Vertical Debt Externalities in Overlapping Governments

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Abstract:

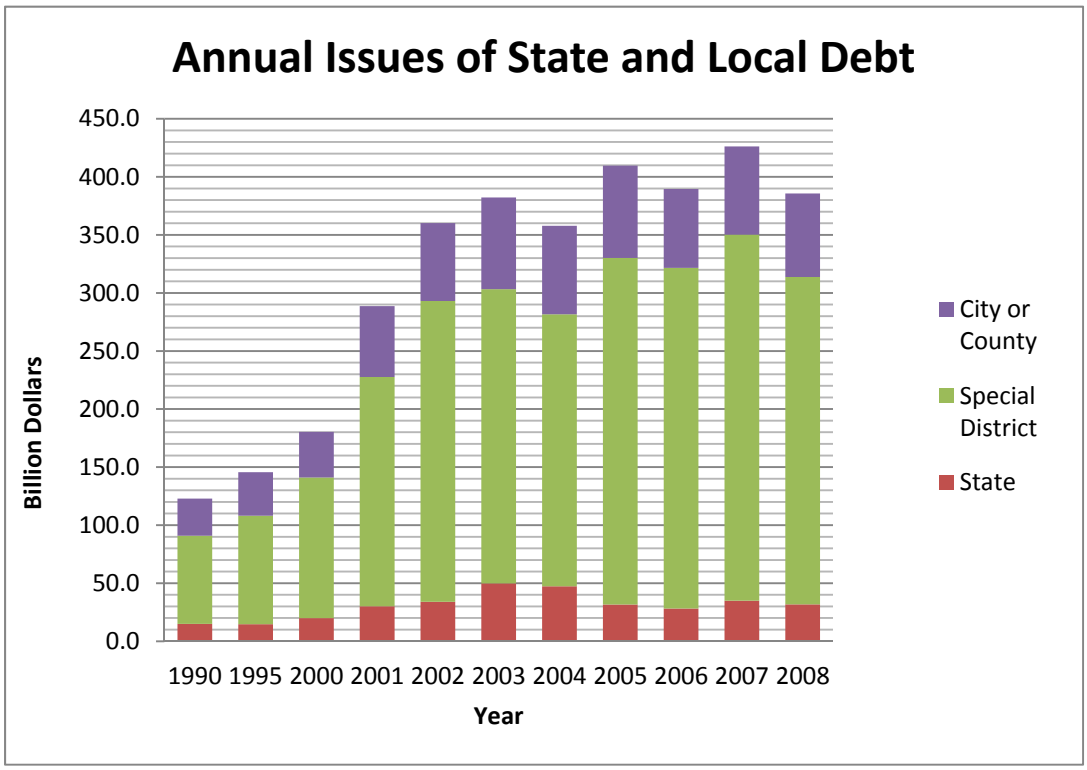
Municipal debt has become increasingly important as local governments turn to tax-backed bonds as a significant source of funds. Given the extensive use of municipal bonds policy makers, administrators, and analysts are interested in the factors that influence the cost of borrowing. The fiscal interaction of different levels of government are important factors for borrowing, but the existing literature on vertical externalities that arise from overlapping governments has so far been limited to the effects of taxes and expenditures. Vertical fiscal externalities that arise from issuing debt especially in local governments have yet to be fully considered in the literature. In this study a simple model of the simultaneous determination of debt levels by multiple lower level governments and a single higher level government is developed. From this model predictions about the additional risk generated by leveraged lower level governments, and the effect on the interest costs paid by a higher level government are made. These predictions are tested by estimating reaction functions for sub-county government debt on county government interest costs. Findings suggest that on average an increase in the total amount of debt issued by sub-county governments increases the true interest cost paid by county governments on tax backed debt. Furthermore, increasing the number of overlapping governments also increases interest costs for county debt. The models are corrected for possible endogeneity, and the results still hold. These findings are important in determining optimal institutional debt policies, as well as attaining the lowest possible interest rates when issuing government debt.

Introduction

Competition among local governments is a phenomenon that has been discussed and studied extensively in economics and policy literature. One side argues that competition is good, and keeps tax rates low and government services competitive. Another side argues that competition does not result in welfare gains it merely moves resources between communities. In that redistribution governments lose revenues and resources competing over attracting businesses through incentives or tax rates. The arguments are well developed and consider a variety of perspectives including taxation, expenditures, citizen welfare, and industry growth. One aspect of the argument that is less developed is the role that local government debt plays in competition. Debt competition may influence governments in different ways, but in general jurisdictions are competing for the ability to issue debt at the lowest interest cost it can obtain.

State and local government debt has been on the rise for the last twenty years. As shown in Figure 1 state and local debt has increased as a whole, but the amount of debt issued by special districts has far outpaced other government types. The recent recession and media attention to national debt issues combined with several high profile municipal bankruptcy filings including Jefferson County Alabama and Harrisburg Pennsylvania that resulted from significant municipal debt obligations has drawn attention to the issue of local government debt. Trying to measure and analyze local government debt and be a tricky endeavor, because the current governance landscape is a complex network of overlapping jurisdictions including a variety of special districts.

