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Overlapping Local Government Debt and the Fiscal Common

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Abstract

In a complex federalist system, the interactions across levels of government have important fiscal implications. Municipal debt has become increasingly important as local governments turn to tax-backed bonds as a significant source of funds. In a system of local governments that have overlapping borders, fiscal interactions become a factor in issuing debt. In this system, debt acts as a fiscal common resource similar to traditional common-pool resources. Specifically, vertical externalities are created with multiple levels of governments issuing bonds backed by the same tax base. Empirical results show that on average an increase in the total amount of debt issued by subcounty governments increases the true interest cost paid by county governments on tax-backed debt. Furthermore, increasing the number of overlapping governments also increases the interest costs for county debt. These findings show support for analyzing debt capacity as a fiscal common resource and have implications for debt management strategies.

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Debt financing has become an important fiscal management tool for state and local governments. At the same time, the strategic fiscal interactions among local governments in an ever-increasing system of overlapping governments have complicated local government debt management. One dimension of these strategic interactions is competition for fiscal resources. This article extends the current tax competition literature to include competition for debt resources. There are many examples in both theoretical and empirical literature that demonstrate the effects of competition across similar governments as well as competition between levels of government. This literature models and estimates the effect of tax or expenditure increases by one government on the taxes or expenditures of another government. This article takes the position that the ability to issue debt at a given interest cost is a resource and that utilizing that resource will change the availability and prices of subsequent users.

The argument is that local government debt is a fiscal common resource similar to traditional common-pool resources (CPRs). This argument is supported by developing a basic theory of debt competition among local governments and estimating several models of local government interest cost. It is shown that by increasing the amount of debt at a lower level of government, the interest cost of a higher level of government increases. In addition, increasing the number of overlapping governments that issue debt increases the interest cost of the higher level of government. While literature has shown the effects of increased debt levels on interest costs, this study adds the dimension that increased debt by third-party governments can increase the interest cost of a borrowing municipality.

While federal debt attracts the majority of media attention, state and local government debt have been on the rise for the last twenty years. All types of state and local debt have been increasing, but the amount of debt issued by special districts has far outpaced debt by other sources.[1] The recent recession coupled with several large municipal bankruptcies resulting from significant municipal debt obligations has also drawn media attention to the issue of local government debt. The visibility of municipal defaults illustrates the salience of municipal debt.

This article adds to the current literature by developing a relatively simple theory of debt competition between governments with a shared tax base in a second best world. The theoretical argument is that debt capacity is a CPR, and there are both horizontal and vertical externalities that affect borrowing costs. For a set tax base, there exists a debt capacity level for tax-backed debt. This means that for a given interest rate, a government can only borrow a certain amount before the risk of default would increase, which would drive up the interest costs. The existence of multiple governments that share the same tax base results in a CPR problem. The amount of debt issued by one government will affect the interest costs of another government's debt since both are guaranteed by the same tax base. These negative externalities have consequences for local governments in terms of the amount of debt they issue and the interest rate they pay on that debt. There are also policy implications for regional planners, considering adding new jurisdictions to existing areas, and coordination among debt-issuing governments.

Federalism and Fiscal Externalities

Competition among governments is a well-known and largely discussed aspect of fiscal federalism. A major issue in a federalist system is determining the optimal level of centralization in a public service or revenue source (Oates 1972). As the boundaries between levels of governments are blurred the intergovernmental relationships that govern fiscal administration become increasingly important. These relationships, and centralization decisions, exist throughout federal governments, state governments, and various levels of local governments. The centralization decision depends on the relative impact one level of government has on another level of government. These relative impacts have been explored in terms of taxation and expenditure competition, but the effects of competition for debt resources have yet to be fully explored.

The fiscal competition literature can be broadly divided into studies of horizontal competition and vertical competition. Horizontal competition focuses on intergovernmental relationships between equal or similar levels of government, while vertical competition focuses on the hierarchical relationship between levels of government in a federalist system. Horizontal fiscal externalities exist when a voluntary transaction between two parties affects a third party. For example, city A lowers its property tax rate so citizens in city B move to take advantage of lower taxes. This will force city B to lower its property tax rates to remain competitive. Vertical externalities

exist when a policy set at one level of government effects lower or higher levels of government. For example, a state government increases its sales tax rate that increases prices so that consumers purchase less, which decreases city A's sales tax revenue. A subset of the fiscal competition literature is concerned with governments that share a common tax base or that have overlapping tax jurisdictions. Of this subset of overlapping jurisdictions in fiscal competition, most research has been concerned with the implications to tax policy and the tax rates of the overlapping jurisdictions.

In a typology of government interactions, Dahlby (1996) describes three basic types of interjurisdictional fiscal externalities that occur when "a government's tax and expenditure decisions affect the well-being of taxpayers in other jurisdictions" (Dahlby 1996, 398). This can happen through either directly changing prices or public good provisions or indirectly altering tax revenues or expenditures of other governments. The direct externalities affect the utility functions of nonresidents, whereas the indirect externalities affect the budget constraints of other governments. These effects are always horizontal between same-level governments, whereas the indirect effects can be either horizontal or vertical between different levels of governments. As Dahlby (1996) notes, the externalities can be caused by either taxation or expenditures and can be both positive and negative. This finding highlights the ambiguous reaction effect throughout the literature.

