The Grants are Falling! The Grants are Falling! How Municipal Governments Changed Taxes in Response to Provincial Support in New Brunswick, 1983–2003

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Abstract

The real value of grants to New Brunswick municipal councils from the provincial government fell dramatically from 1983 to 2003. At the same time, municipal property tax rates increased, especially among municipalities with comparatively low tax rates in 1983. This study uses an econometric model of the joint determination of local property tax rates and local property tax bases to examine the hypothesis that municipal responses to falling grants were constrained by tax competition. After controlling for observable characteristics, there is little evidence of spatial interaction among jurisdictions, suggesting that tax competition was not a major factor in municipal decisions. The grant cuts themselves appear to be a far more important determinant of changes in property tax rates. There is also some evidence that the tax base is sensitive to own tax rates. However, the elasticity of the tax base with respect to the tax rate is small enough that there remains scope for municipalities to increase tax revenue by increasing their tax rates.

INTRODUCTION

Municipalities across Canada are expressing concern over their ability to generate sufficient revenue to enable them to provide an adequate level of local public services. Despite being endowed with a diversified arsenal of revenue raising powers in the early years of Confederation, many municipalities are now reliant on a single tax, namely the tax on real property, for much of their revenue (Kitchen 2002). During the 1990s, fiscal restraint by the federal and provincial governments led municipalities to rely more heavily on local revenue sources, heightening concern over the narrow local tax base. The presumed negative effect of increased reliance on local funding can easily be blamed for perceived shortcomings in Canada's municipal infrastructure. Recent federal government initiatives to transfer money to the municipal sector can be interpreted as a response to municipal fiscal isolation.

Faced with decreases in transfers from other governments, municipal councils must alter their budgets. These adjustments necessarily comprise some combination of expenditure reductions, tax increases, and use of non-tax revenue sources. The canonical economic model of local adjustment to changes in grants, due to Bradford and Oates (1971), treats a reduction in unconditional grants as an income loss to the local decision maker (be that a median voter or some other influential political actor).[1] This loss in income induces a need to reduce spending on all goods and services, both publicly provided and privately provided. The reduction in desired local services might reasonably be expected to be less than the reduction in grants, as the local decision maker is likely to experience a reduction in demand for private goods and services as income falls.[2] Whenever demand for local services falls by less than income, municipal councils must generate additional own-source revenue to fund its new operations. Increases in local property tax rates are likely to be part of this search for revenue.

The ability to raise property taxes is subject to economic constraints. The value of the local tax base is likely to be sensitive to the tax rate. There are two explanations for this elasticity of the tax base. First, any value-enhancing improvement to a property increases its tax assessment, thereby increasing the taxes payable on the property. The additional taxes add to the real cost of improvements, thereby deterring some enhancements to properties. The higher the tax rate, the greater is the incentive to economize on improvements. Second, increases in the property tax can directly depress property values. When someone buys a property, they buy with it the obligation to pay the taxes on that property. These future tax burdens decrease a buyer's willingness to pay for the property, thereby lowering its purchase price and its assessed value.[3]

Municipal councils might also be mindful of the responses of other councils when setting their tax rates. Citizens and businesses are free to move across municipal boundaries. Local taxes are likely to be among the factors that influence where firms operate and where people live. Recognizing this, local tax-setters might be loath to increase tax rates for fear of a loss in tax base to nearby municipalities. There is a now a large literature, surveyed by Wilson (1999), on the theory of tax competition and its consequences for the level and composition of public services. As Brueckner (2003) points out, tax competition is just one of the many potential sources of interaction among local governments. One well-studied alternative is yardstick competition, in

which underlying similarities in nearby locations allow local voters to make meaningful comparisons between local decisions and neighboring fiscal choices. For example, two neighboring towns are likely to receive similar snowfalls in any given year. If one town council, citing increased snow clearing expenses, raises its taxes while the other does not, voters will not look kindly on the tax increase.

Empirical investigations of tax interaction among local governments tend to look for explanations of spatial correlation among taxes. Tax rates are said to be spatially correlated if the tax rates of neighboring jurisdictions are more similar than are tax rates of randomly selected jurisdictions. Existing studies have found that local taxes tend, in fact, to be spatially correlated. There is also considerable support for the idea that this correlation is due to municipalities reacting to the tax rates of their neighbors. (See Madiès, Paty and Rocaby (2004) for a survey of results from a number of countries.) Much of the existing evidence is consistent with models of yardstick competition, while there is little direct evidence to substantiate models of competition for the tax base. Indeed, Brett and Pinkse (2000) find no evidence of response to neighboring tax rates in the property tax bases in British Columbia.

