Tax Mix Corners and Other Kinks

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Abstract

This paper models the local tax mix determination process in the presence of statewide fiscal limitations—the decentralized government finance archetype—and shows how excess sensitivity of local public spending to grants (the conventionally and somewhat misleadingly termed "flypaper effect") arises in the constrained tax mix irrespective of whether lower or upper limits bind and how it cannot, in general, be taken as a symptom of local government overspending. An empirical application to Italian province panel data provides consistent evidence of the role of corner solutions produced by two-sided tax limits in explaining the sensitivity of local public expenditures to grants.

1. Introduction

The overall size as well as the tax revenue bundle of the local public sector in multitiered structures of government are outcomes of the decentralized decision-making process subject to the fiscal rules set by central (state) governments. As documented by Anderson (2006) and Wolman et al. (2008) for the United States and by Joumard and Kongsrud (2003) and Sutherland, Price, and Joumard (2005) for Organisation for Economic Co-operation and Development (OECD) countries, top-down tax and expenditure limitations are frequently so tight and pervasive as to jeopardize the principle of local fiscal autonomy.[1]

This paper investigates how statewide revenue-raising limitation rules shape

[1] Nechyba (1997) argues, though, that state command of local fiscal choices (in terms of income-tax-funded grants and state-imposed caps on local property tax rates) arises in equilibrium as optimal outside enforcement when a collusive agreement to simultaneously introduce local income taxes is not self-enforcing. Vigdor (2004) sees statewide local tax limitations as a way of allowing absentee landowners and nonresident employees to contain tax exporting. Calabrese and Epple (2010) provide a comprehensive political economy model of the emergence of tax limits in the presence of multiple policy instruments.

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local governments' budget constraints, focusing on the kinks that are typically generated by tax floors and caps.[2] In particular, it evaluates the effects of tax limits on the determination of the local tax mix and on the response of local public expenditures to grants. As far as the latter issue is concerned, a vast literature, most recently reviewed by Inman (2009), has investigated and sought to explain the anomalously high response of local spending to the receipt of grants relative to the response to private income—the so-called flypaper effect by which money from the central government "sticks where it hits" (Inman 2009).[3] Two broad kinds of explanations of the flypaper effect have been offered in the literature (Hines and Thaler 1995). The first has to do with a variety of specification and estimation errors that applied researchers made for decades. Those errors range from mistakenly treating matching grants as if they were lump-sum grants to omitting important variables—such as unobserved population characteristics or spatial lags of other governments' policies—that are simultaneously correlated with grants and local public expenditures. The second explanation relies on the argument that the political representation process is substantially richer than the one postulated by the standard neoclassical model: asymmetric information, loss aversion, fiscal illusion, separate mental accounting, special interest groups, and citizens' inability to write complete contracts with their elected officials would be responsible for the lack of fungibility between public and private uses of money and would cause the observed large flypaper effect.[4]

I model for the first time the local tax mix determination process in the presence of statewide tax limitations—the decentralized government finance archetype—and show how the flypaper effect arises in the endogenously generated constrained tax mix. In particular, I show that local expenditures are predicted to display a one-for-one response to grants in the presence of binding limitations on all local tax revenue sources. Interestingly, a binding cap on just one of the available own revenue sources is enough to generate some form of the flypaper effect, in the sense of an excess sensitivity (Flavin 1981) of local spending to grants. Importantly, these results hold when either upper or lower tax limitations are binding: in fact, local authorities will exhibit an excess sensitivity of public expenditures to grants irrespective of whether they are facing lower or upper bounds. Finally, the reaction of local public spending to own tax base shocks is a function of the (lower or upper) binding tax rate limits.

An important corollary of the analysis concerns the interpretation of the public

[2] Vertical restraints—such as quantity floors and price ceilings—are ubiquitous in private-sector networks too. Zanarone (2009) discusses the rich theoretical literature on vertical restraints as coordination mechanisms and analyzes empirically the role of public regulation in manufacturer-dealer contracts.

[3] According to Inman (2009), over 3,500 research papers exist documenting and seeking to explain the flypaper effect. Payne (2009) offers an insightful, wide-ranging review of the more recent research into the mirror phenomenon of crowd-out.

[4] Building on the insights of Hamilton (1986) and Becker and Mulligan (2003), Dahlby (2011) relaunches the explanation of the flypaper effect based on the convex deadweight costs of taxation.

spending behavior known as the flypaper effect. Since excess sensitivity of local public spending to grants should be predicted to arise—and generally tends to manifest itself—both when grants increase and when they decrease, the depiction of grants as sticky seems semantically dubious, and the flypaper effect label turns out to be a misleading one: a higher sensitivity of local public expenditures to grants than to own revenue sources cannot in general be interpreted as a sinister symptom of decentralized government overspending.

While the existing literature seems to have almost universally overlooked the potential impact of tax and expenditure limitations on the sensitivity of local public spending to exogenous variations in grants, some recent papers have brought the fiscal limitations issue into the empirical investigation of the flypaper effect. Lutz (2010) conjectures that previous evidence of a flypaper effect might have arisen from state constraints preventing local governments from selecting their preferred bundle of public goods and provides evidence of equivalence between grants and income from school finance reform in New Hampshire—"one of only five states with no state-imposed limitations on the taxing or spending power of local governments" (Lutz 2010, p. 317). Brooks and Phillips (2010) offer the first formal statement and explicit empirical test of the hypothesis that restrictive fiscal institutions might be responsible for the flypaper effect. They use data on the U.S. Community Development Block Grant program and argue that state tax and expenditure limitations may systematically force city governments to underprovide local public goods and increase the stimulative effect of federal grants on city spending. However, since they do not observe either the municipal tax bundle or whether a revenue-raising constraint is actually binding in any given city, they have to rely on a state-level index of fiscal constraints and ignore both the municipal choice as to own revenue source diversification and the issue of endogenous selection of a city government into the fiscally constrained status. Interestingly, Brooks and Phillips (2010) find a generally high sensitivity of spending to grants in a period of dramatic retrenchment, while they find only limited evidence of an effect of statutory state-level tax limitations on municipal governments' response to the collapse in Community Development Block Grants. Finally, Baicker (2001) analyzes states' responses to federally mandated increases in U.S. public medical spending (mandated expansions in Medicaid coverage). She develops a theoretical model showing that states subject to binding tax limits (legal ceilings) would have to reduce spending on other programs by more when faced with a mandatory spending increase than they would if they were able to raise taxes. While her empirical analysis reveals that all states—with or without limits—offset the mandated Medicaid increase by reducing other public welfare spending, she recognizes that this might be because she does not observe whether tax limits are actually binding.

The paper concludes with an empirical application to panel data on Italian provincial governments' budgets. The econometric setup relies on sharply observed corner solutions produced by nationwide tax limits during the years 2000–

2007 and exploits the exogenous features of state retrenchment following Italy's adherence to the European Union Stability and Growth Pact to estimate the effect of state grants on provincial expenditures. An attractive feature of Italian provinces is that their own tax revenue sources (a tax on vehicle registrations, a tax on electricity consumption for business uses, and a waste management surcharge) are subject to strict and frequently binding upper and lower tax rate limitations. The empirical analysis, based on a panel data switching regression approach that allows for endogenous selection into the tax-constrained regime and for potential grant endogeneity, offers evidence of excess sensitivity of local public spending to grants—a one-for-one response—in tax-constrained localities, irrespective of whether upper or lower tax limits bind. In contrast, I show that authorities that are not fully constrained turn out to be able to smooth out their expenditure profile by offsetting state grant policy in a period of fiscal retrenchment through own tax changes and that the impact of own tax bases on local expenditures depends on whether lower or upper limits are binding in the observed tax mix.

The paper is organized as follows. Section 2 sets up a simple model for the analysis of the local tax mix determination process in the presence of upper and lower constraints on own tax instruments. Section 3 develops the model's empirical implications and outlines the econometric strategy. Section 4 presents the tax structure of the Italian provinces. Section 5 reports and discusses the switching regression estimation results. Section 6 deals with grant and regime selection endogeneity issues, and Section 7 concludes.

2. Communicating Vessels

Consider the two vessels in Figures 1, 2, and 3. Say that vessel v_{pn} represents consumption of private goods out of community n's private income i_n ($n = 1, \ldots, N$) and vessel v_{gn} represents consumption of local public services. The width of the v_{gn} vessel relative to that of the v_{pn} vessel can be interpreted as reflecting community n's preferences for publicly provided—and possibly nonrival—services versus market-provided consumption goods.

The structure depicted in Figure 1 amounts to a perfect tax centralization arrangement in which expenditures on local public services are entirely funded by central government grants, g_n. Of course, nothing ensures that the allocation of resources to private and public uses reflects local preferences or that the marginal benefit from private consumption equals the marginal benefit from public consumption.