Where Dahlby (1996) describes externalities arising from tax or expenditure decisions, it can be argued that another set of externalities arise from debt decisions. In Dahlby's framework, debt externalities would be classified as indirect because they alter the revenues or expenditures of other governments. Vertical debt externalities may arise when overlapping governments issue debt that uses the same group of taxpayers as the underlying asset. Local government bonds are typically guaranteed by the revenue from a group of taxpayers. So when another government shares that group of taxpayers and issues additional general obligation bonds, the new debt has a higher risk of default. The increased risk is due to the fact that another government has obligated future tax revenue from those taxpayers. The ability to issue debt backed by taxpayer revenue results in a fiscal externality in that other governments face higher risk when they issue debt, and that higher risk will be reflected in the interest costs. Thus, the ability to issue taxpayer-backed debt is akin to a CPR.

In the economics literature, fiscal externalities, and specifically the problem of CPR, are well known and often discussed. CPRs are traditionally thought to be "sufficiently large natural or manmade resources that it is

costly (but not necessarily impossible) to exclude potential beneficiaries from obtaining benefits from their use'' (Gardner, Ostrom, and Walker 1990). The concept of a CPR has since been extended to taxation and expenditures and has been referred to as fiscal CPRs (Berry 2008). In these cases, the benefits that go along with public spending are accrued to a particular group, but that group does not bear the full costs associated with those benefits. The main prediction of these models is that the disparity between costs and benefits leads to overspending, and as the fiscal externalities increase (i.e., the number of overlapping governments), spending increases. A natural extension of the fiscal CPR models is that if the number of local governments leads to increased spending, it would also lead to increased levels of debt.

The primary question of vertical externalities in a tax setting is how does one level of government's taxes change with another level of government's taxes? Flowers (1988) and Johnson (1988) were the first to address issues of vertical externalities associated with a shared tax base. Despite differences in modeling, some overarching themes have stood out. For example, vertical externalities are generally unaccounted for by governments and so they result in overtaxation. Also, there is ambiguity in the direction of tax responses at the different levels of governments. It is unclear whether states will raise or lower taxes in response to a rise in federal tax rates, and how federal tax rates would respond to state changes. Some of this ambiguity seems to arise from the degree of elasticity in the taxed good and the degree to which state and federally produced public goods are complementary.

Over the last ten years, there have been a series of studies that have empirically tested these theories, although the empirical literature has concentrated more on the tax externalities than expenditure externalities. They have ranged in scope from the vertical externalities that arise across Organization for Economic Cooperation and Development countries (Goodspeed 2000) to those that arise between municipalities and school districts (Wu and Hendrick 2009). The more well-known articles have focused on commodity taxation (Besley and Rosen 1998; Devereux, Lockwood, and Redoano 2007; Fredriksson and Mamun 2008), although several studies have considered personal income taxation (Goodspeed 2000; Esteller-More and Sole-Olle 2001), business income taxation (Brett and Pinkse 2000; Hayashi and Boadway 2001; Leprince, Madiès, and Paty 2007), and local property taxation (Wu and Hendrick 2009). To test the vertical externality theories, reaction functions are estimated for the responses in one level of government to the taxes of another level of government. The

general consensus is that vertical externalities do result in significant reaction functions, although there are mixed results as to the sign of the reaction function.

In addition to empirical tests of tax externalities, there have been several studies that look at the horizontal and vertical externalities that arise from public expenditures. Revelli (2001) set up a model of public spending determination within two levels of English local governments. He finds the degree of vertical interaction to be significant, and by increasing expenditures, counties increase taxpayer burdens which reduce the demand for district-level services. Significant horizontal interactions are also found. Overall higher- and lower-level local government services are found to be complements. Turnbull and Djoundourian (1993) also develop a model of the demand relationship between overlapping government activities for US counties and cities. They find a complementary relationship between the two governments' general service expenditures. In the terminology of the tax reaction literature, these studies show a positive expenditure reaction for a lower-level government given an increase in expenditures by a higher-level government.

The gap in the empirical literature mirrors the gap in its theoretical counterpart, in which there has been little consideration of vertical debt externalities. The studies by Revelli (2001) and Turnbull and Djoundourian (1993) fall short of the full analysis in their discussion of the trade-off between taxes and expenditures in overlapping governments. A natural extension should then be to consider how government debt would be affected. If expenditures of a city increase with the increased expenditures of a county, these government services either will be paid for by an increase in taxes, as Turnbull and Djoundourian (1993) point out or could be paid for by government borrowing. The second option has not been considered in the existing literature.

There have been a couple of studies that have addressed the vertical fiscal externalities that arise due to overlapping governments, specifically in the context of special districts. Berry (2008) discusses the fiscal CPRs in the context of overlapping jurisdictions and argues that overlapping governments result in fiscal "overfishing" and finds a strong positive relationship between the number of overlapping jurisdictions and the size of the public sector. More specifically, Martell (2007) models debt burden using overlapping general purpose and special district jurisdictions and finds that multiple overlapping jurisdictions restrict debt growth and that debt burdens of metropolitan districts are greater than nonmetropolitan districts. This study builds upon and extends Martell's study.

Theoretical Framework

The concept of the fiscal common resource in which taxes and expenditures are viewed as being excludable and rivalrous, similar to classic CPRs, is not a new perspective (Wrede 1999; Berry 2008). As Wrede (1999) shows, the tax base overlap is the fiscal analogue to the common property resource or fiscal common resource. Externalities exist when more than one person have access to a rival good. The result is that extraction of the good today changes opportunities of all players tomorrow via the stock of the resource. Extraction of nonrenewable resources will be too fast, and the steady state stock of renewable resources will be too low. In the case of fiscal common resources, like traditional CPRs, actors will normally fail to achieve the cooperative outcome without some government intervention or explicit cooperative agreement. The argument can be made for debt capacity as another form of a fiscal common resource.