An even simpler explanation of spatial correlation in local tax policy is just that proximate localities happen to be alike. If similarities in the level of taxation are determined primarily by resemblances in local costs or priorities, then we might mistakenly ascribe the observed pattern of tax rates to strategic interactions when correlation in local conditions is the real source of spatial patterns. Thus, it is important to control for heterogeneity among jurisdictions in any spatial analysis of local tax setting. Given that the level of detail in available data tends to decrease as one passes from the national to the local, the possibility of omitted variables and the associated statistical problems are a real concern. We employ panel data techniques that can provide at least a partial remedy for this problem.

This paper is organized as follows. The following section contains discussion of the salient features of local tax setting in New Brunswick. This section is followed by an empirical analysis of the relationships among grants to municipalities, property tax rates and local tax bases in New Brunswick. This begins with a description of the broad trends in local fiscal variables. We then propose an econometric model of the joint determination of local tax rates and tax bases. This model is then estimated on a panel of data from municipal governments in the province of New Brunswick for the time period 1983–2003. The model is able to directly uncover the importance of local tax rates and neighbors' tax rates in determining the local tax base, thereby providing evidence on the relevance of the tax competition framework in New Brunswick. The final section of the paper contains concluding remarks.

We find little evidence of spatial interaction of any kind among local property taxes. On the other hand, we do find an economically significant effect of a municipality's own tax rate on its tax base. The elasticity of the tax base with respect to the tax rate is less than one, suggesting that at current levels of taxation, it is economically feasible for municipal councils to raise additional revenue via increased taxes. We also find that reductions in the real value of unconditional grants explain a significant portion of recent increases in municipal property tax rates.

AN OVERVIEW OF TAX SETTING AND GRANTS TO MUNICIPALITIES IN NEW BRUNSWICK

There are two types of local administration in New Brunswick. Unincorporated, rural areas comprise a set of local service districts. Local service districts occupy the vast majority of provincial land mass. Within local service districts, basic local services, including garbage disposal, policing, road maintenance and fire protection, are provided by the provincial government. These services are financed partly out of the general provincial coffers and partly by a local property tax. The rate at which residential property is taxed varies among local service districts according to differences in the costs of providing services, the value of local property and the provision of optional services, such as street lighting. The provision of such additional services is decided by public meeting. The tax rates in local service districts are set by the provincial government.[4]

The villages, towns and cities of New Brunswick are known collectively as its municipalities. Municipalities have councils and mayors, elected according to a calendar prescribed by provincial regulation. These councils have the power to set the rate of property taxation and to decide on the spending priorities of the municipal government. Provincial statute requires that all municipalities pay for policing. In addition, all municipalities provide fire protection, snow removal, road maintenance, and garbage disposal. Most, but not all, municipalities operate water and/or sewer systems. To varying degrees, municipalities offer recreational and cultural services and engage in activities to promote and manage local economic development. The primary sources of revenue for municipal operations are the property tax, known as the warrant, and unconditional grants from the provincial government. Together, these sources comprised 86.5% of municipal operating revenue in 1983 and just over 89% of municipal operating revenue in 2003 (Government of New Brunswick 1984, 49; 2003, 1). The remaining revenue was from a variety of smaller, targeted granting programs and from fees, fines, and other local non-tax sources.

The provincial government carries out assessments of property values according to a common set of criteria that are designed to reflect market valuations of property. Properties within municipal boundaries are subject to a two-part tax on this assessed value. The provincial government levies a province-wide tax at rates $1.50 per hundred dollars of assessed value for residential property and $2.25 per hundred dollars of assessed value for non-residential property. Owner-occupied housing is exempt from the provincial property tax. The revenue from this portion of the property tax is part of provincial general revenues. Municipalities are free to set their own tax rates on the provincially assessed values. Non-residential property is taxed at one-and-one-half times the residential rate. Owner-occupied housing is not exempt from the municipal component of the property tax. In some municipalities, service provision is spatially differentiated. For example, the town water mains might not extend all the way to the town boundary. In such a circumstance, the municipality sets a higher tax rate on properties served by the water mains than it does on those properties without municipal water services. The higher rates are commonly known as inside rates; the lower, as outside rates.[5]

