$$

The transfer to state i, z^i, is conditioned on the level of the local tax rate τ^i and the tax rate of the neighbor jurisdiction τ^j,

$$z^i = \gamma(\tau^i, \tau^j), \quad \text{where } z^i + z^j = 0. \tag{4}$$

Given the generality of the transfer formula, we impose three reasonable assumptions:

$$\left| z^i_{\tau^i} \right| < d(\tau^i L^i)/d\tau^i, \qquad \text{sign}\{z^i_{\tau^i}\} = \text{sign}\{z^j_{\tau^j}\}, \qquad \text{and} \qquad \text{sign}\{z^i_{\tau^i}\} = const.$$

The first assumption says that changes in taxes do not imply an over-proportional change in transfers. The marginal tax or subsidy on own-source tax revenues is below 100 percent. Second, states are symmetrically treated by transfer policy in the sense that $\text{sign}\{z^i_{\tau^i}\} = \text{sign}\{z^j_{\tau^j}\}$. The transfer formula may still be non-linear in taxes and, thereby, the slope $\{z^i_{\tau^i}\}_{i=1,2}$ may differ in magnitude over the range of feasible taxes. Third, $\text{sign}\{z^i_{\tau^i}\}$ is non-reversal, i.e., it is the same for all feasible levels of taxes.

The transfer scheme (4) is to be understood as a reduced form representation of various real-world transfer systems. It embeds different types of formulaic transfers which most notably differ w.r.t. the sign of the transfer response $z^i_{\tau^i}$. As an example, transfers which share locally collected tax revenues across states typically respond negatively to a rise in own-source tax revenues. Concretely, the transfer formula is

$$z^i = \alpha \left[\frac{\tau^1 L^1 + \tau^2 L^2}{2} - \tau^i L^i \right], \qquad \alpha \in (0,1).$$

State i's entitlement payment follows from comparing its tax revenues with the benchmark of average tax revenues in the federation. The change in transfers z^i following a hike in τ^i is $z^i_{\tau^i} = -0.5\alpha d(\tau^i L^i)/d\tau^i$. Provided the economy in state i operates on the upward-sloping part of the revenue hill, i.e. $d(\tau^i L^i)/d\tau^i > 0$, state i loses in transfers when increasing the tax rate.[6]

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[5]The assumed production function, including the symmetry assumption, is without loss of generality.

[6]As will become clear, embedding the transfer formula in our model and solving for optimal state policy, the requirement is always fulfilled in equilibrium.

Such a scheme is implemented among German states (e.g., Baretti et al., 2002).[7] The formula may also be interpreted as a reduced-form representation of discretionary transfer policy by the federal government which implicitly taxes local tax revenues by reducing transfers. See, e.g., Zhuravskaya (2000).[8]

Differently, fiscal capacity equalization transfers rise in response to a hike in own-state tax rates (Smart, 1998). Transfer schemes which build on the notion of fiscal capacity equalization are implemented in a variety of countries including Australia, Canada, Germany (at the municipal level) and Switzerland. With fiscal capacity equalization, the transfer formula reads

$$z^i \;\; = \;\; \alpha\bar{\tau}\left[\frac{L^1 + L^2}{2} - L^i\right], \qquad \alpha \in (0,1).$$

Entitlement payments are calculated using a standardized tax rate $\bar{\tau}$ rather than actual tax rates. The states' tax base are proxies for the states' fiscal capacity. Straightforwardly, a higher tax rate reduces the tax base and this increases entitlement payments, $z^i_{\tau^i} = -0.5\alpha\bar{\tau}L^i_{\tau^i} > 0$.[9] Effectively, such a scheme partly insulates the state budget from the negative tax base response. Power-equalizing systems which are used in a number of US states to equalize education finances exert a similar positive incentive effect on local tax rates; see, e.g., Fernandez and Rogerson (2003).[10]

State governments are benevolent and maximize utility of the representative household. The sequence of decisions is:

Stage 1: States simultaneously choose whether to optimize over taxes or expenditures.

Stage 2: States simultaneously optimize over the policy variable chosen at the first stage.