In Figure 2, the two vessels are allowed to communicate via local tax revenues. In order for local public goods to be provided optimally, and given that the marginal rate of transformation between private and public goods is assumed to be constant and equal to one, the marginal utility in the two vessels has to be equalized. Just like communicating vessels, for which the force of gravity

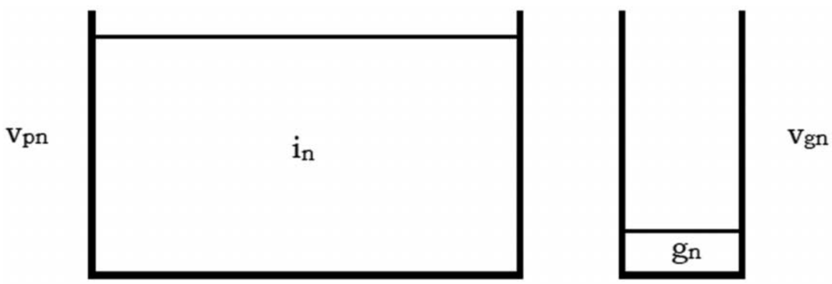

Figure 1. Communicating vessels: tax centralization

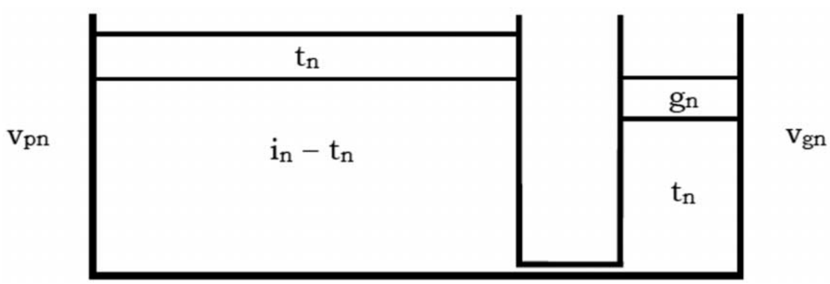

Figure 2. Communicating vessels: tax decentralization

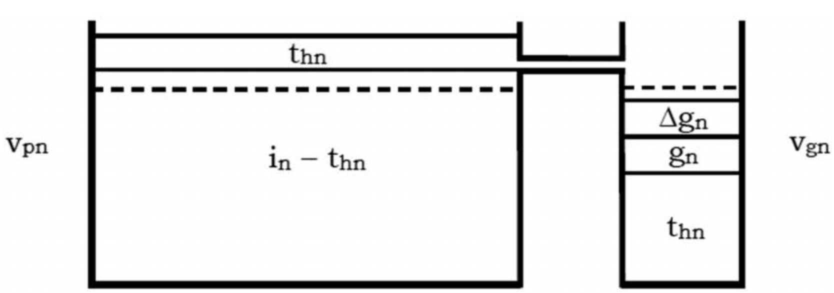

Figure 3. Communicating vessels: tax limitation

requires hydrostatic pressure to be balanced in the two vessels regardless of their relative sizes, the welfare optimization forces make resources flow from v_{pn} to v_{gn} at the tax rate of $\tau_n = t_n/i_n$. Once an even equilibrium level is attained in the two vessels, whether additional resources are poured into v_{pn} or into v_{gn}, the same allocation of private and public consumption will result.

In Figure 3, local jurisdiction n is subject to a tax rate cap of $h = t_{hn}/i_n$, with the cap binding if $t_{hn} < t_n$. The Samuelson condition for optimal public good provision will not be satisfied if the tax cap is binding, which means that more resources ought to flow from v_{pn} to v_{gn} in order to equate the pressure in the two vessels. An additional unit of private income will raise the consumption level at rate $1 - h$ in v_{pn} and at rate h in v_{gn}. If additional grants are poured into (pumped out of) v_{gn}, the level will increase (decrease) in v_{gn} only. This is the flypaper effect.

2.1. The One-Tax Case

Let the welfare of lower-tier jurisdiction n ($n = 1, \ldots, N$) in a two-tier structure of government be expressed as a separable, concave function of public and private goods consumption:

$$w_n = v(z_n) + \rho_n u(c_n) = \ln(z_n) + \rho_n \ln[i_n(1 - \tau_n)], \tag{1}$$

where z_n stands for expenditure on local public services, i_n is some meaningful measure of community income, τ_n is the flat local income tax rate, and ρ_n is a (positive) parameter reflecting preferences for private consumption versus consumption of local public services, and let local authority n abide by a balanced-budget rule:

$$z_n = g_n + \tau_n i_n, \tag{2}$$

where g_n stands for (lump-sum) grants from the upper tier of government.[5] Maximization of equation (1) subject to equation (2) leads jurisdiction n to select the optimal tax rate spending pair (τ_n^*, z_n^*) as a function of the assumed exogenous variables g_n and i_n:

$$\tau_n^* = \frac{1}{1 + \rho_n}\left(1 - \rho_n \frac{g_n}{i_n}\right) \tag{3}$$

and

$$z_n^* = g_n + \tau_n^* i_n = \frac{1}{1 + \rho_n}(g_n + i_n). \tag{4}$$

Equations (3) and (4) generate the standard neoclassical and somewhat uncom-

[5] It is usually convenient to interpret all monetary variables in equation (2) as measured in per capita terms, thus implying that publicly provided services entering the welfare function (equation [1]) are private (rival) in nature, and to ignore the revenue-raising effort and public good provision on the part of the upper level of government.

fortable result that exogenous perturbations in i_n or g_n should be predicted to have an identical effect on z_n^*:

$$\frac{\partial z_n^*}{\partial g_n} = \frac{\partial z_n^*}{\partial i_n} = \frac{1}{1 + \rho_n}.$$

When this does not happen, and in particular if a change in grants turns out in practice to provoke a much larger reaction in local public spending than a change in own resources does, a flypaper effect is said to exist (Hines and Thaler 1995).

Consider now the consequences of the introduction of a nationwide tax rate limitation:

$$l \leq \tau_n \leq h. \tag{5}$$

Quite straightforwardly, expenditures equal grants plus the maximum amount of revenues that can be collected locally ($g_n + hi_n$) if local government n is at the upper bound h, which means that authority n would like to tax private income more than permitted. Similarly, expenditures equal grants plus the minimum amount of revenues that have to be collected locally ($g_n + li_n$) if local government n is at the lower bound l, which means that it would like to tax private income less than permitted. As formally shown in Appendix A, this implies the following:

Proposition 1. Consider the constrained optimization problem given by equations (1), (2), and (5). Whether the upper or the lower tax rate limit binds, the sensitivity of local public spending to grants in the constrained optimum is one. The sensitivity of local public spending to own resources in the constrained optimum equals the binding tax rate limit.

In these circumstances, the flypaper effect is the result of tax limitations and arises irrespective of whether a lower limit (namely, local authorities wishing to tax less than permitted) or an upper tax limit (namely, local authorities wishing to tax more than permitted) binds. Moreover, since constrained local public expenditures should be predicted—and generally tend—to respond one-for-one both when grants increase and when they decrease (Stine 1994; Hines and Thaler 1995; Gamkhar and Oates 1996; Brooks and Phillips 2010), the flypaper effect label seems an inappropriate or even misleading one: the long-studied anomalous response to intergovernmental grants appears to be best described as an excess sensitivity (Flavin 1981) and cannot, in general, be interpreted as a symptom of local government overspending.

2.2. The Multiple-Tax Case

Now let lower-tier government n rely on $M \geq 2$ distinct own tax revenue sources as well as on upper-tier government lump-sum grants. Denoting by τ_n^m the flat rate set on tax base m (i_n^m), the budget constraint and welfare function can be expressed as

$$z_n = g_n + \tau_n' \boldsymbol{i}_n = g_n + \sum_{m=1}^{M} \tau_n^m i_n^m \quad (6)$$

and

$$w_n = \ln(z_n) + \sum_{m=1}^{M} \rho_n^m \ln[i_n^m(1 - \tau_n^m)] \quad (7)$$

with ρ_n^m capturing the contribution of tax base m to community n's social welfare. While I do not wish to make assumptions that are too specific, the M tax bases can be thought of as income flows generated within the local community by different assets held by residents (say, land, physical capital, human capital) or as comprehensive income accruing to distinct groups of residents (for example, depending on households' income brackets or age structure), as long as local governments can discriminate among those income flows by employing a given set of tax instruments $(\tau_n^1, \ldots, \tau_n^M)$.[6] Raising revenues from the M set of available tax bases leads to a welfare loss that depends in turn on the selected M vector of tax rates, with the marginal welfare loss of taxing base m increasing as the m tax rate.[7] The first-order conditions for maximization of equation (7) subject to equation (6) require equalization of the marginal welfare contribution of an additional unit of own tax revenue spent on local public services to the marginal costs of raising revenues across all tax bases. This equalization results in a vector of optimal tax rates and expenditure levels exhibiting again the standard communicating feature, with private resources and state transfers being fungible.

Now let the central government impose the set of tax rate limitations ($m = 1, \ldots, M$):

$$l^m \leq \tau_n^m \leq h^m. \quad (8)$$

Depending on the size and contribution to welfare of the M tax bases, their respective tax rates might be observed in left-corner ($\tau_n^m = l^m$) or right-corner ($\tau_n^m = h^m$) solutions, which results in a tax mix that can potentially display lower and upper limits binding at the same time on different tax rates. Consider now the effect of a grant change on local government spending behavior. As I formally prove in Appendix A, the sensitivity of local public spending to grants in the constrained optimum turns out to be increasing with the number of tax rate limits that are binding. Moreover, such sensitivity equals one if all limits bind. Interestingly, the one-for-one response of spending to grants emerges either when all upper limits bind or when all lower limits bind or for any of the admissible

[6] A more general model would have the government design a tax schedule, $T(\boldsymbol{b}_n)$, in which the tax base vector $\boldsymbol{b}_n = [b_n^1, \ldots, b_n^M]$ is arbitrarily correlated with the income vector $\boldsymbol{i}_n = [i_n^1, \ldots, i_n^M]$, and the latter might not be taxed. As long as $\boldsymbol{i}_n$ is observed, a welfarist government would set T so as to offset any variation in $\boldsymbol{b}_n$ that is not correlated with $\boldsymbol{i}_n$.

[7] The welfare formulation in equation (7) is compatible with the classic Hettich and Winer (1984, 1988) principle of political cost minimization in the presence of M potential tax sources.

fully constrained tax mix outcomes, with some of the limits binding from above and some from below.