In contrast to the recent history of local government in other provinces,[6] there has been little change in the formal responsibilities of municipal governments in New Brunswick since the late 1960s. Apart from a handful of municipal amalgamations

and absorptions of former local service districts into nearby municipalities, the municipal map has changed little.[7] Perhaps the most significant changes in provincial-municipal relations in New Brunswick in recent years have been alterations in the size of the unconditional grant to municipalities and modifications to the procedures by which these grants are allocated among localities. The share of municipal operating revenue covered by the unconditional grant fell from 40.8% in 1983 to 14.4% in 2003 (Government of New Brunswick 1984, 49; 2003, 1). There have also been several revisions to the system of grant allocation during this time. The procedure used in 1983 was established in 1974, and was based on the notion of a provincial share of municipal expenditure. Starting in 1987, municipalities were divided into four groups according to a combination of population, per capita budget, municipal services provided, and urban characteristics. Municipalities with a lower tax base per capita than their respective group average were allotted a greater share of provincial support. This system was phased in gradually from 1987 to 1989 in order to ease adjustment for those municipalities who were most adversely affected by the new formula. This method of allocating grants persisted until 1993, when the provincial government began allotting unconditional grants without explicit reference to a formula.

The formulaic approach to municipal assistance was re-introduced in 1997. The 1997 system was based on a representative tax system approach to allocating grants, similar to the federal-provincial equalization formula.[8] The goal of this system was to soften distinctions among municipalities in their fiscal capacities, rather than to arrive at an appropriate share of provincial expenditure. The system also had a form of needs adjustment. All other things equal, municipalities with fewer people per road kilometer were treated as having greater expenditure requirements. The new system included a redefined set of six groups. However, the phase-in was halted in 2000, and the nominal value of unconditional grants frozen at their year 2000 levels from 2001 until 2003.[9]

ANALYSIS OF THE DATA

The Time Profile of Municipal Government Finance in New Brunswick

The unit of observation for this study is the municipality. The Government of New Brunswick (1983; 1988; 1993; 1998; 2003) publishes information on the budgets of each municipality in the province. Whenever possible, we conduct our analysis on the 103 municipalities existing in New Brunswick in 2003. However, due to municipal restructuring, the exact matching of municipalities over two decades is infeasible in a few cases. Our data contains information on 98 municipalities for 1983 and 1988, 101 municipalities in 1993, and 103 municipalities in 1998 and 2003. We select data at five year intervals with a view to adding demographic information, which can be obtained only from the Census of Canada. A five-year frequency also introduces more period-to-period variation than might be expected in yearly data, reflecting the possibility that municipalities might not be able to rapidly adjust their policies to changing circumstances.

The available data includes information on municipal tax bases, tax rates and other revenue sources, including the unconditional grant from the provincial government. In order to avoid complications arising from the use of inside and outside tax rates, we focus attention on the average tax rate, defined as total tax collections divided by the total tax base. To adjust for inflation, dollar values are converted to

1997 constant dollars using the gross domestic product deflator for the province of New Brunswick (Statistics Canada, 384-0036). Because of great variation in the sizes of municipalities, it is necessary to rescale the fiscal variables into comparable units. The prominent role of property services in municipal expenditure renders per household analysis appropriate for gauging the evolution of revenue against changes in municipal need.

Table 1 displays some summary statistics for several fiscal variables. There was a steady decline in real per household grants across all quartiles. From 1993 to 2003, in particular, there has been an almost proportionate reduction in the grants of nearly all municipalities. It appears that the provincial government has chosen to spread the impact of reduced support fairly evenly across municipalities. Indeed, the motivations for halting the phase-in of the 1997 formula included concern over the distribution of grant cuts and doubts over the ability of some municipalities to adjust to what would have been significant changes in grants (Government of New Brunswick 2001, 23).