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[7]Baretti et al. (2002) show that the marginal tax the interstate equalization system imposes on own-source tax revenues goes up to roughly 50 percent. German states do not set the statutory tax rate, but are in charge for tax collection. Their decision on tax enforcement and auditing thereby influences tax revenues. The transfer system discourages enforcement and auditing effort in the same way as it discourages tax effort.

[8]Local governments in Russia engage in repeated negotiations with the upper level government to determine the amount of transfers from the upper level government and the amount of own-source revenues which are transferred to the upper level. As found by Zhuravskaya, on average 90 percent of each additional ruble in own-source tax revenues is implicitly taxed away by the upper level by a retrenchment of transfers or a higher amount of revenue-sharing.

[9]Empirical analyses finding evidence for a positive incentive effect of fiscal capacity equalization include Buettner (2006), Smart(2007), and Egger et al. (2007).

[10]Similar to fiscal capacity equalization systems, power-equalizing transfers insulate local governments from tax base responses since the transfer scheme assigns a standardized tax base rather than the actual tax base to local governments when equalizing fiscal capacities. Incentives to tax are thereby strengthened.

Stage 3: Households decide on private consumption levels $\{c^i\}_{i=1,2}$ and $\{l^i\}_{i=1,2}$. Firms choose labor demand.

Stage 4: Production takes place, transfers $\{z^i\}_{i=1,2}$ are paid, taxes $\{T^i = \tau^i L^i\}_{i=1,2}$ are collected, and households consume $\{c^i, l^i, g^i\}_{i=1,2}$.

We refer to the four stages as a policy selection game and we solve for a subgame-perfect equilibrium (in pure strategies) by applying backward induction.

3 Equilibrium Analysis

To isolate the incentive effects inherent to federal policy, it is instructive to first characterize local decision-making in the absence of transfers, i.e. $z^i \equiv 0$. In this case state i solves

$$\max \quad u^i(c, l, g) \quad \text{s.t.} \quad \text{Eqs.} \quad (1), (2), \text{ and } (3) \tag{5}$$

either by differentiating w.r.t. τ^i (with g^i being residually determined) or w.r.t. g^i (with τ^i being residually determined).[11] In the former case, the first-order condition is

$$\frac{u^i_g}{u^i_c} = \frac{L^i}{L^i + \tau^i L^i_{\tau^i}}. \tag{6}$$

In the latter case, τ^i residually follows from (3) and the first-order condition is

$$-u^i_c \left(-\tau^i_{g^i} L^i \right) + u^i_g = 0. \tag{7}$$

From (3) we can compute the budget-balancing change in the tax rate in response to a higher spending level which is $\tau^i_{g^i} = 1/T^i_{\tau^i}$. Inserting the response into (7) shows that the provision rule reduces to (6). In either case, public goods are (second-best) efficiently provided and importantly, given the absence of interstate linkages, optimal state policy and hence utility is independent of the neighbor state's policy. The implication for the equilibrium choice of policy variables at stage 1 of the game is straightforward. Given the absence of fiscal interaction between states, tax and expenditure optimization are equivalent irrespectively of how

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[11]Note, the tax rate and the expenditure level are related via the public budget constraint (3) and, so, requiring the budget to be balanced in and out of equilibrium, the government can effectively only optimize over one instrument, while the other instrument is residually determined. An alternative would be to allow governments to optimize over the two sides of the budget simultaneously. Such a strategy would imply that budgets are not balanced out of equilibrium. See Caplin and Nalebuff (1997) for a critique of this type of strategy.

the neighbor state decides on its policy variable. The conclusion is that any choice of policy variable is an equilibrium of the policy selection game.