To see why this is the case, take the example of a two-tax environment and a double-sided limit on each tax rate. While this represents a very simple case, it provides the basic intuition and can be generalized to tax rate vectors of any dimension. Suppose that, conditional on state grants and community tastes for public services, the local government wishes to set tax rates higher than the upper limits on both revenue sources. This implies that any subsequent grant change will leave the government at its upper-constrained tax mix, and spending will respond to grants one-for-one: any additional transfers will be spent on public services to get closer to the desired spending level; in contrast, there is no way of offsetting a grant reduction by further raising local tax rates. Suppose now that the government is at a lower-constrained tax mix, wishing to tax both bases less than is permitted. In this case too, any grant change will cause spending to respond one-for-one: additional transfers will have to be spent, because there is no way of returning them to taxpayers via lower taxes, and it cannot be optimal for a lower-constrained government to offset a marginal grant cut by raising taxes. Finally, consider a tax mix in which the local government wishes to tax one of the two revenue sources, say *j*, less than permitted by the limit and to tax *k* more than permitted, thereby reaching the lower limit for *j* and the upper limit for *k*. Consider what effect a shock to grants would have in that case: the local government would ideally return any additional grant funds to *j* taxpayers via lower taxes, but that is not feasible since the tax rate on *j* is already at the lower limit. Moreover, since it is clearly not desirable to lower the *k* tax rate that is already below what welfare maximization requires it to be, the additional grant funds will be spent on local public services. Similarly, a decrease in grants cannot be offset by further raising the upper-constrained tax rate *k*, nor is it optimal to increase the lower-constrained tax rate *j*. Spending will react one-for-one to the grant reduction by decreasing by the same amount.

In the general case of *M* tax sources, Appendix A shows that tax limits make the marginal cost of raising own revenues steeper and the response of local public spending to grants larger by restricting the number of available tax instruments, and this eventually degenerates into an infinitely high marginal cost of self-financing and a one-for-one local public spending reaction to grants when all tax limits bind. Along a similar line of reasoning, Appendix A shows that in a fully constrained tax mix, the sensitivity of local public spending to a tax base shock turns out to equal the lower or upper binding limit, as the intuitive representation in Figure 3 suggests. The main predictions from the multiple-tax model are summarized in the following:

Proposition 2. Consider the constrained optimization problem given by equations (6), (7), and (8). The sensitivity of public spending to grants is increasing with the number of binding rate limits and equals one if all limits bind, irrespective of whether they bind from above or from below. The sensitivity of local public spending to own tax bases in a fully constrained tax mix equals the binding tax rate limit.

3. Empirical Implications and Econometric Approach

The results in Section 2 prompt me to estimate the sensitivity of local public expenditures to changes in exogenous revenue sources, while allowing for heterogeneous responses depending on the degree to which local governments face financing constraints. In fact, the empirical investigation of the behavior of local government spending in the presence of tax limitations bears a striking similarity with two well-developed lines of research. The first concerns the inquiry into the role of financing and liquidity constraints in explaining the elasticity of investment to cash flow in Q models of the firm (Fazzari, Hubbard, and Petersen 1988; Bond and Meghir 1994; Kaplan and Zingales 1997; Hu and Schiantarelli 1998; Cummins, Hassett, and Oliner 2006).[8] The second relates to the borrowing-constraint interpretation of the excess sensitivity of private consumption to disposable income in permanent income and life cycle frameworks (Zeldes 1989; Runkle 1991; Jappelli, Pischke, and Souledes 1998).[9]

In the empirical investment and consumption literatures, the conventional approach consists of splitting the sample according to an a priori index of financing and liquidity constraint (typically related to the dividend payout or liquid assets–capital stock ratio for firms and to the asset-income ratio for consumers) and compare the switching regression estimates of the sensitivity of investment (consumption) to cash flow (income) for the constrained and unconstrained subsamples (Fazzari, Hubbard, and Petersen 1988; Kaplan and Zingales 1997; Runkle 1991). Similarly, in order to test using panel data whether the local public spending response to revenue sources is affected by tax limitations, a time-invariant selection criterion can be employed to assign authorities to either of two subsamples on the basis of whether they are consistently constrained (or not constrained) during the whole period of observation ($t = 1, \ldots, T$):

$$z_{nt} = \boldsymbol{q}'_{nt}\boldsymbol{\beta}^1 + \zeta^1_n + \eta^1_{nt} \quad \text{if } K_n = 1 \tag{9}$$

and

$$z_{nt} = \boldsymbol{q}'_{nt}\boldsymbol{\beta}^0 + \zeta^0_n + \eta^0_{nt} \quad \text{if } K_n = 0, \tag{10}$$

where $\boldsymbol{q}'_{nt} = [g_{nt}\boldsymbol{i}'_{nt}\boldsymbol{x}'_{nt}]$ and $\boldsymbol{x}_{nt}$ is a vector of local characteristics that can be thought to affect community n's preferences for public services, such as socio-

[8] In their review of the flypaper effect, Hines and Thaler (1995) mention the liquidity constraint explanation of flypaper-like effects in the private sector. However, they do not consider the possibility that local tax and expenditure limitations might be the root cause of the flypaper effect.

[9] Borge and Tovmo (2009) test whether liquidity constraints imposed by balanced-budget rules affect the intertemporal spending behavior of Norwegian local governments and find that departures from rational forward-looking public consumption smoothing can in part be explained by financing constraints.

economic and demographic structure, or ideological complexion. The terms ζ_n^1 and ζ_n^0 are jurisdiction-specific effects comprising all time-invariant, unobservable characteristics that might be correlated with $\boldsymbol{q}_{nt}$, and K_n is the switching indicator.

Clearly, a number of criteria might be employed to code in a binary way the observed tax mix of authority n in the presence of M-constrained tax revenue sources and would lead to different sample splits.[10] For the moment, with the realizations of the M tax rates, let K_n be somewhat arbitrarily defined as

$$K_n = \begin{cases} 1 & \text{if all tax limits bind} \\ 0 & \text{otherwise.} \end{cases} \tag{11}$$

According to the sample separation criterion in equation (11), parameter vector $\boldsymbol{\beta}^1$ in equation (9) measures the response by authorities that are structurally constrained, in the sense that tax limitations are binding for all revenue sources and in all years, while $\boldsymbol{\beta}^0$ in equation (10) captures the response of spending by authorities that are not structurally constrained, in the sense that at least one of their M tax rates does not hit the limits. The theoretical prediction on the size of the grant coefficient in particular is $\boldsymbol{\beta}_g^1 = 1 > \boldsymbol{\beta}_g^0$. Authorities in the $K_n = 1$ regime would necessarily exhibit a one-for-one response to transfers, not being able either to return increased grant money to residents via tax cuts or to raise taxes to offset a decrease in state transfers, irrespective of whether lower or upper limits bind. As for the effect of tax base changes, fully constrained authorities would have $\beta_i^{1m} = h^m$ ($\beta_i^{1m} = l^m$) when an upper (lower) tax limit is binding on tax base m. In contrast, authorities in the $K_n = 0$ regime would be able to transfer any extra grant funds back to their own taxpayers by reducing the unconstrained tax rates; similarly, they would partly offset a grant reduction by raising their unconstrained local tax rates, which means that $\boldsymbol{\beta}_g^0 < 1$.

These considerations suggest that the behavior of expenditures in the $K_n = 1$ versus $K_n = 0$ groups ought to be mirrored by changes in the M vector of local tax rates. Of course, for all the authorities in the $K_n = 1$ regime, $\Delta\tau_n^m = 0$ by the definition of the sample separation criterion in equation (11), and this is actually the force driving spending to follow grants so closely. As regards the $K_n = 0$ regime, local governments would raise (lower) tax rates where possible when grants decrease (increase), trying to offset the grantor's impact on the local public-private consumption mix. Similarly (as formally shown in Appendix A), a positive shock to tax base m fosters an increase in tax rate m in an attempt to reestablish the optimal public-private consumption mix by directing additional resources to public spending and a decrease in all $r \neq m$ tax rates in order to even out the marginal costs of raising revenues across tax bases.

A disadvantage of any separation rule inspired by a principle similar to equation (11), though, is that it implies freezing the sample and renouncing the use of information on governments that switch from one regime to the other over

[10] In principle, partitions finer than the two-sample split can be constructed according to the degree to which tax limitations bind.

the period of observation (Hu and Schiantarelli 1998).[11] An alternative empirical approach—based, among other studies, on Zeldes (1989), Bond and Meghir (1994), Jappelli, Pischke, and Souledes (1998), and Cummins, Hassett, and Oliner (2006)—consists of allowing for a time-varying constraint status, as in equation (12), in which an authority is rated as unconstrained in year t ($K_{nt} = 0$) if it can maneuver at least one of its tax instruments:

$$K_{nt} = \begin{cases} 1 & \text{if all tax limits bind in year } t \\ 0 & \text{otherwise.} \end{cases} \tag{12}$$

However, whether an authority is at a tax mix corner solution in a given year might in principle be determined endogenously, say, if unobserved shocks to expenditures push local authorities toward the (left or right) tax limits. With K_{nt} in equation (12) depending in a structural way on M distinct tax rate realizations originated from the two-sided constrained optimization problem, the reduced form of the binary selection index can be expressed in a stochastic way as a function of the vector of exogenous variables $\boldsymbol{q}_{nt}$:

$$K_{nt} = 1[K^{*}_{nt} = \boldsymbol{q}'_{nt}\delta + \mu_n + \varepsilon_{nt} > 0]. \tag{13}$$

According to equation (13), $K_{nt} = 1$ if $K^{*}_{nt} > 0$, K^{*}_{nt} is an auxiliary latent variable with no straightforward intrinsic meaning, ε_{nt} is normally distributed, and μ_n is a time-invariant, authority-specific effect. On modeling the selection process as in equation (13), it is possible to apply the Wooldridge (1995) two-stage procedure for fixed-effects panel data, with the selection equation (13) being consistently estimated in the first stage and the spending equation for $K_{nt} = 1$ being estimated in the second stage after correcting for selection bias.[12]

4. Local Tax Limitations in Italy

I analyze the local public spending and tax-setting behavior of the Italian provinces by using panel data for the years 2000–2007, that is, during the fiscal consolidation process following Italy's adherence to the European Union Stability and Growth Pact. The Italian system of local government is organized as a three-tier structure, with the 103 provinces constituting the intermediate level between regional (20 regions) and municipal (over 8,000 municipalities) tiers. Provinces have responsibility mainly in the areas of education (maintenance and repair of schools and office buildings); road cleaning and maintenance in nonmetropolitan areas, environmental protection in terms of measurement and monitoring of air and water pollution, waste dumps and sewage systems; and finally planning, coordinating, and providing technical support to municipalities' policies.