TABLE 1 HERE

At the same time, there has been a steady increase in the median property tax rate, and an equally steady and more pronounced increase in the first quartile tax rate. Indeed, there has been a remarkable convergence of local property tax rates in New Brunswick toward the highest tax rates displayed at the beginning of the study period. Two possible explanations for this pattern of convergence immediately suggest themselves. Perhaps the slower growth of the tax rate among high-tax areas points to the existence of a tax ceiling, a level of taxation beyond which a municipal council dare not tread. Alternatively, the tax base may have grown more quickly among the province's cities — which have consistently shown the highest tax rates — than its more rural areas. This extra growth in the tax base would reduce the need to increase tax rates to maintain local services. In order to differentiate between these explanations, or to find others, we need to look more closely at the interactions between the tax rate and the tax base.

Most municipalities have experienced some growth in per household tax base. Earlier losses experienced by municipalities in the bottom half of the distribution of tax base per household were more than recouped by 2003. This somewhat modest tax base growth has coincided with increases in property tax rates. However, it would be hasty to conclude that tax rates have no impact on the tax base. It may have been the case that tax increases depressed the tax base while other changes in economic conditions increased tax bases, masking the effects of taxes. Regression modeling can help to sort out issues of causation.

Econometric Modeling

Following Brett and Pinkse (2000), we assume that the tax rate and tax base at a specific location at a specific date are simultaneously determined. The dependence of the tax base on tax rate was discussed in the Introduction. The tax rate might depend on the tax base because increases in the tax base need not be exactly correlated with increases in the demand for public services. Thus, the first econometric issue that must be faced is that the model must feature simultaneous equations.

We posit the following model of local tax rates and tax bases:

$$R_{it} = \eta B_{it} + \phi G_{it} + \beta X_{it} + \alpha RN_{it} + u_{it}; \quad (1)$$

$$B_{it} = \psi R_{it} + \delta RN_{it} + \gamma Z_{it} + \kappa ZN_{it} + v_{it}. \quad (2)$$

R_{it} and B_{it} denote the tax rate and tax base, respectively, in municipality i during year t. The tax rate depends on the unconditional grant, G_{it}, received by a municipality, on X_{it}, a set of demographic and financial variables and an index of the tax rates of neighboring municipalities, RN_{it}. The tax base depends on the tax rate, neighbors' tax rates, a set of variables, Z_{it}, including such things as the education and occupational structure of the local workforce, and the types of services provided by the municipal government. The values of these same variables in neighboring jurisdictions might attract residents and firms to the neighbors, lowering a municipality's tax base. Greek letters denote (possibly vectors of) parameters to be estimated, and u_{it} and v_{it} are error terms.

Equation (1) models taxes as a function of the local tax base, various local characteristics and the tax rates of nearby localities. The effects of neighbors operating in equation (1) are not the result of competition for tax base; these are captured in equation (2). The direct effect of neighbors' taxes on own taxes in equation (1) is perhaps most easily rationalized by appealing to yardstick competition[10] or demonstration effects. Equation (2) models the tax base as a function of the tax rate and local characteristics of a municipality, and the taxes and characteristics of nearby, alternative locations for economic activity. The relative importance of tax base competition versus yardstick competition can be inferred from the estimates of the parameters η, α and δ. If, for example, α is zero while η and δ are non-zero then any positive correlation in tax rates among neighbors is best explained by the migration of tax base across borders. A non-zero value for α indicates the presence of yardstick competition.

The potential for strategic interactions among local governments introduce a second layer of simultaneity in the data. If jurisdictions are reacting to the policies of their neighbors, then the neighbors are simultaneously reacting to the policies of the jurisdictions themselves. The process of determining unconditional grants introduces a third type of simultaneity. The use of local tax base information, however sporadic, in computing grants to local governments implies that the grant is also likely to be determined jointly with system (1)-(2).

Under suitable assumptions on the error terms of equations (1) and (2), the introduction of municipal-specific effects renders the errors of the system white noise.[11] In this case, the results of Kelejian and Prucha (2004) can be applied to justify estimation by instrumental variables procedures. Suitable instrumental variables are needed to apply this procedure. The instruments are developed through exclusion restrictions. We divide the demographic variables into three categories: tax rate shifters, tax base shifters and common shifters. Included in the tax rate shifters are pure demographic factors such as language factors and the share of children in the population. These are likely to be correlated with the demand for local services, but not a direct determinant of the tax base. Base shifters include variables that measure the industrial composition of the local workforce. The educational attainment of the local population and the presence of a fee for publicly supplied water are included as dual shifters.