Berry (2008) shows that a system of overlapping jurisdictions viewed through the classic model of utility maximizing governments with a benevolent planner each jurisdiction would consider any cost that its actions imposed on the other jurisdiction. The planners would then set their taxation and service levels at the Samuelson's optimum so that the sum of marginal benefits equals marginal costs. The resulting level of taxes, expenditures, and debt of this system of overlapping jurisdictions with benevolent planners would be the same as the levels under a single general purpose government. In this theoretical setting, jurisdiction overlap has no effect on tax rates or levels of debt, but given the literature previously discussed, it can be shown that this is not the case. Berry (2008) argues that special jurisdictions are susceptible for political capture and therefore are not equivalent to central planners. Martell (2007) also shows that multiple overlapping general purpose and special district jurisdictions restrict debt growth. These findings suggest that the ability to issue debt acts as a fiscal common resource similar to traditional CPRs.

The ability to issue debt is a resource that holds significant value to local governments. A vertical debt externality exists if interest rate premiums increase for a municipality in response to increased debt level of third parties. To conceptualize the problem of fiscal externalities arising from debt in a situation of overlapping jurisdictions, it is helpful to think of a city government that shares a tax base with a school district, both of which are within the borders of a county or state government. In this example, when all three governments issue tax-backed debt, they are pledging future incomes based on the same tax base. While it may be the case that different

levels of government tax different goods (property, incomes, sales, etc.), they are still taxing the same geographic area and in most cases have the ability to levy additional types of taxes to service the debt.

In the debt management literature, it is well known that governments are concerned with "debt affordability" or "debt capacity," which is the level of debt and/or debt service that a local government can support without risking default or creating undue budgetary constraints (Denison, Hackbart, and Moody 2009). The problem that arises with overlapping jurisdictions is that the amount of debt issued by one level of government may cause another level of government to pay a higher interest rate, resulting in a vertical as well as horizontal fiscal externality. The result of the externality is a CPR problem akin to Hardin's (1968) tragedy of the commons where each jurisdiction's marginal cost of accumulating debt is less than the social marginal cost of that accumulation. Each jurisdiction issues debt to increase its own utility or to maximize a representative citizen's utility, and they receive the positive benefit from that debt. The problem is that the externality component reduces the debt capacity and increases the interest rate shared by all the jurisdictions that share that tax base. If these findings are considered in the context of the CPR problem, debt capacity would be affected by a system of overlapping governments.

To develop a theoretical illustration of these externalities, a more simplified scenario is constructed. A hierarchical government system with multiple small jurisdictions and one larger jurisdiction that is administratively above the smaller jurisdictions is considered. For simplicity, the smaller jurisdictions are referred to as lower level and the larger jurisdictions as higher level. As shown in the empirical section, lower and higher refer only to the size and administrative hierarchy. For example, in the case of a county and a city, the county would be "higher" and the city "lower," which is to denote that counties are typically geographically larger and, in terms of an administrative hierarchy, are above the city, but they do not control the city. All jurisdictions levy taxes and issue debt to finance a government service, and the interest paid on government debt is a function of how much total debt is borrowed by both levels. A standard framework of a second best world is considered to model debt in fiscal competition with overlapping jurisdictions and vertical fiscal externalities. For simplicity, some assumptions need to be made. While these assumptions may not fully capture the complexities of the government debt market, they are necessary to develop a basic economic model.

It is assumed that there are n identical lower-level jurisdictions that have the same objectives. As jurisdictions are identical, this analysis focuses on

the policies of a single representative jurisdiction. For notation purposes, the representative lower-level jurisdiction is represented with lower case letters and the higher-level jurisdiction is represented with upper case letters. The underlying credit risk factors are assumed to be the same for all levels of governments, and all governments make their borrowing decisions simultaneously with perfect knowledge of other government's decisions. The credit risk assumption is necessary so that the only variation in risk level stems from default risk associated with additional borrowing rather than other factors such as recessions or political factors.

There is assumed to be a large number of identical individuals acting as consumers, workers, and citizens. They are all born at the beginning of period 1 and die in the second period in a two-period finite-horizon case. For both levels, there is one input, labor, used in the production of a private good, c, and two public goods, g and G, both of which are normal goods.

Each individual has the objective function:

$$U_1(c_1, g, G) + \beta U_2(c_2, g, G), \tag{1}$$

where c is private consumption, g is a public good produced by a lower-level government, G is a public good produced by the higher-level government, and β is the discount rate of future consumption. In this scenario, public goods can be thought of as infrastructure, which is a common use of government debt. The utility function for a representative individual, U_i, is continuous, at least three times continuously differentiable, strictly increasing, and strictly concave, where i is the time period. Both governments produced goods, g and G, are financed through taxes and bonds. Both the lower-level governments issue bonds, b, and the higher-level government issues bonds, B. Consumption in period 1, c_1, is determined by income, w_1, and a lump sum tax τ, whereas consumption in period 2 is determined by income period 2, w_2. Debt is exogenously supplied, but the interest rate is a function of the total demand for debt.

$$g = \tau + b. \tag{2}$$

$$G = T + B. \tag{3}$$

$$c_1 = w_1 - \tau - T. \tag{4}$$

$$c_2 = w_2 - (1 + r)b - (1 + r)B. \tag{5}$$

$$r = f(b + B). \tag{6}$$

Maximizing the representative resident's utility produces a social welfare function.