Proposition 1: *In the absence of transfers ($z^i \equiv 0$) any pair of policy variables selected by state governments is a subgame-perfect equilibrium of the policy selection game.*

We now re-introduce federal transfer policy and analyze the extent to which the equivalence result leading to Proposition 1 is preserved. First, assume that state j optimizes over τ^j. Optimal policy in state i follows from

$$\max \quad u^i(c, l, g) \quad \text{s.t.} \quad \text{Eqs.} \quad (1), (2), (3) \text{ and } (4), \tag{8}$$

taking τ^j as given, Consider first that state government i optimize over the tax rate. Differentiating w.r.t. τ^i, given τ^j, yields

$$\frac{u_g^i}{u_c^i} = \frac{L^i}{L^i + \tau^i L_{\tau^i}^i + z_{\tau^i}^i}. \tag{9}$$

When $z_{\tau^i}^i < 0 \, (> 0)$ state i anticipates a loss (gain) in transfers in response to a rise in taxes with the consequence that public goods are underprovided (overprovided) relative to the second-best rule (6). Provided $z_{\tau^i}^i < 0$, state i operates on the upward-sloping part of the tax revenue hill - an implication which may not hold when $z_{\tau^i}^i > 0$. In what follows we assume that $T_{\tau^i}^i > 0$ holds in equilibrium.

Consider now that state i optimizes over expenditures g^i while state j continues to select the tax rate τ^j. (3) implicitly defines state i's tax rate as a function of expenditures, $\tau^i(g^i)$ with slope $\tau_{g^i}^i = 1/(T_{\tau^i}^i + z_{\tau^i}^i)$. Solving (8) by selecting expenditures, taking τ^j as given, yields the first-order condition (7) with the exception that transfers now also influence the residual variation in the tax rate, as shown above. Inserting $\tau_{g^i}^i$ and rearranging, the first-order condition reduces to (9). Hence, tax and expenditure optimization lead to identical fiscal outcomes and the same level of state i utility for any given level of state j's policy variable τ^j. Intuitively, transfer payments react in the same way to taxes irrespectively of whether the state government directly pins down the change in taxes or whether the change follows residually from the budget constraint.

When state j optimizes over expenditures, its tax rate adjusts residually to a change in transfer income which in turn affects state i's transfer payment. State i realizes the fiscal

feedback mediated via the transfer system and, hence, perceives transfer income to be given by

$$\bar{z}^i = \gamma(\tau^i, \tau^j(\tau^i)), \tag{10}$$

where $\tau^j(\tau^i)$ describes the relation between taxes for a given level of g^j as implicitly defined by (3) (indexed to j). State i solves

$$\max \quad u^i(c, l, g) \quad \text{s.t.} \quad \text{Eqs.} \quad (1), (2), (3) \text{ and } (10), \tag{11}$$

taking g^j as given. Differentiating w.r.t. τ^i, the optimal policy satisfies

$$\frac{u_g^i}{u_c^i} = \frac{L^i}{L^i + \tau^i L_{\tau^i}^i + \bar{z}_{\tau^i}^i}. \tag{12}$$

$\bar{z}_{\tau^i}^i$ describes the total response in transfers including the "see-through" effect. Straightforwardly, public consumption is underprovided (overprovided) relative to the second-best rule when $\bar{z}_{\tau^i}^i < 0 \ (> 0)$.

When state i chooses g^i, the budget constraint (3) and transfers (10) implicitly define τ^i as a function of g^i with slope $\tau_{g^i}^i = 1/(T_{\tau^i}^i + \bar{z}_{\tau^i}^i)$. Straightforwardly, the first-order condition which follows from solving (11) w.r.t. g^i is identical in structure to (7). Inserting the tax rate response $\tau_{g^i}^i$ into (7) and rearranging shows that the public good provision rule coincides with (12). Consequently, state i's incentive to provide public goods and also state i's utility are unaffected by its choice of the policy variable conditional on the level of g^j. As before, the intuition for the conditional equivalence result is that both policy regimes have identical consequences for taxes and, thus, transfer payments as long as g^j stays constant.