We complete our model by adding a set of indicator variables for the time periods in equation (2). These variables control for the cyclical variation in the tax

base displayed in Figure 3. Despite the upward drift of tax rates shown in Figure 2, we do not add time variables to equation (1). This omission is motivated by a practical limitation in the data. The time variables are highly collinear with the unconditional grant, because of the nearly proportion manner in which grants have been cut. There is also an economic justification for treating time effects differently in the two equations. Underlying economic cycles might produce variation in the tax base that is beyond the control of municipal councils. The tax rate is not subject to such random variation. Councils might feel it necessary to change tax rates in response to shocks in the tax base.[12] This effect is accounted for by the inclusion of the tax base in equation (1). The exclusion of time effects from equation (1) also makes them available as instrumental variables for the unconditional grant.

Results on the Behavior of Tax Setters

Table 2 contains parameter estimates for the tax rate equation (1) obtained by generalized method of moments estimation and by three stage least squares.[13] It is evident from the second line of Table 2 that municipal councils have used increases in the municipal tax rate to offset revenue losses due to the declining real value of aid from the provincial government.

TABLE 2 HERE

The magnitude of the effect of the unconditional grant on the tax rate deserves some clarification. The estimated coefficient gives the effect on the tax rate of a 100 per cent increase in the unconditional grant. Thus, using the estimate given the second column of Table 2, for every ten percent point decrease in unconditional grant, tax rates are predicted to rise by 3.7 cents per hundred dollar of property value. Over the sample period, the median per household unconditional grant fell from $644.14 to $234.16, a fall of 63.6 per cent. According to the chosen estimate, this reduction would induce a 23.6 cent increase in tax rates. The observed increase in median tax rates was 37.66 cents per hundred dollar of value. Thus, changes in the unconditional grant account for 62 per cent of the increase in the median property tax rate.

The estimated effect of neighbors' tax rates on municipal tax rates is both algebraically small and statistically insignificant. Thus, there is no evidence in support of yardstick competition or local demonstration effects in tax setting. In addition, there appears to be little effect of the tax base on the tax rate.

The only consistently significant demographic variable is the share of French-speaking inhabitants, and the share of the population with a degree. The positive effect of the share of persons speaking French could be indicative of a higher demand for public services among Francophone New Brunswickers, or may reflect the geographical reality that the French speaking population of the province is more highly concentrated in more northern and somewhat more remote regions of the province; these factors may make the provision of local services more expensive.

The first two columns of Table 3 contain parameter estimates for equation (2) when neighbors' tax rates and base shifting variables are included. There is no evidence of and effect of neighbors' tax rates on the tax base. This is consistent with the findings of Brett and Pinkse (2000) for municipalities in British Columbia.

Moreover, neighbors' characteristics appear to have little effect on the tax base. Thus, there is no evidence of tax base movement across municipal boundaries.

The remaining columns of Table 3 show the results of estimation without the inclusion of neighbors' variables. The estimates of the effects of own characteristics on the tax base are not very sensitive to the inclusion of neighbors' characteristics. Extremes in educational attainment are associated with lower tax bases. There is some evidence of lower per household tax bases in areas of higher owner occupation. Also important is the existence of water and sewage services, which has a positive influence on the tax base. The provision of basic infrastructure appears to influence the location of residents and firms.

TABLE 3 HERE

The dependent variable in the tax base analysis is the natural logarithm of the tax base, while the level of the tax rate enters as an explanatory variable. This specification of the relationship implies that neither the marginal effect of the tax rate on the tax base nor the elasticity of the tax base with respect to the tax rate is constant. Instead, the elasticity of the tax base with respect to the tax rate increases as the tax rate increases. Specifically, the elasticity is the magnitude coefficient on the tax rate multiplied by the tax rate itself. This specification captures the pattern of the data better than a purely linear or standard double logarithmic form. If the tax base becomes more responsive to tax rates the higher is the tax rate, then municipalities with higher tax rates collect proportionately less revenue from a given tax rate increase than do low-tax municipalities. Thus, the consequences of raising tax rates are more severe. The point estimates of the effect of tax rate on the tax base shown in Table 3 give rise to a substantial range in estimates of the elasticity of the tax base. For example, applying the estimates from the second column to the highest tax rate in the 2003 data gives an elasticity of 0.91, while applying the estimate from the third column to the median tax rate for 2003 gives an elasticity of 0.47. Moreover, these point estimates are subject to large statistical error and should be used with caution. Perhaps the only safe judgment to be made from these estimates is that the tax base elasticity is less than one, which implies that total revenue increases as the tax rate increases.