$$\begin{aligned}\mathrm{Max}_{b,\tau} w = {} & U_1(w_1 - \tau - T, \tau + b, T + B) \\ & + \beta U_2(w_2 - (1+r)b - (1+r)B, \tau + b, T + B).\end{aligned} \tag{7}$$

Maximizing with respect to both taxes and debt for a representative local government results in the following first-order conditions:

$$\frac{\partial w}{\partial b} = -U_{1g}^{'} + \beta U_{2g}^{'} - \beta U_{2c}^{'}(1+r) = 0. \tag{8}$$

$$\frac{\partial w}{\partial \tau} = -U_{1c}^{'} + U_{1g}^{'} + \beta U_{2g}^{'} = 0. \tag{9}$$

From equations (8) and (9), the marginal rate of substitution (MRS) between periods 1 and 2 consumption for the local government is determined. Equation (12) shows the marginal utility of consumption in period 1 is equal to the discounted marginal utility of consumption in period 2 times the interest rate. It can also be rearranged to show the MRS between periods 1 and 2 is equal to the discounted interest rate (equation 13).

$$\beta U_{2g}^{'} = \beta U_{2c}^{'}(1+r) + U_{1g}^{'}. \tag{10}$$

$$\beta U_{2g}^{'} = U_{1c}^{'} - U_{1g}^{'}. \tag{11}$$

$$\beta U_{2c}^{'}(1+r) = U_{1c}^{'}. \tag{12}$$

$$\frac{MU_1}{MU_2} = \beta(1+r). \tag{13}$$

Equation (13) represents the MRS between consumption in period 1 and consumption in period 2 for all lower jurisdictions. Since they do not consider their individual effect on the overall interest rate, the trade-off between the two time periods is simply the discounted interest rate. The interest rate is a function of total borrowing, and so each jurisdiction creates an externality when it borrows that does not factor into their social welfare optimization problem. The externality that is created by local government borrowing can be seen in the state optimization problem.

The higher-level government would maximize the same social welfare function only if it is proving a public good, G, to all local jurisdictions in the state. This means they maximize the same social welfare function times

n jurisdictions and choose the amount of higher-level bonds, B, and state taxes, T, that maximize social welfare across all jurisdictions.

$$\begin{aligned}\mathrm{Max}_{b,\tau} W = {} & nU_1(w_1 - \tau - T, \tau + b, T + B) \\ & + \beta n U_2(w_2 - (1+r)b - (1+r)B, \tau + b, T + B).\end{aligned} \tag{14}$$

$$\frac{\partial W}{\partial B} = nU_{1G}^{'} + \beta n U_{1c}^{'}(1+r) + \beta n U_{2G}^{'} - \beta n U_{2c}^{'}(b+B)\frac{\partial r}{\partial b} = 0. \tag{15}$$

$$\frac{\partial W}{\partial T} = -nU_{1c}^{'} + nU_{1G}^{'} + \beta n U_{2G}^{'} = 0. \tag{16}$$

Solving for the MRS, the same analysis can also be done for the higher-level government by rearranging equations (15) and (16) and solving for the MRSs. Because the higher-level takes into account the effect its borrowing has on the interest rate, the last term illustrates the fiscal externality created by the local jurisdictions and internalized by the state government. The term $\beta n U_{2c}^{'}(b+B)\frac{\partial r}{\partial b}$ can be interpreted as the total effect on interest rates created by multiple borrowing governments and will be positive in the higher-level maximization problem where it was zero in the lower-level maximization problem.

This finding illustrates one aspect of the fiscal common resource problem in local government debt. If no CPR existed, then in a system overlapping benevolent central planners, all jurisdictions would issue the same amount of debt at the same interest rate. By maximizing the higher-level jurisdiction social welfare function, it can be shown that if one level does not consider the effect their borrowing has on interest rates then changes in social welfare with respect to bonds differ from the central planner social welfare maximization problem. Furthermore, since the term $\beta n U_{2c}^{'}(b+B)\frac{\partial r}{\partial b}$ is positive for the higher-level government, then as the number of jurisdictions (n) increases, the externality term will also increase. This is the same finding we would expect in a classic CPR problem when more fishermen are added to a common fishing pond. The policy implication of this finding is that as more local jurisdictions that do not consider their effect on the market are created, then the amount of debt issued will increase, which in turn will increase the risk of default and interest rates.

From the higher-level government perspective, the social planner considers the direct welfare implications of borrowing but also the impact borrowing has on local government budgets.

$$\beta n U'_{2G} = \beta n U'_{2c}(b + B)\frac{\partial r}{\partial b} + \beta n U'_{2c}(1 + r) - n U'_{1G}, \tag{17}$$

$$\beta n U'_{2G} = n U'_{1c} - n U'_{1G}, \tag{18}$$

$$\beta n U'_{2c}(b + B)\frac{\partial r}{\partial b} + \beta n U'_{2c}(1 + r) = n U'_{1c}, \tag{19}$$

$$\beta(b + B)\frac{\partial r}{\partial b} + \beta(1 + r) = \frac{MU_1}{MU_2}, \tag{20}$$

$$\beta(b + B)\frac{\partial r}{\partial b} + \beta(1 + r) \neq \beta(1 + r), \tag{21}$$

$$\text{or } \mathrm{MRS}_{g,c1} + \mathrm{MRS}_{G,c1} \neq \mathrm{MRS}_{g,c2} + \mathrm{MRS}_{G,c2}. \tag{22}$$

Since the term $\beta n U'_{2c}(b + B)\frac{\partial r}{\partial b} > 0$, the externality created by lower-level borrowing is internalized by higher-level borrowing, and the aggregated first period MRSs for the lower- and higher-level governments are not equal to the aggregated second period MRSs. The distortion causes the trade-off between public and private consumption between government levels and time periods to be different. It should be noted that this interaction only exists if both governments issue debt, because if not, the first term in equation (21) is zero.