Figure 1

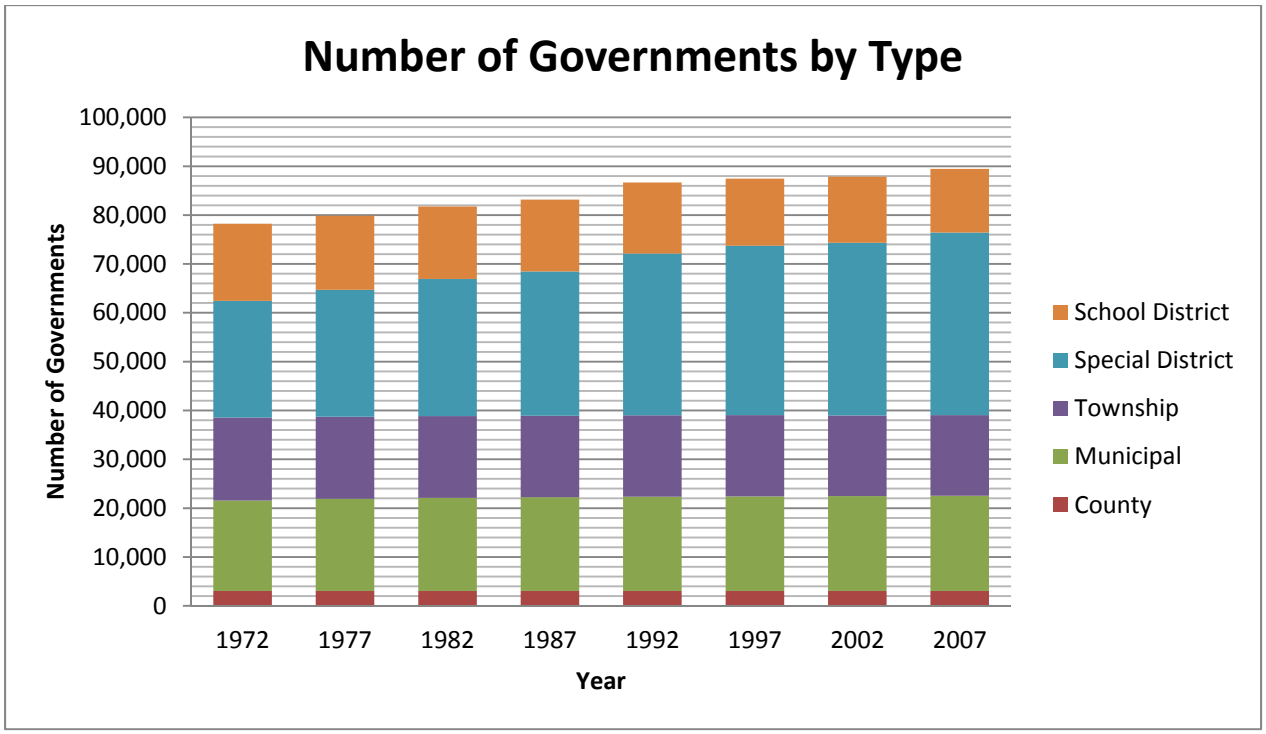


In the United States within each of the fifty states exists hundreds of separate governments including counties, cities, townships, school districts, special districts, and municipal utility districts to name a few. Most of these districts have the power to tax, set regulation, and issue their own debt. The result is a complicated network of various policies affecting citizens and corporations alike. The fiscal policies of one government may directly or indirectly affect other governments through both horizontal and vertical interactions. One form of these interactions is through fiscal competition. Fiscal competition may take a variety of forms including through tax policy and debt capacity.

As an illustration consider Denton County, which is a county in north-central Texas just north of the Dallas-Fort Worth metroplex. In the official statement for a recent 2010 issue of permanent improvement bonds all taxing entities that overlapping with Denton County were

listed with their tax rates and amount of net debt principal outstanding. In total Denton County had 68 overlapping tax entities including 34 cities, 17 school districts, and 17 special districts. This resulted in around $4.4 billion worth of overlapping outstanding debt for this one county. When the own outstanding debt for Denton County is added in residents had $6,907 worth of total direct and overlapping debt principal per capita. It is unclear whether residents of the 68 lower level jurisdictions that are contributing to that figure are aware of that situation, but it almost certainly has implications for risk of default, interest cost payments, and fiscal sustainability of the area. Denton County is not alone in this situation. In fact the number of total local governments has increase by over ten thousand in the last thirty years. Figure 2 shows that while the number of school districts have gone down, the number of special districts is on the rise.

Figure 2



This paper adds to the current literature by contributing a relatively simple model of debt competition between governments with a shared tax base in a second-best world, which is an area that has yet to be fully explored in the literature. The theoretical argument is that for a given tax base there is a set level of debt capacity for tax backed debt issued by state and local governments. This means that for a given interest rate a government can only borrow a certain amount of before the risk of default would increase, which would drive up the interest cost of the debt. The existence of multiple governments that share the same tax base results in negative externalities because the amount of debt issued by one government will affect the interest costs of another government's debt since both are backed by the same tax base. These negative externalities have consequences for local governments in terms of the amount of debt they issue, the interest rate they pay on that debt, and the timing of their debt issuance. 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

The subject of fiscal competition between governments is not new to the field of economics, and it includes a variety of approaches resulting in various policy implications. The 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. An example would be if one city set a property tax rate which results in a neighboring city losing revenue.

Vertical externalities exist when a policy set at one level of government effects lower or higher levels of government. One example would be if a state sets a sales tax rate that then results in a city losing revenue. Through the vertical externality literature it is common to refer to central governments as federal and lower level government such as a province, state, county, or other local government as a state. 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 almost all economic research has been concerned with the implications to tax policy, and the tax rates of the overlapping jurisdictions. There has been little research on the amount of debt issued by these governments or the interest rates of the resulting bonds.

The literature typically referred to as tax competition models the horizontal externalities that arise from the interactions across the same level of governments, and is a subject that has been well covered (see Wilson 1999). The roots of tax competition can be traced back to Tiebout's (1956) theory of local public good provision, but the topic as it is discussed today is closer to Oates' (1972) theory of tax competition. Most scholars consider Zodrow and Mieszkowski (1986) as the first formal modeling effort of Oates' theory. Since its publication this model has been criticized, revised, and extended but it remains a staple in the literature and is often referred to as “the basic model of tax competition” (Wilson 1999; Edward and Keen 1996).