CONCLUSION

Local tax rates in New Brunswick do not appear to be the product of localized tax competition. Moreover, there is no evidence to suggest that local tax bases respond to neighbors' tax rates or to neighbors' characteristics. While this finding is in contrast with much of the literature on tax competition, it is easy to reconcile with the geography of New Brunswick. Few of its municipalities are geographically contiguous, and distance tends to soften tax competition.[14] Moreover, because tax rates tend to be lower, and especially so for nonresidential property, in local service districts than in municipalities, municipal councils may be more concerned about the mobility of the tax base to nearby LSDs than they are about competition with other councils.[15] Alternatively, the more circumscribed and provincially-regulated role of municipalities in Canada relative to those in the United States may help to explain why local competition is more commonly observed in the United States than has thus far been documented in Canada.

The recent history of local tax setting in New Brunswick has been dominated by municipalities increasing their tax rates to make up for revenue lost due to the declining real value of unconditional transfers from the provincial government. This substitution of revenue sources was possible because the elasticity of the municipal tax bases with respect to the tax rate has been less than one. The experience of New Brunswick appears to substantiate Kitchen's (2002, 333-334) view that the local property tax base is capable of generating enough revenue to cover municipal expenses in the short term. Property tax rate increases may be economically feasible, but they need not be the most efficient or the most desirable way to make municipal ends meet.

The outlook for municipal finances in New Brunswick is less clear. The relatively slow growth of the highest tax rates in New Brunswick suggests a reluctance to raise property tax rates above some ceiling. Our results give a partial explanation for this tendency. As municipal tax rates have increased, so too has the elasticity of the tax base to own tax rates. Municipalities in New Brunswick are edging closer to the point where increases in tax rates will bring no increase in revenue. Unfortunately, the results presented here are too imprecise to give a good prediction as to when it will become economically infeasible to raise additional revenue from local property taxes. They say even less about when property tax increases become politically infeasible.

NOTES

[1] Brennan and Pincus (1996) dispute the claim that intergovernmental grants are net income to the recipient jurisdiction. They argue that these grants must be financed from within the nation. Rational citizens realize, they argue, that grants must be financed by taxes levied by the donor government.

[2] There is a large literature on the "flypaper effect" in local responses to unconditional aid, which tries to explain the seemingly anomalous result that increases in grants to local governments have a greater stimulative effect on local public spending than do equivalent increases in local private-source income. Hines and Thaler (1995) and Bailey and Connolly (1998) provide surveys of this literature. The evidence summarized by Hines and Thaler substantiates the flypaper effect, but is also consistent with the claim that stimulative effect of unconditional grants is less than dollar-for-dollar.

[3] The direct influence of taxes on property values is termed "tax capitalization." Palmon and Smith (1998a,b) find evidence of economically significant, though incomplete, capitalization of local taxes in some cities of the United States.

[4] In 1995, a rural community, Beaubassin East, was established. This rural community is an amalgamation of pre-existing local service districts, with enhanced power over land use planning. It has no power to set tax rates. A second rural community, Saint-André, was incorporated in 2006.

[5] Recently, a small number municipalities have further differentiated their property taxes and list rates for named zones within town boundaries.

[6] Tindal and Nobes Tindal (2000) provide a detailed account of the recent efforts to redefine the roles of local and provincial governments in other Canadian provinces.

[7] The largest such amalgamation occurred in 1995 when the city of Miramichi was created by combining five municipalities with four local service districts and parts of three other local service districts.

[8] For an account of the general features of, and motivations for employing, representative tax system approaches to equalization, see Boadway (2002).

[9] Nominal grants were then cut by ten percent in 2004. A new formula, which combines an escalating base grant with an equalizing top-up, governs unconditional grants for the years 2005 through 2008. The current formula contains no explicit needs adjustments.

[10] Bordignon, Cerniglia and Revelli (2003) argue that it is possible to interpret equation (2) as a yardstick competition model when citizens have limited information about some tax-relevant local characteristics.

[11] These assumptions include a lack of spatial correlation in the errors. A formal test for this type of correlation, based on residuals from the two-stage least squares regression, has been suggested by Kelejian and Prucha (2004). As Tables 2 and 3 demonstrate, the residuals from our equations show no spatial patterns.