The difference between the MRSs is the term $\beta(b + B)\frac{\partial r}{\partial b}$, which consists of two components. The first is the discounted amount of total debt issued by both the levels of governments. The second is the change in interest rates with respect to the change in lower-level debt. If we would expect that debt is a fiscal common resource that acts like conventional CPRs, then it will hold that $\frac{\partial r}{\partial b} > 0$, so that as lower-level jurisdiction debt increases, the interest rates would increase. If local government debt is not a CPR, then there should be no relationship between the interest rates for a higher-level government and the amount of debt that is issued at the lower-level ($\frac{\partial r}{\partial b} = 0$). In the case that no relationship exists and $\frac{\partial r}{\partial b} = 0$, then the first term in equation (21) is zero, and the MRSs between the two periods and the two levels of government will be the same. If the MRSs are the same, then they will both be equal to the discounted interest rates and thus the Samuelson's condition is satisfied.

Empirical Framework

Two relationships from the theoretical framework on whether or not debt is a fiscal common resource, and thus produces externalities similar to traditional CPRs, can be empirically tested. The first relationship is between lower-level debt and the risk associated with higher-level government debt stemming from overlapping jurisdictions. This can be tested by examining the impact an increase in the amount of debt at a lower level of government has on the interest rates of a higher level of government, controlling for other risk factors. In the case of local governments, this relationship will be expressed as a "higher"-level county government, and "lower"-level governments will include cities, school districts, and other special districts. The second relationship is between the number of lower-level jurisdictions and the magnitude of the externality. Again, if debt acts like classic CPRs, then as the number of jurisdictions that issue debt increases, the externality also increases. This can also be empirically tested using interest rates. The implication is that as the number of lower-level jurisdictions that issue debt increases, the interest rates of the higher-level jurisdictions will also increase.

For both the testable relationships, it is expected that local government debt is a fiscal common resource. If debt is not a fiscal common resource, then there should be no effect on interest rates from either the amount of lower-level debt or the number of lower-level jurisdictions. To address both of these relationships empirically, two separate models will be estimated. The first will aggregate all subcounty local government debt to examine the effect of total lower-level debt on interest costs of a higher-level government bond. The second will examine the effect of the number of debt-issuing governments on the interest costs of a higher-level government bond.

The dependent variable for this study is the interest cost paid by county governments on tax-backed debt. While there are several methods for calculating municipal interest rates, the public finance literature has been fairly clear on the point that true interest cost (TIC) is the superior method (Simonsen, Robbins, and Helgerson 2001). The TIC is an overall interest rate indicating the performance of a bond. TIC is the most accurate measure of the total cost of debt issuance, because it takes into account the time value of money and is essentially an internal rate of return calculation. This is superior to the alternative, net interest cost, which is a more simplistic calculation of the average value of the coupon rate.

There have been many studies that model TIC to answer a variety of questions including the effect of multiple credit ratings (Hsueh and Kidwell 1988), competitive-only laws (Peng and Brucato 2001), and jurisdiction

size and sale type (Simonsen, Robbins, and Helgerson 2001). Some of the key factors identified in these studies that influence TIC are the number and type of credit enhancements, including how many credit ratings are purchased, the type of sale, the level of experience of the government issuing the bond, the tax-exempt status of the state in which the bond is being issued, the size of the bond, and the size of the jurisdiction.

To identify the impact of either aggregate lower-level debt or the number of issuing jurisdictions, the models need to control for other variables that may influence TIC. For these controls, a fairly standard model of TIC derived from the literature is used. These explanatory variables include total county expenditures, tax debt per capita, a Bond Buyer 20-Bond GO Index, median income, population, par amount, years to maturity, credit ratings from Standard & Poor's (S&P) Rating Service, and a dummy variable indicating whether or not a county is in a metropolitan statistical area (MSA).

The reduced form estimating equation for model 1 takes the form:

$$t_{ict} = \beta \ln D_{ct} + \gamma X_{ct} + \delta Z_{ict} + \alpha_t + \varepsilon_{ict}, \tag{23}$$

where t_{ict} is the TIC of a county, c, bond issue, i, in fiscal year, t; D_{ict} is the total amount of subcounty debt issued in county, c, in fiscal year t; X_{ct} is a vector of control variables that vary by county; Z_{ict} is a vector of control variables that vary by issue; α_t controls for the fiscal year; and ε_{ict} is a random error term. The equation for model 2 takes the form:

$$t_{ict} = \beta \ln N_{ct} + \gamma X_{ct} + \delta Z_{ict} + \alpha_t + \varepsilon_{ict}, \tag{24}$$

Model (23) is the same as model (24) except that instead of using the total amount of lower level debt as the main explanatory variable the number of issuing lower-level governments is used and denoted by N_{ct}. The log of both explanatory variables of interest will be used because there are likely to be large values with diminishing marginal impact. This requires counties with no overlapping jurisdiction debt to be dropped.

Data and Results

The data used for this study consist of tax-exempt bonds issued by county governments in the state of Texas between fiscal years 2005 and 2010. The data are restricted to general obligation debt, which is different in risk and other characteristics from revenue-backed debt. The bond issue data were obtained from the Texas Bond Review Board, an oversight agency that collects, analyzes, and reports information on debt issued by state and local entities as well as approving state debt issues and lease purchases greater

than $250,000 or longer than five years of maturity. Population estimates for counties are from the Texas State Data Center. Median income estimates are from US Census Bureau's Small Area Income and Poverty Estimates. The Bond Buyer Indices are from Bondbuyer.com.