The basic model begins with assumption that governments maximize citizen welfare and concludes that tax competition results in an under provision of public goods. There have been many revisions proposed, but perhaps the category of tax competition models that provide the starkest contradiction are known as Leviathan models. Leviathan models start with the

assumption that governments are revenue maximizing and conclude that tax competition places restrictions on governments which results in less governmental waste. Both the underlying assumptions and technical components of these models are important to understand how tax competition works.

In the lone model of tax competition that allows for government debt Jensen and Toma (1991) propose a game theoretic tax competition model where governments are allowed to borrow, as well as tax, to finance government expenditures. They find strong incentives for governments to issue debt as well as a more severe problem of under-provision of government services in the period when the debt is retired. While the general tax competition literature also suffers from a lack of consideration of how horizontal competition works with government debt, the focus of this review will be on vertical externalities associated with debt.

In a typology of government interactions Dahlby (1996) describes three basic types of inter-jurisdictional 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 by altering tax revenues or expenditures of other governments. The direct externalities affect the utility functions of non-residents 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. The major difference is that unlike tax and expenditure indirect externalities, debt externalities are more likely to be observed vertically because of the shared tax base. Vertical debt externalities may arise when overlapping governments issue debt that leverages the same group of tax payers. If debt is issued it is backed by the revenue from a group of tax payers. When another government that shares that group of tax payer's issues additional tax payer backed debt, that additional debt has a higher risk of default due to the fact that the first government has already leveraged future tax revenue from those tax payers. The ability to issue debt backed by tax payer 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 tax payer backed debt is akin to a common-pool resource.

In the economics literature fiscal externalities, and specifically the problem of common-pool resources (CPR), are well known and often discussed. Common pool resources 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"(Garden, Ostrom, Walker 1990). The concept of a CPR has been since extended to include fiscal common-pool resources that maintain the properties of rivalrous and non-excludable, but are applied to taxes and debt issues. 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 common-pool resource models is that if the number of local governments leads to increased spending, it would also lead to increased levels of debt.

Vertical Fiscal Externalities

Compared to the research on horizontal tax competition the vertical externality literature is sparse, but over the last fifteen years the number of both theoretical models and empirical tests of vertical interactions between governments has grown substantially. In his review of fiscal federalism literature Keen (1998) notes that the majority of federalism literature in economics focuses almost exclusively on the tax implications of horizontal tax competition. In the basic models jurisdictions share a border in order to model how mobile resources move between jurisdictions. The problem with this system is that in reality there are many levels of governments with different borders which often overlap one another. Keen (1998) frames the vertical fiscal federalism issue in terms of concurrent taxation. He shows that common public economics issues such as optimal taxation, redistribution through intergovernmental grants, and the allocation of tax instruments across levels of governments can all be addressed through the framework of vertical tax externalities.

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. Flowers (1988) concluded that in a federation with leviathan governments both federal and state level governments may end up on the downward sloping portion of the Laffer curve indicating total taxation is too high. Similarly, Johnson (1988) found that with benevolent government’s tax base overlap may create incentives for state governments to redistribute

income to their residents, because the cost of the redistribution would be borne to all federal taxpayers and not just state taxpayers. Both of these finding suggest vertical externalities result in over taxation.

The theoretical framework of Flowers (1988) and Johnson (1988) has sparked a small body of theoretical vertical externality literature. Similar to the horizontal tax competition literature there is a split between those who model benevolent governments and those who model leviathan governments. In the vertical tax externality literature the two camps are about equal in number of studies. Directly following Johnson several studies published in the 1990's preferred benevolent governments in models of vertical externalities and government redistribution. For example, Broadway and Keen (1996) and Broadway et al. (1998) both modeled tax and expenditure decisions of benevolent governments with wage income taxes, and concluded that tax rates will be too high if state governments ignore the reduction in federal tax revenues that occurs when a state increases a distortionary tax and shrinks the shared tax base.

One important result from the various models of vertical externalities is the ambiguity of the reaction direction from responses to vertical externalities. For example, Dahlby and Wilson (2003) show that an increase in the provision of a public good at the state level can either increase or reduce federal tax revenues, which leads to either under or over-provision of the State produced good. Their model assumes a tax on wage income at both levels of government, and an inelastic labor supply. Wrede (1999) shows that the Leviathans in a federation tax the fiscal common resource more extensively than the single Leviathan in a unitary state. Wrede (2000) also finds that in a federation some coordination may be optimal, and that the optimal level of coordination between levels of governments depends on the degree of complementarity between public goods and tax bases.

Despite the differences in modeling some overarching themes have stood out. For example, vertical externalities are generally unaccounted for by governments and so they result in over-taxation. This also has implications for redistributive grant policies. Also, there is ambiguity in the direction of tax responses at the different levels of governments. It is unclear whether state's 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. To more fully explore the vertical externality mechanisms and how they work it is important to consider the empirical tests of these theories.

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 OECD 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 (Devereux et al. 2007; Besley and Rosen 1998; and Fredriksson and Mamon 2008), although several studies have considered person income taxation (Goodspeed 2000; Esteller-More and Sole-Olle 2001), business income taxation (Hayashi and Broadway 2001; Brett and Pinske 2000; and Leprince et al. 2004), 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.