[11] Moreover, K_n might be correlated with spending. However, since selection effects can occur only through correlation between K_n and the time-invariant authority-specific effects, any selection bias is canceled by differencing them away, and a linear panel data fixed-effects estimator can be applied to the two subsamples (Charlier, Melenberg, and van Soest 2001).

[12] The Wooldridge (1995) procedure is discussed in detail in Revelli (2010).

Over three-quarters of current provincial expenditure is funded by grants from upper levels of government (state and regions).[13] State grants are either specific or general, the latter aiming at equalizing interprovincial structural differences in spending needs and fiscal capacity. Provinces are divided into two demographic bands on the basis of a 400,000-resident population threshold, and grants are computed according to band-average service cost indexes and tax bases. In principle, state support concerns only a number of mandated provincial functions, while expenditures on nonmandated services must be entirely funded by own revenues. In practice, the presence of a number of distinct state grant programs and the complexity of the distribution rules tend to make the overall amount of grants the outcome of bargaining between states and provinces.[14] In contrast, regional grants typically finance specific functions that were devolved to the provinces during the decentralization reform started in the late 1990s. While the devolution process follows nationwide rules, the regions have a considerable degree of discretion in the delegation of functions to the provinces as well as in the quantification of the resulting spending needs.

The rest of current spending is funded by three own tax revenue sources: the vehicle registration tax, the electricity consumption tax, and the waste management tax. The vehicle registration tax represents over 50 percent of own tax revenues. All new vehicles and used vehicles in cases of a change in ownership are liable to the payment of the tax the first time they are registered in a provincial archive under a given owner's name.[15] As shown in Table 1, the central government establishes lower and upper bounds on the vehicle tax parameters that provinces can set, with the upper-bound tax 20 percent higher (raised to 30 percent in 2007) than that for the lower bound. Consequently, the decision of each province consists of determining autonomously the surcharge rate τ^v. Second, the electricity consumption tax is applied by provinces on business uses of electricity. As shown in Table 1, provinces set a tax rate τ^e between a statewide lower limit of .093 and an upper limit of .114 euro per kilowatt-hour (kWh). Electricity tax revenues are around one-third of total own tax revenues. Finally, the waste management tax is a surcharge applied by provinces on the waste collection bill charged by the municipalities located in the province on all households and businesses. Table 1 shows that this surcharge τ^w must lie between 1 percent and 5 percent of the municipal levy. Revenues from the waste management tax amount to less than 20 percent of total provincial own tax revenues.

Table 2 reports the number of authorities reaching lower and upper limits, with the latter showing a considerable increase during the fiscal consolidation process, while Tables 3 and 4 rate the authority-year observations on the basis

[13] A small fraction of grants—less than 1 percent for most provinces—are funded by the European Union.

[14] The grant endogeneity issue is dealt with in Section 6.

[15] The total tax due is made up of a lump-sum amount plus a variable component that is related to the size, power, and destination of the vehicle.

Table 1
Rate Limits

Tax Rate Limit	2000–2006	2007
Vehicle registration:		
Lower	0	0
Upper	20	30
Electricity consumption:		
Lower	.093	.093
Upper	.114	.114
Waste management:		
Lower	1	1
Upper	5	5

Note. The vehicle registration tax rate is the percentage surcharge on the national rate. The electricity consumption tax rate is in euros per kilowatt-hour. The waste management tax rate is the percentage surcharge on the municipal levy.

of how severely they are affected by the tax limitations.[16] More than half of the observations in the data set (416 of 720) correspond to fully bound instances, with all available tax sources being set at left or right corners, while in only nine observations none of the constraints is binding. For about 40 percent of the observations, either one tax limitation is binding or two are. Interestingly, in over one-third of the observed tax mix outcomes, one lower and one upper limit are binding at the same time. In terms of the theoretical model of Section 2, and while we cannot accurately measure the vector of income flows on which the welfare of a community depends, it seems plausible that the costs of raising revenues across the three available provincial tax sources are different. Taxes on business uses of energy, vehicle registrations, and waste service consumption tend to have a heterogeneous impact on business income depending on firms' sectors of activity and factor input mix (large versus small, energy intensive versus labor intensive), as well as on the business versus household sectors in general and on wealthy versus poor households. This implies that different tax vectors will likely generate different welfare losses and degrees of political opposition to taxation, thus explaining the diversity of observed tax mix outcomes and the lack of fungibility between alternative tax revenue sources.

5. Empirical Implementation

5.1. Time-Invariant Sample Separation

The sample is first split according to a time-invariant indicator K_n that equals one if province n is constrained on all own tax revenue sources for the entire period of observation and equals zero if the authority is never observed to have all constraints binding. Application of the splitting criterion in equation (11)

[16] The data refer to the 90 provinces (of 103) for which all information from 2000 to 2007 is available.

Table 2
Authorities at Lower and Upper Limits

Tax	2000	2001	2002	2003	2004	2005	2006	2007
Vehicle registration:								
Lower	25	15	9	7	7	5	4	3
Upper	55	65	71	72	73	77	79	43
Electricity consumption:								
Lower	66	54	43	37	34	27	18	15
Upper	16	29	39	45	47	52	59	64
Waste management:								
Lower	3	2	2	3	3	2	3	3
Upper	66	64	66	65	65	66	66	68

yields $K_n = 1$ for 24 provincial authorities and $K_n = 0$ for 20 authorities in the 2001–6 period, the rest of the observations being discarded (to be used later) because of a changing regime during the period. This narrowing leaves me with 264 observations.[17] Of the 24 structurally capped authorities, 17 were at the upper bounds on all three own tax rates for the entire period, five were at two upper bounds and one lower bound, one was at one upper bound and two lower bounds, and one province was consistently at the three lower bounds. In contrast, the authorities in the $K_n = 0$ regime have one or two binding constraints.

I first estimate the switching regression model from equations (9)–(11) as a single equation, with K_n working as a switcher, thus allowing me to test the difference between the $\boldsymbol{\beta}^0$ and $\boldsymbol{\beta}^1$ coefficient vectors:

$$z_{nt} = \boldsymbol{q}'_{nt}\boldsymbol{\beta}^0 + K_n \times \boldsymbol{q}'_{nt}(\boldsymbol{\beta}^1 - \boldsymbol{\beta}^0) + \zeta_n^0 + \eta_{nt}^0 + K_n \times [(\zeta_n^1 + \eta_{nt}^1) - (\zeta_n^0 + \eta_{nt}^0)], \tag{14}$$

where z_{nt} equals current spending per capita in real terms and the vector of explanatory variables $\boldsymbol{q}_{nt}$ includes grants per capita (all current financial transfers from upper levels of government), proxies for private income flows in the province (tax base indicators for the three own provincial revenue sources and provincial gross domestic product at market prices), and a set of provincial characteristics: population size to control for economies of scale in service provision, demographic composition of the resident population (share of the population ages 0–4 years and ages 65 years and over), a binary election year indicator to allow for opportunistic policy maneuvering prior to elections,[18] and a right-wing control dummy to capture a partisan cleavage in spending policy between right-wing and left-wing governments.

As for tax bases, since official figures are not formally reported either by

[17] In order to preserve the size of the $K_n = 1$ sample, it seems sensible to exclude for now the last year in the sample because of the relaxation of the vehicle tax cap that occurred in 2007 (from 20 percent to 30 percent). Similarly, the first year (2000) is excluded since several provinces became consistently capped from the year 2001 on.

[18] Provincial elections take place every 5 years with direct election of the president. The election schedule is asynchronous, which means that provinces hold elections at different points in time.

Table 3
Tax Limitation Intensity: Fully Constrained

Tax								
Vehicle registration	h	h	h	l	h	l	l	l
Electricity consumption	h	h	l	h	l	h	l	l
Waste management	h	l	h	h	l	l	h	l
N	238	6	130	0	3	0	28	11

Note. $N = 416$. h = binding upper limit; l = binding lower limit.

Table 4
Tax Limitation Intensity: Moderately Constrained

Tax																			
Vehicle registration	h	h	–	h	l	h	l	–	–	l	l	–	h	–	–	l	–	–	–
Electricity consumption	h	–	h	l	h	–	–	h	l	l	–	l	–	h	–	–	l	–	–
Waste management	–	h	h	–	–	l	h	l	h	–	l	l	–	–	h	–	–	l	–
N	61	60	27	36	3	0	0	1	39	32	0	0	1	15	4	1	15	0	9

Note. $N = 304$. h = binding upper limit; l = binding lower limit; dash = nonbinding limit.

provincial governments or by the ministry, they need to be collected from other sources. The national motor vehicle registry system (Pubblico Registro Automobilistico) publishes annual data for all new vehicle registrations by province, and the electricity grid company (Terna Rete Elettrica Nazionale) releases yearly data on domestic and business electricity use by province. As for provincial surcharges on municipal waste collection bills, average city waste collection tax payments are available from the National Statistics Institute (Istituto Nazionale di Statistica). In fact, while constituting reasonable proxies for the level of resources available within provinces, none of those measures accurately reflect the actual tax bases. First, the nationwide vehicle registration tax on which provinces set the 0–20 percent surcharge is based on a nonlinear formula related to the type, engine power, and destination of the vehicle. I take the total number of registered vehicles in a province and transform it into a monetary tax base by multiplying it by the average baseline registration tax payment. As for electricity, the available total business consumption data do not equal the actual tax bases because large energy-intensive plants exceeding 300,000 kWh consumption per month are exempt from the provincial charge, which means that the tax base in provinces where larger plants are located will be overstated. Finally, municipal waste collection tax payments are available for provinces' main cities only, and actual provincial surcharge revenues tend to differ from theoretical revenues because of endemic low compliance.