To examine the theoretical nature of local government debt as a fiscal common resource, it is appropriate to restrict the data to general obligation debt that is backed by the full faith and credit of the issuing jurisdiction, but it has been hypothesized that special districts and public authorities, among other jurisdictions, may use revenue bonds to avoid tax and expenditure limitations (Bunch 1991). Counties in urban areas with more jurisdictions will also face different incentives for instituting local option sales taxes and may face different capital infrastructure demands. Additionally, Martell (2007) shows that debt burdens associated with metropolitan districts are greater. To control for these various urban government-related issues, a dummy variable indicating whether the county is located in an MSA is included. In the 2005 to 2010 year time frame, all the county governments that issued a revenue bond and a general obligation bond in the same year were located in an MSA.

The state of Texas has 254 counties, but not every county issues tax-exempt debt in every year. Furthermore, some counties issue debt multiple times in the same year. Of the 254 counties, 113 of them issue tax-exempt debt in this data set. In the 113 that do issue, 64 of them only issued once, meaning that the remaining 49 issued multiple times. The top issuer, Travis County, home to the state capital, Austin, issued twenty-seven times. Conclusions drawn from this analysis only apply to counties that issue debt and have overlapping debt. Table 1 shows the descriptive statistics for the tax-exempt bond sales in Texas. The units of analysis are Texas Counties that issued tax-backed debt between fiscal years 2005 and 2010. The average TIC is just over 4 percent and is fairly symmetrical with only slight skewness. The main explanatory variable of interest, amount of overlapping debt, averages US$338 million issued by lower-level governments within the county. The median is significantly lower at $62 million, showing a skewed distribution.

The dependent variable for all models is the TIC of the bond. In equation (23), the main explanatory variable of interest is the amount of overlapping debt issued by lower-level governments. The amount of overlapping lower-level debt was calculated by aggregating the par value of all tax-backed bonds in a fiscal year for local governments located within a county. Local government types include cities, school districts, municipal utility districts, health districts, community college districts, and other special districts. In cases where a district's boundaries crossed multiple county lines, that

Table 1. Descriptive Statistics.

Variable	Description	Mean	*SD*
True interest cost (TIC)	Internal rate of return on a bond	4.042	0.9
Log par overlap	Log amount of tax-exempt debt that has been issued by all subcounty governments in the same fiscal year	18.2	2.19
Log num. overlap	Log number of subcounty governments that share a tax base with the county and issued debt	2.07	1.42
Texas visible supply (in billions)	Amount of debt available over the next 30 days	1.5	0.63
MSA	If the county is in a designated MSA	0.57	0.5
Total expenditures (in billions)	Total county expenditures for the fiscal year	1.87	3.19
Tax debt per capita (in hundreds)	County tax debt per capita for the fiscal year	4.52	5.55
Bond Buyer Index	A national index of municipal bonds	4.53	0.24
Median income	County median income for the fiscal year	0.05	0.01
Population (in millions)	County population for the fiscal year	0.52	0.91
Log par amount (in millions)	Amount the bond is being issued for	15.7	1.57
Years to maturity	Years to maturity for the bond	13.44	7.55
Competitive sale	If the bond was competitively sold	0.11	0.32
Bond insurance	If the bond had insurance	0.33	0.47
Credit rating scale	AAA rating by S&P	0.99	1.19
No credit rating	No rating by S&P	0.32	0.47

Notes: MSA = metropolitan statistical area; S&P = Standard & Poor's.

district's debt was assigned to its primary service area county.[2] In Texas, special district boundaries are not co-terminus with county boundaries. There does not appear to be any systematic process to designate if a district spans multiple counties; therefore, this source of error is believed to be random.

The main explanatory variable of interest for equation (24) is the number of overlapping subcounty governments that issue debt. The number of overlapping governments' figure was calculated by adding up the total number of governments that issued debt within a county, as opposed to the amount of debt that was issued. There was also wide spread in the number of overlapping governments, ranging from 0 to 173. The county with 173 overlapping governments is Harris County where the city of Houston is located.

The rest of the explanatory variables are categorized as either county variables, issue variables, or market variables. County variables include the county expenditures, debt per capita, income, and population. These variables are measured by the fiscal year. Issue variables come from each bond that is issued by the county. Also included is a dummy variable indicating whether or not a county is in an MSA. Issue variables include the par amount (amount of the bond), years to maturity, type of sale (competitive or not), bond insurance, and the underlying credit rating if the issue was rated. Market variables are controls for the tax-exempt bond market and include the visible supply for the next thirty days of tax-exempt debt for the state of Texas and the BondBuyer.com Index of twenty general obligation bonds.

There is a large range in the thirty-day visible supply, suggesting that there are certain times throughout the year when more debt is issued, although on average there is about $1.5 billion worth of tax-exempt debt available. The average county has about $1.87 billion in expenditures and about $452 of debt per capita. Very few of the issues are competitive sale, meaning they are either issued by negotiated sale or private placement. The majority of rated issues receive AAA bond ratings from S&P, which is the highest available. In the following model, credit ratings have been assigned numerical values. It is also noteworthy that roughly a third of issues have no bond rating from S&P.