Commodity taxes offer perhaps the most obvious test of vertical tax externalities because both the federal and state governments in the United States often levy excise taxes on the same commodities, and there has been a large amount of variation in the rates. The literature has specifically focused on cigarette and gasoline taxation starting with Besley and Rosen (1998). Besley and Rosen (1998) found that when the federal government increases taxes on either cigarettes or gasoline there is a significant positive response in state taxes. For gasoline they found that a 10 cent per gallon increase in the federal tax rate leads to a 3.2 cent increase in the state tax rate. In another study of vertical externalities in cigarette taxation Fredriksson and Mamun (2008) find that a federal tax increase may reduce the amount of generated state tax revenues through both a decline in the state tax base and through the decline of the state tax rate. They show that states may reduce their tax rate on cigarettes by as much as 48 cents per dollar increase in the federal tax rate. These two studies are in contrast to Devereux et al. (2007) which suggests that with inelastic demand and low transportation costs federal taxes would have little effect on state taxes, and that the tax rates of neighboring states plays a more important role. Some of the differences in findings may be attributed to how neighboring government tax rates are weighted, and the presence of cross boarder shopping.

In addition to commodity taxes several studies using business taxes, income taxes, and property taxes. The property tax studies are obviously more focused on local governments, since property taxes are not typically levied at the federal level. In a recent study Wu and Hendrick (2009) examined tax competition in Florida local governments including school districts, municipalities, and counties. Their results show different reactions to different levels of interactions, for example, the response of municipal governments is negative to county property tax rate, but positive to school districts prop tax rate. Overall there are significant vertical

externalities between all three levels, but different directions of tax reactions. Results show that a 10 percent increase in the school districts property tax rate results in a 1.7 and 4.6 percentage point increase in the municipal property tax rate depending on the model specification. However, the estimates are negative and significant for the county property tax rate variable in all models. A 10 percent rise in county property tax rate leads to a 1.4 and 2.3 percentage point drop in the municipal tax rate. These results give rise to interesting questions about how reactions to vertical externalities may be different for a given set of hierarchical relationships.

Aside from empirical tests of tax externalities there have been a couple 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 reduces 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 U.S. counties and cities. They find a complementary relationship between the two government's general service expenditures. However, breaking down expenditures into specific categories they found no effect for police and road expenditures. These findings suggest that while not all municipal and county services are perfect compliments, on the whole increasing expenditures at the county level will also increase spending at the municipal level. 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.

In the last ten years the number of empirical tests for vertical interactions between two governments that share tax base has grown to match the theoretical predictions previous made. Table 1 summarizes these empirical tests for both tax and expenditure reactions. As shown the studies have included the major tax types as well as various levels of interaction. While the results are mixed, the trend seems to point to positive reactions of lower level governments to increases in both taxes and expenditure increases by higher level governments.

Table 1 - Empirical Tests of Vertical Externalities

Authors (Year)	Fiscal Type	Level of Interaction	Reaction
Besley and Rosen (1998)	commodity tax	federal - state	positive
Fredriksson and Mamun (2008)	commodity tax	federal - state	positive
Devereux *et al*. (2007)	commodity tax	federal - state	no reaction
Hayashi and Broadway (2001)	business tax	federal - province	negative
Leprince, Mades and Paty (2004)	business tax	region - department	no reaction
Brett and Pinske (2000)	business tax	province - municipal	mixed
Goodspeed (2000)	personal income tax	federal - local	negative
Esteller-More and Sole-Olle (2002)	personal income tax	federal - state	positive
Esteller-More and Sole-Olle (2001)	personal income tax	federal - province	positive
Wu and Hendrick (2009)	property tax	county-city-school	mixed
Revelli (2001)	expenditures	county-district	positive
Turnbull and Djoundourian (1993)	expenditures	county-city	positive

The obvious gap in the empirical literature mirrors the gap in its theoretical counterpart, which is there has been no consideration of debt in the tests of vertical externalities. The studies by Revelli (2001) and Turnbull and Djoundourian (1993) fall short the full analysis in their discussion of the tradeoff 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 will either be paid for by an increase in taxes, as Turnbull and Djoundourian (1993) point out, or they could be paid for by government borrowing. The second option has not been considered in the existing literature.

Theoretical Framework

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 relative to current revenues that an issuing entity could support without creating undue budgetary constraints that might impair the ability of the issuer to repay bond outstanding or make timely debt service payments" (Ramsey and Hackbart 1996). The problem that arises 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 subnational government interest rate literature has done a fairly comprehensive job at explaining the factors that explain variance in interest costs. Simonsen (2003) reviews some of these studies pointing to a number of studies that use OLS regression to predict true interest cost, which is the most compressive measure of borrowing costs, with R squares between .7 and .96. The explanatory variables are usually classified into two groups. The first are factors of the actual bond issue such as the amount of the bond and the credit rating. The second set of factors are economic or financial characteristics such as the government's current level of debt or population. The vertical externalities created by overlapping jurisdictions may affect the ability

for government's to repay their debt, which could decrease their credit rating as well as make the overall economic region's ability to repay more risky. This would affect both sets of factors that are commonly associated with true interest costs.

The result of the externality is a common good 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 their own utility or to maximize a representative citizen's utility, and they receive the positive benefit from that debt. The problem is that the negative component, which is using up the debt capacity and ultimately increasing the interest rate, is shared by all the jurisdictions that share that tax base. The effect on debt capacity can be considered in connection with the findings of Trautman (1995) who found that states with decentralized management structures have higher levels of outstanding debt than centralized states. Trautman's findings support the hypothesis that reduced oversight and institutional control leads to increased levels of borrowing. If these findings are considered in the context of the common-pool resource problem it seems that debt capacity would be affected by a system of overlapping governments.

To develop a theoretical model of these externalities a more simplified scenario is needed. I consider a hierarchical government with multiple lower level jurisdictions, and one higher level jurisdiction. 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 debt is borrowed. The following section formalizes this theory in a simplified economic model based on fiscal competition models found in the literature.