The fixed-effects estimation results of equation (14) are reported in Table 5, while Table 6 reports the separate estimation results of equations (9) and (10) for the two subsamples. All equations include year dummies. Descriptive statistics and data sources for all variables are reported in Tables B1 and B2. Interestingly, all authorities exhibit what would be termed a flypaper effect according to con-

Table 5
Time-Invariant Splitting Criterion

	(1)	(2)	(3)	(4)	(5)	(6)
Grants	.844**	.722**	.838**	.744**	.843**	.759**
	(.035)	(.046)	(.034)	(.047)	(.035)	(.051)
Grants × K		.253**		.205**		.200**
		(.069)		(.070)		(.074)
Tax base: vehicle			.203**	.224**	.215**	.183+
			(.060)	(.088)	(.065)	(.098)
Tax base: electricity			.057	.096	.058	.049
			(.054)	(.084)	(.056)	(.092)
Tax base: waste			.024	.019	.023	.016
			(.015)	(.020)	(.015)	(.020)
Income					−.001	−.002
					(.001)	(.002)
Population					−.088	−.227
					(.077)	(.134)
Age 0–4 share					.561	−2.965
					(6.412)	(7.784)
Age 65+ share					−3.272	−2.992
					(3.334)	(5.226)
Election					−.634	−.664
					(1.333)	(1.775)
Right wing					2.375	6.627
					(2.823)	(6.615)

Note. The dependent variable is real current spending per capita. Fixed province and year effects are included; year effects are interacted with the switching indicator K for the results in columns 2, 4, and 6; exogenous variables are interacted with K for the results in columns 4 and 6. Standard errors are in parentheses. $N = 264$ for 44 authorities. e = electricity consumption tax; v = vehicle registration tax; w = waste management tax.
$^{+}$ $p < .10$.
** $p < .01$.

ventional criteria in the literature. The results in Tables 5 and 6 show that the grant effect is large and highly statistically significant. In fact, the $K_n = 0$ subsample is far from being unconstrained in practice, given that it groups authorities that are facing one or two tax limits. However, the results also show that authorities that are fully constrained react to grants to a significantly larger extent, on a one-for-one basis. The estimate of the effect of grants on spending is around .7 for the moderately constrained subsample (columns 2, 4, and 6 in Table 5), while the coefficient estimate almost equals 1 for structurally bound provinces (columns 1, 3, and 5 in Table 6). The difference between the two coefficients (over .2) is highly statistically significant. The large and significant difference in the response to grants in the two subsamples is robust to the introduction of various controls, none of which—including provincial gross domestic product and demographic and political characteristics—contribute much to further explaining the pattern of spending. In particular, the estimated coefficients on the own tax bases all have the expected positive sign and generally plausible magnitudes that are compatible with the statutory tax rate admissible range, though they are hardly statistically significant.

Table 6
Time-Invariant Splitting Criterion: Separate Equations

	$K = 1$ (1)	$K = 0$ (2)	$K = 1$ (3)	$K = 0$ (4)	$K = 1$ (5)	$K = 0$ (6)
Grants	.975**	.722**	.949**	.744**	.959**	.759**
	(.048)	(.050)	(.049)	(.050)	(.051)	(.055)
Tax base: vehicle			.121	.224*	.133	.183^{+}
			(.079)	(.095)	(.091)	(.105)
Tax base: electricity			.025	.096	.036	.049
			(.064)	(.091)	(.068)	(.099)
Tax base: waste			.036^{+}	.018	.037^{+}	.016
			(.021)	(.021)	(.022)	(.022)
Income					.001	−.002
					(.001)	(.002)
Population					−.032	−.227
					(.101)	(.144)
Age 0–4 share					9.940	−2.965
					(10.434)	(8.400)
Age 65+ share					.959	−2.992
					(4.599)	(5.639)
Election					−.172	−.664
					(1.962)	(1.915)
Right wing					1.089	6.627
					(2.993)	(7.247)
N	144	120	144	120	144	120
Authorities	24	20	24	20	24	20

Note. The dependent variable is real current spending per capita. Fixed province and year effects are included. Standard errors are in parentheses. e = electricity consumption tax; v = vehicle registration tax; w = waste management tax.
$^{+}$ $p < .10$.
* $p < .05$.
** $p < .01$.

5.2. The Behavior of Tax Rates

The theoretical model of Section 2 suggests that the one-for-one sensitivity of fully constrained authorities' expenditures to grants arises from the fact that they cannot maneuver their own tax rates in an attempt to offset changes in transfers. The difference that has emerged with regard to authorities that are not fully constrained ought then to be due to their ability to purposefully use their tax policy to smooth out expenditures in front of year-to-year changes in state transfers. In fact, the authorities in the $K_n = 0$ sample changed their tax rates frequently during the period, with over 30 tax rate increases over the years 2001–6. Interestingly, grants to those authorities decreased by around 10 percent in real terms between 2001 and 2006. I can therefore investigate if those tax rate changes can be explained as offsetting responses of own-revenue-raising policy to widespread state retrenchment.

I take the provincial tax rates as the dependent variables and estimate the impact of grants and tax bases on the $K_n = 0$ sample, while controlling for a set of local characteristics as well as year and province fixed effects. The results

Table 7
Tax Rates

	Vehicle (1)	Electricity (2)	Waste (3)	Vehicle (4)	Electricity (5)	Waste (6)
Grants	−.070**	−.008**	−.003	−.066*	−.009**	−.005⁺
	(.028)	(.003)	(.002)	(.032)	(.003)	(.003)
Tax base: vehicle				−.013	−.004	−.013**
				(.061)	(.006)	(.005)
Tax base: electricity				.097	−.004	−.001
				(.057)	(.006)	(.005)
Tax base: waste				−.004	.004**	−.004**
				(.013)	(.001)	(.001)
Income				.001	−.001	.001
				(.001)	(.001)	(.001)
Population				−.071	−.013	−.013⁺
				(.085)	(.008)	(.007)
Age 0–4 share				1.074	.001	.228
				(2.173)	(.212)	(.176)
Age 65+ share				−1.096	.013	−.050
				(1.424)	(.139)	(.115)
Election				.889	−.035	.033
				(1.113)	(.108)	(.090)
Right wing				2.292	−.883*	−.015
				(4.041)	(.393)	(.327)

Note. The dependent variable is the tax rate on vehicle registrations (v), electricity consumption (e), or waste management (w). Fixed province and year effects are included. Standard errors are in parentheses. $N = 120$ for 20 authorities.
⁺ $p < .10$.
* $p < .05$.
** $p < .01$.

are reported in Table 7. With the exception of the waste management tax rate in column 3, whose grant coefficient is estimated imprecisely, grants turn out to have a strong negative impact on own provincial tax rates, as suggested by the theoretical model (equation [A13]). The fiscal policy changes observed over the decade seem, therefore, to be interpretable as offsetting responses to changes in state policy, which suggests that state retrenchment was responsible for the secular upward shift in provincial tax rates documented in Table 2.[19]

The estimated coefficients on the provincial tax bases are more mixed. Vehicle registration and business electricity tax bases have insignificant effects on their own and cross-tax rates, while the waste management surcharge rate appears to be negatively affected by the municipal waste management charge base. The latter effect might seem at odds with the theoretical results in Appendix A, which predict positive effects of tax bases on tax rates (equation [A16]). However, an increase in the municipal waste charge revenues on which provinces apply their own surcharge actually amounts to a decrease in residents' disposable income

[19] Similar results (negative and significant impact of grants on vehicle and electricity tax rates and no effect on the waste management tax rate) emerge when estimating the tax rate equations for the unbalanced panel of 304 moderately constrained observations in Table 4.

Table 8
Time-Varying Splitting Criterion

	(1)	(2)	(3)	(4)	(5)	(6)
Grants	.864**	.834**	.686**	.683**	.686**	.683**
	(.016)	(.020)	(.037)	(.038)	(.037)	(.038)
$K \times$ Grants		.051**	.203**	.210**	.205**	.211**
		(.020)	(.038)	(.039)	(.040)	(.041)
$K(2) \times$ Grants			.162**	.170**	.162**	.170**
			(.035)	(.035)	(.035)	(.035)
$K(h, h, h) \times$ Grants					−.003	−.003
					(.025)	(.025)
Tax base: vehicle	.057+	.055+	.066*	.068*	.065*	.067*
	(.030)	(.030)	(.030)	(.033)	(.030)	(.033)
Tax base: electricity	.101**	.103**	.107**	.109**	.109**	.111**
	(.032)	(.032)	(.031)	(.033)	(.032)	(.034)
Tax base: waste	−.001	.001	.004	.007	.004	.007
	(.008)	(.008)	(.008)	(.008)	(.008)	(.008)
Income				.001+		.001+
				(.000)		(.000)
Population				.027		.027
				(.019)		(.019)
Age 0–4 share				1.566		1.502
				(3.003)		(3.012)
Age 65+ share				−1.920		−1.942
				(1.515)		(1.520)
Election				.911		.926
				(.952)		(.956)
Right wing				1.173		1.146
				(1.748)		(1.753)

Note. The dependent variable is real current spending per capita. Fixed province and year effects are included. If two limits bind in year t, $K(2) = 1$; if three limits bind in year t, $K(h, h, h) = 1$. Standard errors are in parentheses. $N = 720$ for 90 authorities. e = electricity consumption tax; v = vehicle registration tax; w = waste management tax.
+ $p < .10$.
* $p < .05$.
** $p < .01$.

and is likely to increase the marginal cost for provinces of collecting further revenues from the waste management bill—a sort of negative fiscal externality arising from tax base co-occupation by municipalities and provinces (Keen and Kotsogiannis 2002). In fact, the results in Table 7 suggest that a higher cost of raising revenues from the waste management surcharge instead twists the provincial tax mix toward increased reliance on business electricity taxes.