The results for all three models are presented in table 2. The results from estimating equation (23) where the main explanatory variable of interest is log par overlap are reported in column (A). Column (B) reports the results of equation (24) where the main explanatory variable of interest is the log number of overlapping governments. Column (C) estimates an instrumental variable model corrected for endogeneity of log par overlap, which may be endogenous if local governments react to the county's TIC. This is discussed subsequently. It should be noted that counties that had no overlapping debt were dropped from the estimation. These observations are dropped because as specified in the theoretical framework, no predictions can be made if there are no overlapping jurisdictions that both issue debt.

It can be shown from the results in table 2 that the total amount of debt for lower-level governments is positive and statistically significant at the .05 level. This suggests that on average, increasing the amount of lower-level overlapping debt will increase TIC for county tax-backed debt issues. Specifically, on average, a 10 percent increase in the amount of overlapping lower-level debt (10 percent increase is approximately an increase the log of 0.10) is associated with a .0063 (0.1 times 0.063, from the table 2), or sixty-

Table 2. Estimation Results.

Variables	(A) Coefficient	(A) Standard error	(B) Coefficient	(B) Standard error	(C) Coefficient	(C) Standard error
Log par overlap	0.064**	(0.031)	—	—	0.072**	(0.035)
Log num. overlapping	—	—	0.091*	(0.048)	—	—
Log par amount	−0.081**	(0.040)	−0.079	(0.052)	−0.083**	(0.040)
Visible supply	0.133**	(0.059)	0.134**	(0.057)	0.132**	(0.059)
MSA	−0.002	(0.099)	0.037	(0.097)	−0.015	(0.102)
Total expenditures	−0.071**	(0.036)	−0.062*	(0.0342)	−0.075**	(0.037)
Debt per capita	0.032***	(0.0112)	0.029***	(0.0112)	0.032***	(0.0112)
Bond Buyer Index	0.458**	(0.177)	0.438**	(0.202)	0.459**	(0.177)
Median income	−9.565***	(3.383)	−9.849**	(3.844)	−9.900***	(3.441)
Population	0.199*	(0.119)	0.162	(0.104)	0.202*	(0.119)
Years to maturity	0.078***	(0.006)	0.078***	(0.010)	0.078***	(0.006)
Issue comp sale	−0.235**	(0.111)	−0.220***	(0.069)	−0.236**	(0.111)
Issue insurance	−0.118	(0.122)	−0.106	(0.125)	−0.115	(0.122)
S&P rating	−0.113**	(0.044)	−0.110**	(0.056)	−0.112**	(0.044)
No credit rating	0.329*	(0.170)	0.327*	(0.190)	0.337**	(0.171)
2006	0.060	(0.139)	0.086	(0.160)	0.048	(0.141)
2007	0.394***	(0.131)	0.408***	(0.153)	0.388***	(0.132)
2008	0.420***	(0.141)	0.453***	(0.165)	0.409***	(0.143)
2009	0.109	(0.135)	0.160	(0.148)	0.101	(0.136)
2010	0.107	(0.149)	0.127	(0.176)	0.107	(0.150)
Constant	1.058	(1.048)	2.045	(1.315)	0.952	(1.066)
Observations	386		386		386	
R^2	.454		.452			

Notes: MSA = metropolitan statistical area; num. number of; S&P = Standard & Poor's.
***$p < .01$, **$p < .05$, *$p < .1$.

three basis points, increase in the TIC of a county bond issue, ceteris paribus. Considering the average TIC is 4.042 percent, this can be an important factor. For example, the average county has approximately $338 million worth of lower-level overlapping debt. If a city within an average county decided to issue a $34 million bond, holding everything else constant, that county's TIC would increase from 4.04 to 4.05 percent, which over a thirty-year bond would be a significant cost increase. The statistical significance confirms the theoretical predictions and indicates that local government debt capacity is a fiscal common good. On average, increasing the amount of debt issued by a lower-level government increases the interest costs, and thus the risk associated with jurisdictional overlap, of a higher-level government.

Several other variables were statistically significant for increasing TIC on average including tax debt per capita, population, years to maturity, and not having a credit rating. These results show that on average having higher debt per capita, having a larger population, longer time to maturity, and not receiving a credit rating, all increase TICs for counties. Conversely, increasing total expenditures, amount of the bond, median income, and credit ratings decrease TIC on average. Competitively sold bonds also have lower TICs compared to negotiated bond sales. These results are consistent with the existing literature on municipal interest cost models.

The results of equation (24) are similar to equation (23). The positive coefficient on log number of overlapping governments suggests that as the number of governments that share a tax base with the county, and issue tax-backed debt, increases, the TIC paid on county bond issues also increases. This provides additional evidence to support the theoretical prediction that local government debt is a fiscal common resource because as the total number of overlapping jurisdictions increased, the externality associated with the jurisdiction overlap increases. In this case, the externality can be observed through higher interest costs. On average, a 10 percent increase in the number of subcounty governments that have overlapping tax bases with a county will increase that county's TIC by 91 basis points, ceteris paribus. The average number of overlapping governments is about 18, which means that on average if two additional jurisdictions are created within a county that both issue debt that county's TIC would also increase from 4.04 to 4.05 percent (increase of 2/18 times 0.091). This means that both the layering of governments and the stock of overlapping debt influences interest costs.

Further specifications of these models have also been considered. For example, a county fixed effects model was tested, but the fixed effect was

found to not be statistically significant with a p value of approximately .319. The county fixed effect did account for approximately 56 percent of the variance in TIC but was not close to being statistically significant. Overall, the explanatory variables explained around 89 percent of the fixed effect. Furthermore, the county fixed effect was positively associated with the logged par overlap variable. The correlation coefficient between log par amount overlap and an estimated county fixed effect is 86 percent.