Basic Model

I consider a familiar framework to construct a simple second-best world model of debt in fiscal competition with overlapping jurisdictions and vertical fiscal externalities. For simplicity some necessary 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 local government jurisdictions that have the same objectives. Our analysis focuses on the policies of a single representative jurisdiction. Local governments are represented with lower case letters and the state government is represented with upper case letters. All local jurisdictions, and thus the representative jurisdiction, are assumed to be atomistic so that they are price takers in the market for debt. The state government is assumed to be large enough to affect the market, and that is taken into consideration when issuing debt. This assumption may not hold in cases where one jurisdiction makes up the majority of a state, but in cases of federal to state interactions and most state to local government interactions this is a reasonable assumption. While vertical debt externalities can also be shown without this assumption, but they are more complex and do not add to the analysis.

It is also assumed that the deductibility of interest costs from taxes at a higher level of government are ignored in this analysis. Relaxing this assumption would make for an interesting extension of the model, but is not currently considered. In addition, 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. 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 one and die in the second period in a two period finite-horizon case. In the lower level government, and thus the state government 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:

$$U_1(c_1, g, G) + \beta U_2(c_2, g, G) \quad (1)$$

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 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. 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 so that:

$$g = \tau + b \quad (2)$$

$$G = T + B \quad (3)$$

$$c_1 = w_1 - \tau - T \quad (4)$$

$$c_2 = w_2 - (1 + r)b - (1 + r)B \quad (5)$$

$$r = f(b + B) \quad (6)$$

With the objective of maximizing the representative resident's utility after substitution you obtain a social welfare function. Maximizing with respect to both taxes and debt a representative local government chooses gives the first order condition.

$$Max_{b,\tau}\, w = U_1(w_1 - \tau - T, \tau + b, T + B) \tag{7}$$
$$+ \beta U_2(w_2 - (1+r)b - (1+r)B, \tau + b, T + B)$$

$$\frac{\partial w}{\partial b} = -U'_{1g} + \beta U'_{2g} - \beta U'_{2c}(b + B)\frac{\partial r}{\partial b} = 0 \tag{8}$$

Note, since local governments do not consider the effect of their borrowing on the interest rate the last term in equation 8 drops out so that the first order conditions are:

$$\frac{\partial w}{\partial b} = -U'_{1g} + \beta U'_{2g} - \beta U'_{2c}(1 + r) = 0 \tag{9}$$

$$\frac{\partial w}{\partial \tau} = -U'_{1c} + U'_{1g} + \beta U'_{2g} = 0 \tag{10}$$

From equations 9 and 10 we can rearrange and solve for the marginal rate of substitution between period 1 and period 2 consumption for the local government. Once rearranged equation 13 shows the marginal utility of consumption in period one equal to the discounted marginal utility of consumption in period two times the interest rate. It can also be rearranged to show the marginal rate of substitution between period one and two is equal to the discounted interest rate (equation 14).

$$\beta U'_{2g} = \beta U'_{2c}(1 + r) + U'_{1g} \tag{11}$$

$$\beta U'_{2g} = U'_{1c} - U'_{1g} \tag{12}$$

$$\beta U'_{2c}(1 + r) = U'_{1c} \tag{13}$$

$$\frac{MU_1}{MU_2} = \beta(1 + r) \tag{14}$$

Equation 14 represents the marginal rate of substitution between consumption in period 1 and consumption in period 2 for all local jurisdictions within the state. Since they do not consider their individual effect on the overall interest rate the tradeoff 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 they borrow that is 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 state government would maximize the same social welfare function, only they are 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 state bonds, B, and state taxes, T, that maximize social welfare across all jurisdictions.

$$Max_{b,\tau}\, W = nU_1(w_1 - \tau - T, \tau + b, T + B) + \beta nU_2(w_2 - (1+r)b - (1+r)B, \tau + b, T + B) \quad (15)$$

$$\frac{\partial W}{\partial B} = nU'_{1G} + \beta nU'_{1c}(1+r) + \beta nU'_{2G} - \beta nU'_{2c}(b+B)\frac{\partial r}{\partial b} = 0 \quad (16)$$

$$\frac{\partial W}{\partial T} = -nU'_{1c} + nU'_{1G} + \beta nU'_{2G} = 0 \quad (17)$$

Solving for the marginal rate of substitution the same analysis can also be done for the state government by rearranging for equations 16 and 17 and solving for the marginal rates of substitution. Because the state takes into account the effect state 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 $\beta nU'_{2c}(b+B)\frac{\partial r}{\partial b}$ can be interpreted as the total effect on interest rates created by multiple borrowing governments, and will be positive in the state maximization problem where is was zero in the local jurisdiction maximization problem. From the state perspective the social planner considers the direct welfare implications for state borrowing, but also the impact state borrowing has on local government budgets.

$$\beta nU'_{2G} = \beta nU'_{2c}(b+B)\frac{\partial r}{\partial b} + \beta nU'_{2c}(1+r) - nU'_{1G} \quad (18)$$

$$\beta n U'_{2G} = n U'_{1c} - n U'_{1G} \tag{19}$$

$$\beta n U'_{2c}(b + B)\frac{\partial r}{\partial b} + \beta n U'_{2c}(1 + r) = n U'_{1c} \tag{20}$$

$$\beta(b + B)\frac{\partial r}{\partial b} + \beta(1 + r) = \frac{MU_1}{MU_2} = MRS^{G}_{c1c2} \tag{21}$$

$$\beta(b + B)\frac{\partial r}{\partial b} + \beta(1 + r) \neq \beta(1 + r) \tag{22}$$

$$or\ MRS^{g}_{c1c2} \neq MRS^{G}_{c1c2} \tag{23}$$

Since the term $\beta n U'_{2c}(b + B)\frac{\partial r}{\partial b} > 0$ the externality created by local borrowing is internalized by state borrowing, and the marginal rate of substitution between first and second period consumption is different for the state than for the local government. 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. If we measure the externality created through the interest rate paid on bonds these theoretical results can be used to make several empirical predictions.