5.3. Time-Varying Sample Separation

Table 8 reports the estimation results of the spending determination model based on the time-varying index in equation (12). I first use all available sample observations (as summarized in Tables 2, 3, and 4) and estimate a single equation that allows for interaction terms depending on the corresponding tax mix of provincial authorities and a unique set of authority fixed effects. Column 1 presents the estimation results when pooling all observations irrespective of their tax mix. The estimated coefficient on grants is around .8, roughly the same value as in Table 5. The vehicle registration and electricity consumption tax base coefficients are significant, and their sizes are compatible with the statutory tax limits (reported in Table 1), while that on the waste management tax base is virtually zero, again a result similar to that for the restricted sample of Table 5.

Column 2 in Table 8 shows the estimation results when grants are interacted with the dummy K_{nt} as defined in equation (12). It turns out that authorities in the $K_{nt} = 1$ regime—where all limits are binding—have a significantly higher sensitivity to grants than authorities that can maneuver at least one revenue source. However, the difference in behavior between the two regimes is considerably smaller than in the time-invariant split sample: fully constrained authorities' expenditures are estimated to have only a 5 percent higher response to grants (standard error = .02) than ones that are not fully constrained. This smaller result might be due to some of the two-limit authorities being fairly close to a fully constrained regime and basically mimicking the behavior of fully bound authorities. In order to verify if that is the case, and to further test whether the sensitivity of spending to grants actually increases with the number of binding limits, I partition observations into three groups: three binding constraints ($K_{nt} = 1$), two binding constraints ($K(2)_{nt} = 1$), and one or no binding constraint, the last constituting the reference group. I then interact these group dummies with the grant variable and estimate the equation with year and authority fixed effects; the results are shown in columns 3 and 4. In this case, it turns out that public expenditures in localities where two or three limits are binding are significantly more sensitive to grants than where one or no limit binds, and the difference is around .2, a value similar to that for the time-invariant split sample of Table 5. In contrast, there seems to be no significant difference between authorities that have two or three binding rate limits.

For the results in columns 5 and 6 of Table 8, I proceed to a finer partition of the data set in order to investigate if the specific features of the tax mix affect the response of provincial expenditures to grants. In particular, I test for different responses of authorities in a fully upper constrained tax mix relative to those that are fully constrained but are against at least one lower bound: in most instances, the lower bound refers to the electricity tax, though there are cases (as shown in Tables 3 and 4) of binding lower constraints for vehicle and waste management taxes too. Of course, the theoretical model predicts that fully constrained authorities should exhibit a one-for-one response to grants, irrespective of whether they are at upper or lower bounds. The results in columns 5 and 6 suggest that all authorities in a fully constrained tax mix have a very large response—almost one-for-one—to grants, while it does not make any difference whether they are facing upper or lower bounds.

In Table 9, I present the estimation results of an expenditure determination equation that focuses on fully constrained authorities, with the aim of verifying whether those authorities respond differently to changes in tax bases depending

Table 9
Upper and Lower Constraints

	(1)	(2)	(3)	(4)
Grants	.936**	.944**	.947**	.950**
	(.020)	(.020)	(.025)	(.026)
$D(h)$ × Grants			−.013	−.010
			(.026)	(.026)
Tax base: vehicle	.099*	.113*	.104*	.107*
	(.042)	(.046)	(.043)	(.047)
Tax base: waste	.017	.020	.016	.019
	(.012)	(.012)	(.012)	(.012)
Tax base: electricity	.084*	.088*	.084*	.075*
	(.039)	(.042)	(.041)	(.046)
$D(h)$ × tax base: electricity			.059+	.057+
			(.031)	(.034)
Income		.002+		.002+
		(.001)		(.001)
Population		−.005		−.006
		(.038)		(.038)
Age 0–4 share		4.799		1.475
		(4.421)		(4.729)
Age 65+ share		−1.560		−2.077
		(2.036)		(2.053)
Election		.445		.404
		(1.255)		(1.258)
Right wing		2.925		2.671
		(2.125)		(2.152)

Note. The dependent variable is real current spending per capita. Fixed province and year effects are included. If the upper limit on the electricity tax is binding in year t, $D(h) = 1$. Standard errors are in parentheses. $N = 368$ for 63 authorities. e = electricity consumption tax; v = vehicle registration tax; w = waste management tax.
+ $p < .10$.
* $p < .05$.
** $p < .01$.

on the specific features of their constrained tax mix. In fact, their expenditures' response to tax bases should differ according to whether they are at lower or upper bounds, with the estimated coefficients equaling the respective binding tax rates (as shown by equations [A18] and [A19]). In order to have as focused a test as possible, I take the sample of the 238 observations at an (h^v, h^e, h^w) tax mix and the sample of 130 observations with (h^v, l^e, h^w), the only tax mix difference among the two samples being that the former is upper constrained on energy and the latter is lower constrained on energy, as shown in Table 3. These are the two most frequent tax mix outcomes in the data set. Table 9 first reports estimates of the spending equation when pooling the two samples in a single equation (columns 1 and 2). Columns 3 and 4 allow for heterogeneous effects from grants and energy tax bases by introducing interaction terms via a dummy that equals one if the observation corresponds to a fully upper constrained tax mix.[20] The results for the pooled sample in columns 1 and 2 show that the grant coefficient estimate is above .9. Energy and vehicle registration tax bases have positive and significant effects on spending, and the estimated coefficients are within (vehicle tax) or close to (energy tax) the range of admissible rates. The energy tax base coefficient is in fact slightly below the lower bound of .093. The vehicle tax coefficient estimate is about half what it could be expected to be, given that all authorities in the sample are at the .20 cap. The waste management tax base has no significant impact, a result in line with the evidence presented above and likely attributable to the poor measurement of the waste management tax base. Among the controls that are added along with tax bases in column 2, only provincial income shows some small positive effect.

When allowing for heterogeneous responses by interacting grants and electricity tax base with a dummy variable $D(h) = 1$ if the electricity tax upper limit is binding, there is no evidence of significant differences among the two samples in their sensitivity to grants. Even when constrained at the lower energy tax limit ($D(h) = 0$), local authorities react to grants on an almost one-for-one basis. Authorities at the lower energy bound have a grant coefficient of .95, an even higher point estimate than the one obtained for fully upper constrained authorities, though the difference between the two coefficients is not statistically significant. As for the estimated response of spending to the energy tax base, it turns out to be higher and significantly so when the upper limit binds than when the lower limit binds. Though somewhat stretched, the magnitude of the difference between the estimated energy tax base coefficients—.08 for lower-constrained authorities and .14 for upper-constrained authorities in column 3; .07 and .13, respectively, in column 4—is compatible with the statutory limits.

6. Endogeneity Issues

One might wonder at this point whether the high sensitivity of local spending to grants—an almost one-for-one response for fully constrained authorities—is in fact determined by a spurious correlation between expenditures and transfers due to omitted variables driving both.[21] In the context I deal with here, shocks to provincial expenditures—due, say, to natural disasters or major infrastructure works—might simultaneously boost state grants to tackle rising spending needs and induce local authorities to raise own taxes up to the rate limits. I tackle these endogeneity issues in the next two sections. First, in Section 6.1 I exploit the institutional features of the Italian multitiered structure of government and adopt an instrumental variables approach relying on within-province grant variability due to changes in variables that can be plausibly thought to have no

[20] No further significant differences emerge when allowing for heterogeneous effects from the other tax bases or control variables.

[21] Recent research finds little evidence of a flypaper effect when grant endogeneity arising from a number of sources is explicitly and properly accounted for (Knight 2002; Gordon 2004; Lutz 2010).

independent effect on provincial spending. Second, I explicitly model endogenous selection into the fully constrained regime in Section 6.2.

6.1. Discontinuity, Ideology, and Advocacy

As argued in Section 4, a fraction of state general grants are distributed to provinces according to a formula in which localities are split into two demographic bands (less than and more than 400,000 inhabitants) in recognition of the specific features that tend to be typical of larger, metropolitan provinces relative to smaller, rural ones. The two-band system creates a discontinuity at the 400,000-resident population threshold, with provinces on either side of the threshold facing a different reference group against which their spending needs are evaluated.[22] I therefore build a dummy variable equaling one if the population of a province exceeds the threshold in a given year and use it as an instrument for grants.

Second, a far from negligible share of grants to the provinces (over one-third) come from the regions and are intended to fund specific administrative functions that the latter delegate to the former. While the delegation process abides by general national rules, the regions have a substantial degree of discretion in implementing and quantifying it, and it seems reasonable to allow the ideology of the regional governments to affect their policy design concerning the provinces. In particular, with the idea that the political complexion of the regional government might affect the size of grants flowing to the provinces within the region, while not directly influencing provincial expenditures, I use a right-wing regional government dummy as an instrument for grants.[23]

Finally, in spite of the undisputed national parliament's supremacy in the Italian multitiered governmental structure, all laws concerning subnational administrative or financial issues, including local public service organization, management, and financing, need to be preliminarily discussed in a state and local governments committee before final approval. The committee was established in 1996 to foster dialogue and cooperation between central and local governments. It can make recommendations, submit proposals, or require amendments to state acts to be discussed in parliament. Besides central government representatives (typically the finance, regions, infrastructures, and interior ministers), the committee is composed of 14 representatives from the municipalities and seven representatives from the provinces and meets regularly during the year. The province representatives in the committee include the president of the na-

[22] The argument is similar to that in Gordon (2004) and Dahlberg et al. (2008). Gordon (2004) exploits the infrequent updating of poverty data used in the U.S. federal education grants to school districts (Title I) and uses a purely census determined grant change measure as an instrument for actual Title I revenue change. Dahlberg et al. (2008) make use of a discontinuity in the grant formula for municipalities in Sweden, where localities with a net out-migration rate above a state-set threshold are entitled to extra grants.