One possible objection to equation (23) with log par amount overlap as the explanatory variable of interest is the presence of endogeneity. If par amount overlap is a measure of the supply of tax-exempt debt and it is regressed on TIC, which is a measure of price, the argument can be made that the two are endogenous. To address this concern, the use of an instrumental variable is appropriate. Finding an instrument that is correlated with the amount of total lower-level debt of subcounty governments, but should not be included in the original model of TIC, is a difficult task. To solve this problem, a rather unorthodox instrument is constructed.

As stated previously, county fixed effects are not found to be statistically significant in a model of TIC and therefore not included in the original model. On the other hand, the estimated fixed effects are highly correlated with the amount of overlapping lower government debt. The explanation for this set of results is that historical county factors, such as the degree of fragmentation in that county, are reflected in the county fixed effects. At the same time, investors and underwriters do not consider these unexplained, historical county factors when determining interest rates. Economic conditions and specific issue factors influence interest costs, whereas fixed county characteristics do not. Since county is a geographic designation, it is exogenous, and the county fixed effect makes a valid instrument for log par amount overlap.

Statistically this satisfies the requirements of an instrument because estimated county fixed effects do not appear in the original model, are correlated with log par amount overlap, and are exogenous. Theoretically, this addresses any questions of endogeneity because county fixed effects can be historical in nature and will capture elements like fragmentation of local governments. A county like Dallas County has considerably more local governments within its borders compared to somewhere like Bexar County because Dallas has historically allowed municipalities and special districts to form easily. Bexar County, on the other hand, is home to the city of San Antonio, which has historically annexed newly developed areas aggressively. Those counties with more fragmentation, and thus more governments, are going to have more entities issuing debt; therefore, they have more overlapping subcounty debt.

The results of an instrumental variable regression with county fixed effects with the described specifications are listed as column (C) in table 2. When the county fixed effect is used as an instrument for log par overlap, it is still statistically significant and even has a slightly higher coefficient. The results of the instrumental variable model as a whole look very similar to equation (24), with only slight variations in significance and coefficient magnitudes. Correcting for possible endogeneity on average when log par overlap is increased by 10 percent, TIC will increase by seventy-two basis points. The instrumental variable regression is used as a robustness check to show that by using a reasonable instrument to correct for possible endogeneity, the coefficients do not change in sign or significance between columns (A) and (C) in table 2. This robustness check lends additional support to the finding that increasing the amount of overlapping debt issues by lower-level governments increases the interest costs of a higher-level government bond.

Discussion and Policy Implications

The results found in the last section are an extension of existing literature on tax externalities to include debt externalities. It is shown that interest costs of a higher-level government are affected by the borrowing of lower-level governments. This finding contributes to both the literature on regional fiscal competition and the literature on municipal bonds. It has been shown previously that debt levels can increase borrowing costs, and this study extends that finding by including increased debt levels of overlapping governments to the factors that increase interest costs. The results also extend the literature on tax competition by demonstrating that debt capacity can be thought of as a fiscal resource similar to tax capacity. Direct comparison to tax competition literature is not straightforward, but the increase in the higher-level (county) interest rates in response to increased lower-level aggregate debt is a positive reaction. In the studies of local governments, both Revelli (2001) and Turnbull and Djoundourian (1993) found positive reactions between county and district or county and city interactions. In the most direct comparison to previous literature, this study supports the findings in Martell (2007) that multiple overlapping governments restrict debt growth.

As theorized, debt capacity in a region can be viewed as a fiscal CPR. As lower-level governments draw on a resource, it diminishes the ability of higher-level governments to utilize the resource without paying higher costs. As local governments compete over debt resources, the institutional constraints, individual government debt policies, and strategic interactions

between governments become increasingly important. Furthermore, these findings fit into a larger discussion about centralized and decentralized debt policy at the state and local levels. If the externalities are created through fragmentation and overlapping borrowing authority, then one solution would be to centralize the borrowing in that area.

One major policy implication for these findings is the effect of creating additional governments that overlap an existing tax base. The results from the second model show that on average, adding an additional lower-level government that issues debt will increase the TIC. With multimillion dollar debt issuances, this can add up to economically significant amounts. These findings have implications for the fragmentation literature as well as the centralization literature. In terms of interest costs, it may be beneficial to limit the amount of special districts with borrowing power that overlap general purpose governments such as cities and counties. Another policy implication is that across debt-issuing jurisdictions, there can be debt competition that increases costs. The increased costs may be avoided through coordination efforts so that future generations are not burdened with higher debt service payments.

This study lays out a basic conceptual framework to think about the externalities that arise from overlapping governments that are issuing debt. The prediction is that interest costs will increase as the level of total amount of debt being issued in a region increases. Results from three different models show that on average both the total amount of lower-level government debt that overlaps a county and the total number of governments issuing that debt increases the TICs that a county pays on tax-backed bonds. These results have several policy implications for centralization and fragmentation of governments, the creation of special districts with borrowing authority, and the types of fiscal competition in which local government are involved. Given the current importance of debt at all levels of government, these are important considerations for fiscal policy and interregional governance.

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Notes

1. Board of Governors of the Federal Reserve System, statistical supplement to the Federal Reserve Bulletin, monthly, May 6, 2013.
2. In the case of districts that span multiple counties, the Texas Bond Review Board lists all the overlapping counties. The designation of primary service area is defined by the author based on county that has the most geographic overlap with the district.

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