Proposition 1: In overlapping jurisdictions that share a tax base increasing the total amount of debt at one level of government will increase the interest costs paid on tax-backed debt for other levels of government.

Using this basic model as a starting point several extensions can be considered. For example, the model does not account for different types of lower government jurisdictions. This would be a realistic problem where several types of overlapping local governments shared a tax base under a central government. This situation could easily arise in a metropolitan area where a county, city, school district, and municipal district all share a tax base within a state. If this were the case, and the interest rate is maintained as a function of the total demand for public debt it could be formalized as:

$$r = f(\sum_{i=1}^{n} b_{1i} + b_{1s}) \tag{24}$$

This would not directly affect the marginal rate of substitution for each of the local governments, although from maximizing the social welfare function for all local governments and for the state produces the following marginal rates of substitution:

$$MRS_{c1c2}^{g} = \beta(1 + r) \tag{25}$$

$$MRS_{c1c2}^{G} = \sum_{j=1}^{n} (b + B)\frac{\partial r}{\partial b} + \beta(1 + r) \tag{26}$$

This shows that as the number of jurisdictions increases there are more fiscal externalities, which leads to a third empirical prediction.

Proposition 2: As the total number of issuing jurisdictions increases the extent of the externality will increase.

There are many more extensions to this basic model that could account for more realistic conditions. Future extensions could include a redistribution role for either government through grants or other inter-governmental transfers. This simple model holds taxes and expenditures constant to focus on the externalities related to debt, but a more robust model may consider all three factors. While there are many theoretical and empirical extensions it is important to have a foundation for understanding how debt works in a model of fiscal externalities.

Empirical Framework

From the theoretical section it is predicted that increasing the amount of lower level government debt will increase the interest cost paid by higher level governments. One of the complicating factors in this model is distinguishing the effect of the number of overlapping

governments from the effect of aggregate lower level debt (propositions 1 and 2). To address this issue empirically two separate models will be estimated. The first will aggregate all sub-county local government debt to examine the effect of total lower level debt on interest costs of a higher level government bond, and the second will examine the effect of the number of debt issuing governments on the interest costs of a higher level government bond. To correct for any downward bias in the standard errors Huber-White standard errors will be used in an ordinary least squares regression.

These models will be tested on local government tax-exempt bonds. Local governments include city, school district, municipal district, hospital district, community college district, and special district debt on county true interest cost. There are several advantages to using local level governments over federal to state. First, federal and state debt markets may be significantly different because debt levels are a function of economic conditions as well as cultural and political factors that fluctuate with electoral cycles (Clingermayer and Wood 1995). Those differences are likely to be larger between federal and state governments than between overlapping local governments. Second, the literature has not specifically looked at debt prices and overlapping governments, and existing research on government debt tends to focus on federal and state debt. The research on local government debt, especially in special districts, is less robust so this study adds to that field as well.

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 is the superior method (Robbins, Simonsen, and Jump 2001).The true interest cost (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 (IRR) calculation. This is superior to the alternative, net interest cost (NIC), which is a more simplistic calculation of the net present 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), income tax differentials (Clarke and Bland 2003), 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.

Of course in order 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 true interest cost. 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, and dummy variables for credit rating categories.

The basic estimating equation for Model 1 takes the form:

$$t_{ict} = \beta lnD_{ct} + \gamma X_{ct} + \delta Z_{ict} + \alpha_t + \varepsilon_{ict} \quad (27)$$

Where t_{it} is the true interest cost of a county, c, bond issue, i, in fiscal year, t, D_{it} is the total amount of sub-county debt issued in county, c, in fiscal year t, C_{ct} is a vector of control

variables that vary by county, Z_{it} is a vector of control variables that vary by issue, α_t controls for the fiscal year, and ε_{it} is a random error term. The equation for Model 2 takes the form:

$$t_{it} = \beta lnN_{ct} + \gamma X_{ct} + \delta Z_{ict} + \alpha_t + \varepsilon_{ict} \quad (28)$$

Where the model is the same except instead of total amount of lower level debt the number of issuing lower level governments isN_{it}. 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 consists of tax exempt bonds issued by county governments in the state of Texas between fiscal years 2005 and 2010. To restrict the model to general obligation debt, which is different in risk and other characteristics from revenue backed debt, only general obligation debt. The bond issue data were obtained from the Texas Bond Review Board, an oversight agency which 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 maturity. Population estimates for counties came from the Texas State Data Center. Median income estimates are from U.S. Census Bureau's Small Area Income and Poverty Estimates. The Bond Buyer Indices are from Bondbuyer.com.

The State of Texas has 254 counties, but not every county issues tax exempt debt in every year. Furthermore, some counties issues debt multiple times in the same year. Out 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 27 times. The distribution by year also fluctuates

with the lowest amount being issued in fiscal year 2009 at 59 issues, and the highest in 2008 at 95 issues. The other years fall between 64 and 84 issues each. The unbalanced nature of the panel will not complicate the analysis. However, it may limit the generalizability of the study to all counties in all years. Conclusions drawn from this analysis only apply to counties that issue debt and have overlapping debt.