However, comparing (9) and (12) reveals that the choice of the policy variable in the neighboring state influences state i's policy. More concretely, state i's policy deviates from the second-best rule for any choice of policy variable by the neighboring state. But, given the different transfer responses, the scope of inefficiency depends on which variable the neighboring state optimizes. To relate the transfer response in (9) to the response in (12), we differentiate (10) which gives

$$\bar{z}_{\tau^i}^i = z_{\tau^i}^i + z_{\tau^j}^i \tau_{\tau^i}^j. \tag{13}$$

The first term on the right-hand side is the direct effect of own-state taxes on transfer income, while the second term captures the "see-through" effect. Implicitly differentiating (3), while

keeping g^j constant, and using the self-financing requirement $z^j_{\tau i} = -z^i_{\tau i}$ yields

$$\tau^j_{\tau i} = \frac{z^i_{\tau i}}{T^j_{\tau j} + z^j_{\tau j}}. \tag{14}$$

Combining (13) and (14) and inserting $z^i_{\tau j} = -z^j_{\tau j}$, we get

$$\bar{z}^i_{\tau i} = \frac{z^i_{\tau i}}{1 + z^j_{\tau j}(T^j_{\tau j})^{-1}} \quad \Rightarrow \quad \bar{z}^i_{\tau i} < z^i_{\tau i}. \tag{15}$$

Note from our previous discussion that the denominator of the first term in (15) is positive. The consequential inequality in (15) reveals that the tax-induced change in transfers is more favorable for state i (either more inflow or less outflow) when state j optimizes over taxes.[12] The rationale is that tax and expenditure policy interact differently through the transfer scheme. Precisely, changes in state i's tax policy have consequences for transfers in state j since both states' entitlement payments are linked via the transfer budget constraint. This raises the issue of how state j uses the additional funds. When it optimizes over taxes, state i conjectures state j to adjust spending levels which has no consequences for transfers. These are conditioned only on tax rates. However, when state j optimizes over expenditures it is conjectured to adjust taxes residually which initiates a change in state j's and, thus, state i's transfer income.

The inequality in (15) shows that the repercussion on state i's transfer income is negative when $z^i_{\tau i}$ is negative as well as positive. For instance, provided $z^i_{\tau i} < 0$ transfers flow to state j in response to a higher tax in state i. The additional transfer income is used to reduce taxes which in turn lure even more transfers to state j financed by a cut-back of transfers to state i. The reduction in transfer income clearly dilutes state i's incentives to spend on public consumption. A similar line of reasoning applies when $z^i_{\tau i} > 0$. We can thus summarize:

Lemma 1: *State i's incentives to provide public goods are less pronounced when state j optimizes over expenditures rather than taxes. In particular, provided $z^i_{\tau i} < 0$ (> 0) public goods are more severely underprovided (less severely overprovided) in state i relative to the second-best rule when public expenditures rather than taxes are subject to optimization in state j.*

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[12]In case $z^i_{\tau i} < 0$ the first-order condition (12) only holds provided $z^i_{\tau i}$ is not too negative. Otherwise, state i will select a zero tax rate. To save on notation we abstract from corner solution in what follows.
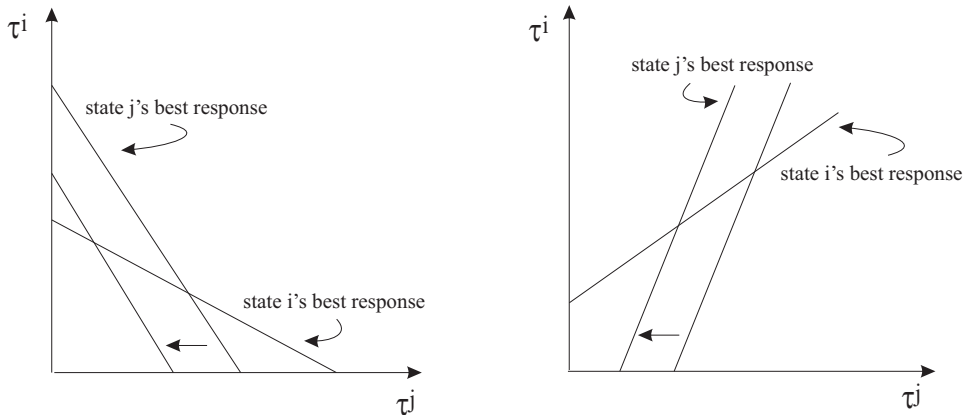
Figure 1: Best Responses for $z_{\tau^i}^i < 0$ (left panel) and $z_{\tau^i}^i > 0$ (right panel).