[23] Arulampalam et al. (2009) and Solé-Ollé and Sorribas-Navarro (2008) show that alignment with grantors and vote swing can affect the size of grants. However, this does not appear to be the case for Italian provinces.

tional union of the Italian provinces (who is normally elected every 5 years from among the province presidents) and six province presidents who are nominated by the union and sit on the committee for 5 years (unless they leave office earlier). Province delegates tend to reflect the demographic (large metropolitan versus small rural), political (right wing versus left wing), and geographic (northern, southern, and central) diversity of the province universe.[24] In practice, the union criteria for selecting its representatives in the state and local governments committee are hard to decipher and plausibly seem to follow some crude rotation principle. Of course, and similar to U.S. congressional delegations (Knight 2002), sitting in the state and local governments committee can enhance the political power of delegates to advocate for their home province's needs and interests. In light of the virtually random process of committee member selection, I build an advocacy dummy variable equaling one if the president of a province sits in the state and local governments committee in a given year and use it as an instrument for grants.

The instrumental variables estimation results are reported in Table 10. I focus here on the sample of authorities that are observed to switch from one tax mix regime to the other over the panel duration. This specification allows me to test the effect of grants on spending behavior conditional on both observed tax mix regimes (Table 10) and the probability that an authority moves into a fully constrained tax mix (Table 11). After excluding provinces that are never observed to reach all tax limits, as well as those that are observed in the $K_{nt} = 1$ or $K_{nt} = 0$ regime for less than 2 years, I end up with a balanced panel of 40 switching provinces over the years 2000–2007, with 188 observations for $K_{nt} = 1$ and 132 observations for $K_{nt} = 0$. Importantly, since I want to estimate the response of authority *n*'s spending to grants in year *t* provided that authority *n* stays on the same portion of its budget constraint—that is, it does not jump to a different segment of its kinky budget constraint by, say, raising a tax rate from a lower to an upper limit—I require the tax mix of authority *n* in year *t* to be identical to that in year $t - 1$ in order for that observation to be selected into the $K_{nt} = 1$ regime (Bond and Meghir 1994).[25]

Table 10 reports ordinary least squares estimates of the spending equation on the whole sample of 40 switching provinces for comparison. The first-stage results of the two-stage least squares approach reveal that two of the three instruments play a significant role in explaining grants. The population threshold dummy has no significant effect, though: this is likely due to the fact that only a tiny fraction of provinces actually cross the 400,000-resident threshold in the period considered. Moreover, since provinces tend to approach the population threshold

[24] Over the years, the committee has included delegates from very large metropolitan provinces (Milan and Rome, with around 4 million inhabitants) as well as small ones such as Brindisi in the south (<400,000 inhabitants), Trieste in the northeast (<250,000 inhabitants), and Rieti in the central region (<150,000 inhabitants).

[25] This implies that I cannot exploit the changes in the K_{nt} selection index that are generated by the exogenous relaxation of the vehicle tax rate cap that occurred nationwide in the last sample year.

Table 10
Grant Endogeneity

	OLS (1)	First-Stage 2SLS (2)	Second-Stage 2SLS: All (3)	Second-Stage 2SLS: $K = 1$ (4)	Second-Stage 2SLS: $K = 0$ (5)
Exogenous regressors excluded:					
Grants	.945**		.926**	.949**	.750**
	(.020)		(.059)	(.069)	(.163)
Discontinuity		−12.127			
		(11.690)			
Ideology		−16.750**			
		(3.789)			
Advocacy		24.163**			
		(6.789)			
$F(3, 270)$ test		11.42			
		(.00)			
Overidentification test		2.50			
		(.29)			
Exogenous regressors included:					
Grants	.931**		.947**	.951**	.797**
	(.020)		(.055)	(.075)	(.178)
Discontinuity		.259			
		(11.802)			
Ideology		−18.372**			
		(3.796)			
Advocacy		29.538**			
		(6.691)			
$F(3, 261)$ test		14.32			
		(.00)			
Overidentification test		1.39			
		(.49)			
N	320	320	320	188	132

Note. Fixed province and year effects are included. The overidentification test is $\chi^2(2)$. Standard errors are in parentheses. There are 40 authorities. OLS = ordinary least squares; 2SLS = two-stage least squares.
** $p < .01$.

toward the later sample years, the effects in terms of grant entitlements are likely to be observed after the end of the observation period. As far as the other instruments are concerned, provinces receive fewer grants when the regional government is from a right-wing coalition: switching from an extravagant left-wing regional government to a thrifty right-wing one is estimated to lead to a decrease in grants to provinces located within the region of over 10 percent on average. In contrast, it turns out that having a delegate in the state and local governments committee attracts significant additional resources to a province: on average, gaining a seat on the committee amounts to an almost 20 percent boost in grants to a province. Overall, the three instruments are valid and jointly significant in the first stage when the other exogenous regressors are excluded or included, with F-test statistics of over 11 and over 14, respectively.

Table 10 also reports second-stage results. When instrumented, the grant co-

Table 11
Wooldridge Two-Stage Approach

	First-Stage Probit (Balanced) (1)	Second-Stage Wooldridge Correction (2)
Grants	−.017**	.956**
	(.007)	(.035)
Tax base: vehicle	.004	.172*
	(.013)	(.070)
Tax base: waste	−.002	.010
	(.003)	(.017)
Tax base: electricity	−.011	.074*
	(.009)	(.030)
Income	.001	−.002
	(.001)	(.002)
Population	.006	−.203
	(.022)	(.122)
Age 0–4 share	−1.123	1.167
	(1.244)	(8.375)
Age 65+ share	.789	.856
	(.628)	(3.836)
Election	-1.063^{+}	1.758
	(.543)	(1.950)
Right wing	.879	4.048
	(.896)	(3.140)
Wooldridge *t*-test		−1.12
		(.79)
N	216	147

Note. Standard errors are in parentheses. There are 27 authorities. e = electricity consumption tax; v = vehicle registration tax; w = waste management tax.
$^{+}$ $p < .10$.
* $p < .05$.
** $p < .01$.

efficient decreases modestly in the overall sample, while remaining pretty close to 1 under the $K_{nt} = 1$ regime. The gap among the estimates of the expenditure sensitivity to grants in the two regimes remains around .2. Overall, allowing for endogeneity of grants still delivers an impressively high estimate of the spending sensitivity to grants in the $K_{nt} = 0$ subsample ($\beta_g^0 > .7$), which suggests that binding tax limits might not be the sole source of excess sensitivity of local public expenditure to grants.

6.2. Endogenous Selection

As far as the issue of endogenous selection into the $K_{nt} = 1$ regime is concerned, Table 11 reports the estimation results of the Wooldridge (1995) two-stage approach. In order to focus on the forces pushing local authorities toward the upper tax rate limits, I perform the Wooldridge procedure on the 27 local authorities that were not fully constrained for at least 2 periods, which means that they could maneuver at least one of their own revenue sources, and that switched at some point to the fully upper constrained regime (*h, h, h*) and were observed there for at least 2 periods. Probit estimation of the first-stage binary selection equation (13) reveals that grant policy played an important role in driving selection into the fully upper constrained regime: the effect of grants on the probability of being in an (*h, h, h*) tax mix is negative and highly statistically significant. In contrast, as far as the stochastic component of equation (13) is concerned, the second-stage estimation results suggest that the selection process can be considered exogenous with respect to the local public spending pattern. The Wooldridge (1995) variable addition test reported in Table 11 is far from statistically significant, and column 2 reveals that performing the Wooldridge (1995) correction has a negligible impact on the estimation results, including in particular the excess sensitivity of local public spending to grants.

Finally, as I have argued, one might believe that treating grants as exogenous in the selection equation is illegitimate, because of the possibility of shocks (say, a plant relocation) driving local authorities to corner solutions and simultaneously soliciting grants from upper-level governments. In order to test whether this is the case, I regress grants on the three instruments discussed in Section 6.1 (as well as all other exogenous variables in equation [13]) and include the residuals from that estimation in equation (13). The *t*-statistic of the estimated coefficient on the residuals is a test of grant exogeneity in the selection equation (Rivers and Vuong 1988); it takes on the value of around one (*p*-value of about .3), which suggests that grants can legitimately be treated as exogenous in the selection equation.

7. Concluding Remarks

By explicitly incorporating the corner solutions that are typically produced by statewide limitations on local tax rates, this paper modeled the local tax mix determination process and has demonstrated that the so-called flypaper effect arises in the constrained tax mix. In particular, the paper shows that local expenditures are predicted to display a one-for-one response to grants in the presence of binding limitations on all local tax revenue sources. Interestingly, the result holds when either upper or lower tax limitations are in place, and it turns out that a binding limitation on just one of the available own revenue sources is enough to generate a sort of excess sensitivity of local spending to grants. Moreover, such excess sensitivity should be expected to arise—and generally tends to manifest itself—both when grants increase and when they decrease. In contrast, the response of public spending to a shock to a local tax base whose rate is constrained turns out to be a function of the (lower or upper) binding rate limit.

I tested the key empirical predictions of the model in terms of local public spending and tax rate sensitivity to grants and own tax bases on panel data on the Italian provinces through the years 2000–2007. The Italian provinces' data allow me to exploit the sharp corner solutions generated by the central government's upper and lower limitations on own sources of tax revenue (a tax on vehicle registrations, a tax on electricity consumption for business uses, and a waste management surcharge). I employed a switching regression approach in which local authorities are assigned to either of two subsamples on the basis of the intensity to which central tax limits bind and estimated the response of local public expenditures to grants and own tax bases in the two subsamples. Whether the sample is split according to a time-invariant criterion or to a time-varying one, the empirical evidence consistently suggests that the reaction of local spending to grants is significantly higher—in fact, one for one—for fully constrained authorities than for authorities that can maneuver at least one of the local tax instruments. Those results are robust when endogenous selection into the constrained sample is controlled for and when grants are allowed to be determined endogenously. In particular, I employed a set of powerful institutionally driven instruments related to exogenous discontinuities in the grant distribution formula, ideological complexion of upper-level (regional) governments, and political power of province delegates sitting in the state and local governments committee. While the results for the response of local public expenditures to own tax bases are less clear-cut, they generally provide a coherent picture of provincial expenditures being tied to the evolution of local resources via the binding upper or lower tax rates. Finally, the empirical evidence for the negative effect of grants on local tax rates for authorities that are not fully constrained provides support for the view that the fiscal policy changes observed over the decade can be interpreted as offsetting responses to changes in state policy in a period of retrenchment, while fully constrained authorities mechanically react to grants on a one-for-one basis.