Table 2 shows the descriptive statistics for the tax exempt bond sales in Texas. The unit of analysis is Texas Counties that issued tax backed debt between fiscal years 2005 and 2010. The average True Interest Cost (TIC) is just over 4%, and is fairly symmetrical with only slight skewness. The main explanatory variable of interest, amount of overlapping debt, averages $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. Model 1's main explanatory variable of interest is the amount of overlapping debt from 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 governments include cities, school districts, municipal utility districts, health districts, community college districts, and other special districts. In cases where a lower level government crossed multiple county lines that districts debt was assigned to its primary service area county. Note that only counties with overlapping debt are included, and the maximum amount of overlapping debt exceeded $3.3 billion.

The main explanatory variable of interest for Model 2 is the number of overlapping sub-county governments. 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 a wide spread in the number of overlapping governments ranging from zero 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. Issue variables include the par amount (amount of the bond), years to maturity, type of sale (competitive or not), bond insurance, and 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 20 general obligation bonds. Visible supply projected for 30 days in the future for each issue while the BondBuyer Index is weekly data.

Table 2 Descriptive Statistics			
Variable	Description	Mean	Std. Dev.
True Interest Cost	Internal rate of return on a bond	4.042	0.93
Log Amount of Overlapping Lower Level Debt	Amount of tax exempt debt that has been issued by all sub-county governments in the same fiscal year	18.2	2.19
Log Number of Overlapping Governments	Number of sub-county 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
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	46,589	14,080
Population	County population for the fiscal year	521,941	911,932
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	Dummy if the bond was competitively sold	0.11	0.32
Bond Insurance	Dummy if the bond had insurance	0.33	0.47
AAA	Dummy for a AAA rating by S&P	0.47	0.5
AA	Dummy for a AA rating by S&P	0.18	0.38
A	Dummy for a A rating by S&P	0.03	0.16
No Credit Rating	Dummy for no rating by S&P	0.32	0.47

There is a large range in the 30 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. These figures are most likely driven by several large counties in Texas. This is further confirmed by the large range in both population and median income. 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 Standard and Poor's, which is the highest available. In the following model the category of receiving a BBB

rating from standard and poor's is the left out category. It is also noteworthy that roughly a third of issues have no bond rating.

The results for all three models are presented in Table 3. Model 1 is an estimation of equation 27 where the main explanatory variable of interest is log par overlap. Model 2 is an estimation of equation 28 where the main explanatory variable of interest is log number of overlapping governments. Model 3 is 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 below. Overall all three perform well with a majority of the controls being statistically significant, and an R^2's of roughly 45%. Both Model's 1 and 2 are estimated with ordinary least squares and Huber-White robust standard errors. The robust standard errors are used to correct for any heteroscedasticity that may exist in the model. 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 theory section no predictions can be made if there are no overlapping jurisdictions that both issue debt.

It can be shown from the results of Model 1 in Table 3 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 true interest cost for county tax backed debt issues. Specifically, on average a ten percent increase in the amount of overlapping lower level debt (10% increase is approximately an increase the log of 0.10) is associated with a .0065 (0.1 times 0.065, from the table), or 65 basis points, increase in the true interest cost of a county bond issue, ceteris paribus. Considering the average TIC is 4.042% 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 $3

million bond, holding everything else constant, that county's TIC would increase from 4.04% to 4.05%, which over a thirty year bond would be a significant cost increase. The statistical significance offers support for proposition 1, which hypothesized that increasing the amount of debt issued by a lower level government would increase the interest costs of a higher level government.

Table 3

	Model 1		Model 2		Model 3	
VARIABLES	coef	se	coef	se	coef	se
Log Par Amount Overlap	0.065**	(0.029)	-------	-------	0.071**	(0.030)
Log Num. of Overlapping Gov'ts	-------	-------	0.095**	(0.046)	-------	-------
Log Par Amount of Issue	-0.082	(0.055)	-0.076	(0.052)	-0.084**	(0.041)
30 Day Visible Supply	0.130**	(0.057)	0.129**	(0.058)	0.130**	(0.059)
Total County Expenditures	-0.079**	(0.035)	-0.074**	(0.034)	-0.081**	(0.036)
Tax Debt Per Capita Ratio	0.035***	(0.012)	0.032***	(0.012)	0.035***	(0.011)
BondBuyer Index	0.482**	(0.199)	0.457**	(0.199)	0.483***	(0.179)
County Median Income	-10.283***	(3.970)	-10.137***	(3.832)	-10.569***	(3.571)
County Population	0.225**	(0.108)	0.202*	(0.109)	0.224*	(0.118)
Issue Years to Maturity	0.077***	(0.011)	0.077***	(0.010)	0.077***	(0.006)
Issue Competitive Sale	-0.276***	(0.070)	-0.264***	(0.070)	-0.276**	(0.114)
Issue Insurance Dummy	-0.173	(0.145)	-0.148	(0.144)	-0.173	(0.142)
AAA Credit Rating	-0.065	(0.169)	-0.078	(0.170)	-0.067	(0.668)
AA Credit Rating	-0.322**	(0.149)	-0.325**	(0.150)	-0.323	(0.665)
A Credit Rating	-0.567***	(0.214)	-0.561**	(0.220)	-0.563	(0.688)
No Credit Rating	0.303**	(0.125)	0.296**	(0.124)	0.304	(0.660)
Fiscal Year 2006	0.311***	(0.104)	0.300***	(0.100)	0.314***	(0.119)
Fiscal Year 2007	0.336***	(0.108)	0.340***	(0.108)	0.337***	(0.117)
Fiscal Year 2008	0.036	(0.098)	0.063	(0.100)	0.039	(0.120)
Fiscal Year 2009	0.025	(0.171)	0.027	(0.169)	0.030	(0.156)
Fiscal Year 2010	-0.065	(0.160)	-0.085	(0.157)	-0.059	(0.140)
Constant	1.055	(1.199)	2.075*	(1.206)	0.992	(1.207)
Observations	386		386		386	
R-squared	0.451		0.448			

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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, having

longer yield time, and not receiving a credit rating all increase true interest costs for counties. On the other side increasing total expenditures, higher median income, competitive bond sales, and credit ratings A through AAA all decrease TIC on average. These results are consistent with existing literature on municipal interest cost models.