We will now turn to the subgame-perfect choice of the optimization variable at stage 1 of the game. This involves a comparison of stage-2 utilities for any possible combination of optimization variables by both states. Utility in the different stage-2 games may differ because the tax price of public expenditures in the neighboring state depends on the own choice of policy variable. States understand the effect and are inclined to manipulate the neighbor state's policy in order to qualify for more transfers. Before proceeding, note that in any stage-2 subgame, the states' best responses are implicitly defined by the first-order conditions (9) and (12), respectively. Equilibrium existence follows from standard fixed point theorems. We assume uniqueness and stability of the stage-2 equilibrium throughout.[13]

We derive our main finding with the help of Figure 1.[14] The left panel in Figure 1 depicts the best response by both states when $z_{\tau^i}^i < 0$ to which we will turn first. Consider both states initially optimize over taxes and state i deviates from tax to expenditure optimization. Point A is the initially prevailing equilibrium of the stage-2 game. Following the deviation, it becomes more costly for the neighboring state j to raise taxes which implies that its best-response function shifts inwards.[15] Recall from the first-order conditions (9) and (12) and the transfer response difference (15) that incentives to tax are weaker when the neighboring state

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[13]In particular, we need to impose global stability rather than local stability since changes in the policy variable at stage 1 trigger discrete changes in states' best responses at stage 2. See, e.g., Vives (2000) for a formal definition of global and local stability.

[14]For simplicity, best responses are drawn as linear functions. The figures are drawn in such a way that taxes are strategic substitutes (complements) when $z_{\tau^i}^i < 0 \ (> 0)$. The chosen classification is irrelevant for the results. Note, it is compatible with optimal state policy and, in fact, it unambiguously follows from the first-order conditions (9) and (12) provided $z_{\tau^i \tau^j}^i \equiv 0$.

[15]The locus of state i's best-response function stays the same (implicitly defined by (9)). Note, state i's provision rule is insensitive to its choice of policy variable and so is its best response.

optimizes over expenditures. The new tax choices are illustrated by point B which entails a lower tax rate in state j.

To see whether state i benefits from the reduced tax rate τ^j, we compare state i's utility in equilibrium A and B. To infer into the utility differential, we evaluate the change in state i's utility when moving along state i's best-response function as a consequence of a change in state j's tax rate. To this end, let's define $v^i(\tau^j)$ as the utility state i obtains along its best-response function. Formally, $v^i(\tau^j)$ follows from inserting state i's best-response function (implicitly defined by (9)) into its utility function. It is important to note that, given the conditional equivalence between tax and expenditure optimization by state i, $v^i(\tau^j)$ is only conditioned on the policy variable by the neighboring state and holds irrespectively of state i's choice of policy variable. It follows that $v^i(\tau^j)$ applies prior and after state i's deviation and so does the utility change which is derived next.

Invoking the envelope theorem and rearranging, the change in utility $v^i(\tau^j)$ in response to a hike in state j's tax rate is[16]

$$\frac{dv^i(\tau^j)}{d\tau^j} = u^i_g g^i_{\tau^j}. \tag{16}$$

The term $g^i_{\tau^j}$ is the residual adjustment in expenditures keeping τ^i constant. The effect of τ^j on v^i via an adjustment of τ^i cancels out since state i's utility is maximized w.r.t τ^i. From (3) and (4), the residual adjustment is $g^i_{\tau^j} = z^i_{\tau^j}$. Inserting this and $z^i_{\tau^j} = -z^j_{\tau^j}$ into (16) yields

$$\frac{dv^i(\tau^j)}{d\tau^j} = -u^i_g z^j_{\tau^j}. \tag{17}$$

Utility decreases following a lower tax rate in state j. The reason is that state j's entitlement payments increase which implies a drop in transfers which flow to state i. So, state i experiences a loss in utility due to a loss in transfer income when moving along state i's best response from A to B.[17] We can conclude that state i is worse off following the deviation to expenditure optimization. By symmetry of policy incentives, neither state has an incentive to switch to expenditure optimization given that the neighbor state optimizes over taxes.