Overall, the results in this paper suggest that statewide limitations on local governments' tax policies—or, more generally, the ample role of diverse forms of central command, including tax base assessment, general revenue limitation, and local public service mandates—ought not to be ignored when investigating the extent to which central funding crowds out local tax efforts and when interpreting the empirical evidence for local governments' response to state grants. In particular, the empirical phenomenon that has been documented for decades and has been conventionally—and somewhat incorrectly—interpreted as arising from stickiness of federal transfers (the flypaper effect) seems instead to be best described as an excess sensitivity of local public spending to grants that cannot in general be taken as a symptom of decentralized government overspending.

Appendix A

Model

A1. The One-Tax Case

Consider an unconstrained government with welfare function (equation [1]), budget constraint (equation [2]), and optimal spending and tax rate given by equations (3) and (4), respectively. Straightforward derivation of equations (3) and (4) shows that the effects of g_n and i_n on τ_n^* and z_n^* are

$$\frac{\partial \tau_n^*}{\partial g_n} = -\frac{\rho_n \quad 1}{1 + \rho_n i_n} < 0, \tag{A1}$$

$$\frac{\partial \tau_n^*}{\partial i_n} = \frac{\rho_n \quad g_n}{1 + \rho_n i_n^2} > 0, \tag{A2}$$

and

$$\frac{\partial z_n^*}{\partial g_n} = \frac{\partial z_n^*}{\partial i_n} = \frac{1}{1 + \rho_n} > 0. \tag{A3}$$

Consider now the constrained optimization problem given by equations (1), (2), and (5). Letting $\lambda' = [\lambda^h \lambda^l] \geq 0$ be the vector of Lagrange multipliers, the Lagrangian function is

$$L(\tau_n, \lambda) = w_n + \lambda^h(h - \tau_n) + \lambda^l(-l + \tau_n), \tag{A4}$$

and the necessary Kuhn-Tucker conditions are $\partial L(\tau_n, \lambda)/\partial \tau_n = 0$, $\nabla_\lambda L(\tau_n, \lambda) \geq 0$, and $\lambda \nabla_\lambda L(\tau_n, \lambda) = 0$. Trivially, the optimal level of spending is $z_n^*(h) = g_n + hi_n$ if local government n is against the upper bound h ($\lambda^h > 0$; $\lambda^l = 0$), and $z_n^*(l) = g_n + li_n$ if it is against the lower bound l ($\lambda^l > 0$; $\lambda^h = 0$). With τ_n^* stuck at either the lower or the upper limit, the effects of g_n and i_n on z_n^* are easily found as

$$\frac{\partial z_n^*(h)}{\partial g_n} = \frac{\partial z_n^*(l)}{\partial g_n} = 1, \tag{A5}$$

$$\frac{\partial z_n^*(h)}{\partial i_n} = h, \tag{A6}$$

and

$$\frac{\partial z_n^*(l)}{\partial i_n} = l. \tag{A7}$$

Whether the upper or the lower tax rate limit in equation (5) binds, the sensitivity of local public spending to grants in the constrained optimum is one.

The sensitivity of local public spending to own resources in the constrained optimum equals the binding tax rate limit.

A2. The Multiple-Tax Case

Consider the constrained optimization problem given by equations (6), (7), and (8). Letting $\lambda' = [\lambda^{h1} \ldots \lambda^{hM}\lambda^{l1} \ldots \lambda^{lM}] \geq 0$ be the vector of Lagrange multipliers, the Lagrangian function is

$$L(\tau_n, \lambda) = w_n + \sum_{m=1}^{M} \lambda^{hm}(h^m - \tau_n^m) + \sum_{m=1}^{M} \lambda^{lm}(-l^m + \tau_n^m), \tag{A8}$$

and the necessary Kuhn-Tucker conditions are $\nabla_\tau L(\tau_n, \lambda) = 0$, $\nabla_\lambda L(\tau_n, \lambda) \geq 0$, and $\lambda\nabla_\lambda L(\tau_n, \lambda) = 0$. Denoting by $\mathcal{L}_n \equiv (\tau_n^m | \lambda^{lm} > 0)$ and $\mathcal{H}_n \equiv (\tau_n^m | \lambda^{hm} > 0)$ the sets of tax rates at the lower and upper bounds, respectively, and by $\mathcal{U}_n \equiv (\tau_n^m | \lambda^{lm} = \lambda^{hm} = 0)$ the set of tax rates lying strictly between the bounds, the constrained tax rate mix ($m = 1, \ldots, M$) is

$$\tau_n^{m*}(\boldsymbol{l}, \boldsymbol{h}) = \begin{cases} l^m & \text{if } m \in \mathcal{L}_n \\ h^m & \text{if } m \in \mathcal{H}_n \\ \psi_n\left[\left(1 + \sum_{r \in \mathcal{U}_n, r \neq m} \rho_n^r\right) - \dfrac{\rho_n^m}{i_n^m}\Gamma_n\right] & \text{if } m \in \mathcal{U}_n, \end{cases} \tag{A9}$$

where $\boldsymbol{l}' = [l^1, \ldots, l^M]$, $\boldsymbol{h}' = [h^1, \ldots, h^M]$,

$$\psi_n \equiv \frac{1}{1 + \sum_{r \in \mathcal{U}_n} \rho_n^r}, \tag{A10}$$

and

$$\Gamma_n \equiv g_n + \sum_{r \in \mathcal{U}_n, r \neq m} i_n^r + \sum_{r \in \mathcal{L}_n} l^r i_n^r + \sum_{r \in \mathcal{H}_n} h^r i_n^r. \tag{A11}$$

From equations (A9) and (6), the level of spending in the constrained optimum is

$$z_n^*(\boldsymbol{l}, \boldsymbol{h}) = \psi_n\left(g_n + \sum_{m \in \mathcal{U}_n} i_n^m + \sum_{m \in \mathcal{L}_n} l^m i_n^m + \sum_{m \in \mathcal{H}_n} h^m i_n^m\right). \tag{A12}$$

The terms g_n and i_n^r are easily found to have the following effects on τ_n^{m*} ($m \in \mathcal{U}_n$) and z_n^*:

$$\frac{\partial \tau_n^{m*}}{\partial g_n} = \frac{\partial \tau_n^{m*}}{\partial i_n^r} = -\psi_n \frac{\rho_n^m}{i_n^m} < 0 \quad \text{if } r \in \mathcal{U}_n, \tag{A13}$$

$$\frac{\partial \tau_n^{m*}}{\partial i_n^r} = -\psi_n \frac{\rho_n^m}{i_n^m} l^r < 0 \quad \text{if } r \in \mathcal{L}_n, \tag{A14}$$

$$\frac{\partial \tau_n^{m\star}}{\partial i_n^r} = -\psi_n \frac{\rho_n^m}{i_n^m} h^r < 0 \quad \text{if } r \in \mathcal{H}_n, \tag{A15}$$

$$\frac{\partial \tau_n^{m\star}}{\partial i_n^m} = \psi_n \frac{\rho_n^m}{(i_n^m)^2} \Gamma_n > 0, \tag{A16}$$

$$\frac{\partial z_n^\star}{\partial g_n} = \frac{\partial z_n^\star}{\partial i_n^r} = \psi_n > 0 \quad \text{if } r \in \mathcal{U}_n, \tag{A17}$$

$$\frac{\partial z_n^\star}{\partial i_n^r} = l^r \psi_n > 0 \quad \text{if } r \in \mathcal{L}_n, \tag{A18}$$

and

$$\frac{\partial z_n^\star}{\partial i_n^r} = h^r \psi_n > 0 \quad \text{if } r \in \mathcal{H}_n. \tag{A19}$$

Appendix B

Data Description

Table B1
Descriptive Statistics

Variable	N	Mean	SD	Min	Max
Vehicle registration tax rate (%)	720	17.7	7.2	0	30
Electricity consumption tax rate (€ per kWh)	720	.104	.010	.093	.114
Waste management tax rate (%)	720	4.5	1.1	1	5
Vehicle registration tax base per capita (€)	720	154.3	46.4	51.9	359.1
Electricity consumption tax base per capita (kWh)	720	122.1	35.9	53.4	279.0
Waste management tax base per capita (€)	720	219.9	89.9	37.4	516.6
Income (GDP per capita €1,000s)	720	20.2	5.1	9.5	34.1
Population (1,000s)	720	567.9	631.6	89.0	4061.5
Age 0–4 share	720	4.4	.6	3.0	6.3
Age 65+ share	720	20.4	3.1	12.0	27.5
Real current spending per capita (€)	720	146.1	46.1	56.9	291.9
Real grants per capita (€)	720	118.2	44.7	36.6	249.0
Election year (%)	720	15.4			
Right-wing control:					
Province (%)	720	33.6			
Region (%)	136	50.4			

Note. GDP = gross domestic product.

Table B2
Data Sources

Variable	Source
Vehicle registration tax rate and base	Automobile Club d'Italia, Pubblico Registro Automobilistico
Electricity consumption tax rate	Italian Ministry of Finance
Electricity tax base	Terna Rete Elettrica Nazionale
Waste management tax rate	Italian government, Ministry of the Interior
Current expenditures	Italian government, Ministry of the Interior
Grants	Italian government, Ministry of the Interior
Election year	Italian government, Ministry of the Interior
Right-wing control	Italian government, Ministry of the Interior
Income	National Statistics Institute (Istituto Nazionale di Statistica)
Population and demographics	National Statistics Institute (Istituto Nazionale di Statistica)

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