The results of Model 2 are similar to Model 1. 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 true interest cost paid on county bond issues also increases. This provides evidence to support proposition 2 which hypothesized that as the total number of overlapping jurisdictions increased the extent of the externality would increase, and in this case that externality can be observed through higher interest costs. On average a 10% increase in the number of sub-county governments that have overlapping tax bases with a county will increase that county's TIC by 95 basis points, ceteris paribus. The average number of overlapping governments is about 18, which means that on average if two addition jurisdictions are created within a county that both issue debt that county's true interest cost would also increase from 4.04% to 4.05% (increase of 2/18 times 0.095 from the table). This means that both the layering of governments and the stock of overlapping debt influences interest costs, based on the arguments in the theory section that both matter.

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 and an F test value of 1.07. The county fixed effect did account for approximately 56% of the variance in true interest cost, but was not close to being statistically significant. Overall the explanatory variables explained around 89% 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 86.6%.

One possible objection to Model 1 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 true interest cost, 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 sub-county 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 the market does not consider these historical county factors when determining the interest rate of the bond. 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 answers 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 sub-county debt.

The results of an instrumental variable regression with county fixed effects with the described specifications are listed as Model 3 in Table 3. 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 Model 3 as a whole look very similar to Model 1 with only slight variations in significance and coefficient magnitudes. Correcting for possible endogeneity on average when log par overlap is increased by 10% true interest cost will increase by 70 basis points. Correcting for endogeneity also makes the log par amount of the bond issue significant and negative so that on average as the amount of bond issue increases the TIC decreases holding everything else constant. It makes sense that larger bond issues would receive more favorable interest rates. The endogeneity correction eliminates significance of the credit rating variables, which is not too surprising since credit ratings may be captured by the county fixed effects.

Discussion and Policy Implications

The results found in the last section are somewhat difficult to directly compare to the existing literature on tax externalities for several reasons. First governments do not directly control their interest rates like they control their tax rates. Interest rates are market driven so the externalities captured in this analysis of debt are those recognized by the market rather than the direct response of one government to another. Second, the majority of vertical tax externality

studies focus on the tax reaction of a lower level government to the change in taxes from a higher level government. This analysis focuses on the opposite direction, and aggregates many different lower level governments rather than focusing on one. Finally, there is the obvious difference between taxes and debt. While related, there is no direct comparison to be made between a tax reaction and the response in interest costs.

Even with the difficulties in a direct comparison we do observe a positive reaction at the higher level (county) interest rates in response to increased lower level aggregate debt. Of the empirical studies on vertical tax externalities that found a statistically significant reaction the majority of those findings were positive. In fact the only two that were negative involved the interaction between a federal and local government. 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. Even Wu and Hendrick (2009) who found mixed reaction saw positive reactions between municipal tax rates and the lower level school district tax rates. While the comparisons are not direct there is some evidence that supports the findings for debt externalities being consistent with existing literature for tax externalities. In the sense that they can be compared this leads to debt competition, the borrowing equivalent of tax competition.

As theorized the debt capacity of a region can be viewed as a fiscal common pool resource. As lower level governments draw on that resource it diminishes the ability of higher level governments to draw on that 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. With millions of dollars worth of interest payments at stake local governments should be carefully observing the

debt issuing policies of those governments it shares a tax base with. Furthermore, these findings fit into a larger discussion about centralized and decentralized debt policy at the state and local level. If the problem is externalities created through fragmentation and allowing multiple government borrowing power over the same taxing areas then one solution would be to centralize the borrowing in that area.

One of the major policy implications for these findings is the effect of creating additional governments which 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 true interest cost. With multi-million 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. Speaking only of the effect on debt costs, it may be beneficial to limit the amount of special districts with borrowing power that overlap traditional municipal governments such as cities and counties. Another policy implication is that within coordination across debt issuing jurisdictions there can be debt competition interactions that increase costs. The increased costs may be avoided through coordination efforts so that future generations are not burdened with higher debt service payments. Given that over ten thousand new local governments have been added over the last thirty years these interactions are important debt policy concerns that should be addressed.

This study extends the existing literature of vertical competition and fiscal interactions across overlapping governments, and shows that there are many opportunities to further explore in this line of research. Going forward it would be helpful to look at multiple directions in the effect of externalities. For example, does county debt affect school district interest costs in the same way? It would also be interesting to apply the same theory at different levels of government

to see if local debt affects State interest costs. Finally, these effects have been analyzed in isolation so it would be helpful to see how various tax rates change with both level of overlapping debt, number of overlapping governments, and interest costs.

Conclusion

The modern government makes fiscal choices based on the tradeoffs between taxation, expenditures, and debt. Each of these fiscal choices has implications beyond the direct impact to the government making the decision. The interaction between governments as taxes and expenditure decisions are made has been explored both across similar governments and between governmental hierarchies. The natural extension of this literature is to consider debt as an alternative to taxes in financing government goods and services, and the indirect effects that may result from those decisions.

This study lays out a basic conceptual framework and model to think about the externalities that arise from overlapping governments that are issuing debt. The model predicts that interest costs will rise as the level of total amount of debt being issued in a region rises. Results from three different models show that on average both the total amount of lower level government debt that overlaps a county as well as the total number of governments issuing that debt increases the true interest costs 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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