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[16]Given that $v^i(\tau^j)$ applies prior and after state i's deviation, we can derive the utility change assuming that state i sets either taxes or expenditures. Here, we follow the former approach. A derivation of the utility change which rests upon the latter approach is available upon request.

[17]Clearly, given the discrete change in state j's tax rate, we cannot quantify the utility differential with the help of (17). But, as shown above, the marginal change of state i's indirect utility along its best response is unambiguous in sign. Thus, the approach is still informative as to the sign of the utility differential which suffices to establish our main result.

The right panel in Figure 1 depicts both states' best responses for $z^i_{\tau^i} > 0$. The initial equilibrium of the stage-2 subgame is point A. Following state i's deviation to expenditure policy state j's tax price of public spending rises, and state j's best-response function shifts inwards. The tax rate τ^j decreases (see point B). Following (17), state i's utility rises when moving along state i's best response from the initial equilibrium A to the new equilibrium B. Consequently, state i's utility increases when it sets expenditures rather than taxes.

In sum:

Lemma 2: *Assume that state j optimizes over taxes. State i's best response is to optimize over taxes (expenditures) iff $z^i_{\tau^i} < 0$ (> 0).*

Next, we will reiterate the steps involved in deriving Lemma 2 for the case that state j optimizes over g^j. The diagrammatic exposition of the choice of policy variable is analogous to Figure 1. We hence refrain from a separate graphical illustration. Suppose that state i initially optimizes over τ^i and deviates from tax to expenditure policy. From Lemma 1 we observe that a deviation to expenditure optimization by state i increases state j's tax price which incentivizes state j to spend less on public consumption. To evaluate the utility change, we define $v^i(g^j)$ as state i's utility evaluated at public policy which satisfies the optimality condition (12). The envelope theorem implies[18]

$$\frac{dv^i(g^j)}{dg^j} = u^i_g g^i_{\tau^j} \tau^j_{g^j}. \tag{18}$$

The term $g^i_{\tau^j}$ describes how state j's tax rate change affects spending in state i for a given tax rate τ^i. Note, τ^i is held fixed in the expression since the effect of changes in the optimal level of τ^i on v^i nullifies by an application of the envelope theorem. The term $\tau^j_{g^j}$ is the effect of g^j on τ^j given τ^i. Using (3) and (4), we can write the two terms as $g^i_{\tau^j} = z^i_{\tau^j}$ and $\tau^j_{g^j} = 1/(T^j_{\tau^j} + z^j_{\tau^j})$. Inserting the expressions into (18), while noting $z^i_{\tau^j} = -z^j_{\tau^j}$, gives

$$\frac{dv^i(g^j)}{dg^j} = -u^i_g \frac{z^j_{\tau^j}}{T^j_{\tau^j} + z^j_{\tau^j}}. \tag{19}$$

As the drop in state j's expenditures translates into a lower tax, state i's transfer income and

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[18]Again, we derive the utility change when state i sets taxes. Given the equivalence between tax and expenditure optimization by state i, the approach is without loss of generality. The alternative derivation is available upon request.

thus utility drops (rises) in response to the lower tax in state j when $z^j_{\tau^j} < 0$ (> 0).[19] Hence:

Lemma 3: *Assume that state j optimizes over expenditures. State i's best response is to optimize over taxes (expenditures) iff $z^i_{\tau^i} < 0$ (> 0).*

We are now equipped to characterize the choice of policy variables which are mutual best responses. Combining Lemma 2 and 3, we conclude for the case $z^i_{\tau^i} < 0$ that state i loses in utility when optimizing over expenditures instead of taxes. The result holds irrespectively of whether state j optimizes over taxes or expenditures. Hence, in the subgame perfect equilibrium of the policy selection game both states optimize over taxes. When $z^j_{\tau^j} > 0$ state i gains in utility when optimizing over expenditures rather than taxes. Again, the finding holds irrespectively of whether state j optimizes over taxes or expenditures. Consequently, the subgame perfect equilibrium of the policy selection game entails states to optimize over expenditures.

We can summarize our main result as follows:

Proposition 2: *The subgame perfect equilibrium of the policy selection game entails tax (expenditure) optimization when transfers undermine (strengthen) state taxing incentives, i.e., $z^i_{\tau^i} < 0$ (> 0).*

States compete for transfers and choose the optimization variable strategically so as to lure more funds to the public budget. In a nutshell, states find it more costly to raise taxes when other states commit to expenditure levels. States play on this effect and strategically induce lower taxes in neighboring states by committing to expenditure levels whenever the transfer system rewards such a strategy. Clearly, the lower tax rate relocates transfers to the own budget provided $z^i_{\tau^i} > 0$. Otherwise, states lose in transfer income and are better off when committing to tax rates. The type of transfer competition is different to the one analyzed in the literature so far which resorts to transfer-induced policy incentives for a given choice of optimization variable.

Finally, it may be interesting to emphasize that in the model states choose the policy variable which leads to a more efficient public good provision. Lemma 1 shows that tax policy

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[19]Recall, the denominator in (19) is positive.

leads to a less severe underprovision of public spending when $z^i_{\tau i} < 0$, while expenditure policy leads to less overprovision of public spending when $z^i_{\tau i} > 0$. Hence, absent corrective federal instruments and other formal coordination devices, states non-cooperatively select the size of the public sector which is socially preferred.

4   Discussion and Concluding Remarks

Previous literature predominantly assumes taxes to be optimized and expenditures to adjust residually. The paper endogenizes the choice of policy variables by state governments and, in particular, explores how federal policy toward state governments influences the choice. We find that governments choose to optimize over expenditures when federal transfers subsidize tax effort. Conversely, governments choose taxes as the policy variable when transfers implicitly tax own-source tax revenues. The paper's results are of relevance for predicting the efficiency of state policy and the design of corrective policy. Specifically, the efficiency of local policy for a given choice of policy variable and the efficiency when accounting for the endogeneity of policy variables may differ and so does the appropriate matching component in the Pigouvian grant formula.

A straightforward question relates to the sensitivity of the results to the channel through which state policy interacts. To infer into it, Koethenbuerger (2008) also considers a different model of fiscal federalism frequently invoked in the literature. Therein, states "see through" the federal tax policy decision which opens up a second source of fiscal interaction.[20] State policy not only affects the amount of transfers, but also influences the amount of taxes state residents pay to the federal government. In this setting, the divergent interaction of tax and expenditure policy implies that states may not optimize over taxes even though transfers undermines taxing effort. Provided the disincentive effect of transfers policy is sufficiently pronounced, the equilibrium choices turn out to be asymmetric in the sense that one state chooses to optimize over taxes, whilst the other state optimizes over expenditures.

The main part of the paper builds on the assumption that state budgets are only fiscally linked through federal policy. In practice, budgets are also fiscally connected through the mobility of taxable resources such as capital or households. Having said this, we believe that

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[20]The type of "see through" delineates a game of decentralized leadership or of soft budget constraints – see, e.g., Wildasin (1997), Qian and Roland (1998), Caplan et al. (2000), Akai and Sato (2005) and Koethenbuerger (2007).

the paper's insights will likewise provide a helpful starting point for analyzing the choice of policy variables in different models of local public finance; e.g., nesting fiscal interaction through both tax base mobility and federal policy.

Finally, a natural question is whether the strategic incentives pertaining to the choice of policy variables may not be more multi-faceted than suggested in the paper. For instance, decomposing the expenditure side of the budget into consumption outlays and infrastructure investment, states are equally in a position to compete for transfers by optimizing over, e.g., consumption expenditures and taxes and by letting infrastructure spending adjust residually. Which pair of policy variables ultimately constitutes an equilibrium choice and how the choice influences the efficiency of the local public sector are interesting questions which are left to future research.

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