[12] The tax base data are budgetary data, known to municipalities before they set their tax rates. This data reflects the property assessments used for property tax bills in the budget year. Thus, the average tax rate is not influenced by random variation in the tax base for that year. The average tax rate is perhaps best termed a tax-base weighted average of the statutory rates.

[13] Hayashi (2000, Chapter 3) provides a description of the techniques used in this paper.

[14] Braid (1993) provides a theoretical model of tax competition in which the degree of competition among jurisdictions declines with distance.

[15] A justification for this concern is outlined in Government of New Brunswick (2001, 23-24).

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APPENDIX

Variable Definitions and Data Sources

Data on municipal tax rates, grants received from the province, and local tax bases are published by the Government of New Brunswick (1983; 1988; 1993; 1998; 2003). This study uses local fiscal data for the years 1983, 1988, 1993, 1998 and 2003. Data on local demographic and economic conditions are available at five year intervals through the Census of Canada, as published by Statistics Canada (undated). These censuses were conducted at five year intervals, starting in 1981, and asked for retrospective information for the previous year. Thus, the demographic information is dated three years prior to the corresponding fiscal information. The use of lagged demographic information is necessary to control for potential reverse causation running from fiscal variables to population characteristics operating through voting with ones' feet.

Tax base. Raw values from the *Annual Report of Municipal Statistics* are first divided by the number of census households (three years earlier) and then converted to real 1997 values using the GDP deflator for New Brunswick.

Average tax rate. Total tax collections (also known as the municipal warrant) divided by the tax base.

Grant. Unconditional grant from the *Annual Report of Municipal Statistics*, transformed in the same manner as the tax base.

Water. An indicator variable that equals one if a municipality charges a fee for water service in that year, zero otherwise.

Degrees. Number of persons aged 15 and over with a university degree divided by the total population (census).

No high school. Number of persons aged 15 and over who have not completed high school — defined as highest level of education less than grade 9, plus some secondary without certificate — divided by the total population (census).

Employment. Number of employed persons aged 15 years or older divided by the population aged 15 years or older (census).

French. Total number of households with French as mother tongue (single responses) divided by the total number of households with a single response to the mother tongue (census).

Child. Total population aged 0-14 years divided by total population (census).

Seniors. Total population aged 65 or older divided by total population (census).

Construction. Number of workers employed in construction divided by the total number of workers in all designated industries (census).

*Primar*y. Number of workers employed in primary industries — defined as agriculture, fishing and trapping, logging and forestry, and mining, milling and quarrying — divided by the total number of workers in all designated industries (census).

Service. Number of workers employed in service industries — defined as communications and other utilities, wholesale trade, retail trade, finance and insurance, real estate and insurance, business services, government services, educational services, health and social service, accommodation, food and beverage services, and other services — divided by the total number of workers in all designated industries (census).

Manufacturing. Number of workers employed in manufacturing divided by the total number of workers in all designated industries (census).

Years. For each year, an indicator variable that equals one in that year and zero otherwise. Because 2003 is omitted, these variables measure differences in the dependent variable relative to 2003.

Spatially Weighted Averages

We assume that for each municipality there exists a set of potential competitors, referred to as its neighbors. The strength of the influence that a neighbor j has on the decisions of municipality i is given by a spatial weight, w_{ij}. We base our spatial weights on the distance between two municipalities along the primary highway system of New Brunswick. We define raw weights $p_{ij}=1/d_{ij}$, where d_{ij} is the highway distance, measured in kilometers, between municipalities i and j. To arrive at $w_{ij,}$ all raw weights are set to zero for pairs of municipalities further than 75 kilometers apart. These revised weights are then standardized so that the sum over j of all w_{ij} equals one. These standardized weights are the w_{ij} used in this analysis.

Adjustments for Municipal Restructuring

There are currently 103 municipalities in New Brunswick. These municipalities are represented in the data for 1998 and 2003. Five of these municipalities were created from portions of former local service districts between 1983 and 1998. Three of these municipalities (Le Goulet, Maisonnnette, and Sainte-Marie-Saint-Raphaél) were created between 1988 and 1993, while two (New Maryland and Saint-Isidore) were formed between 1993 and 1998. Accordingly, the spatial weights have been constructed using three different maps of New Brunswick. For 1983 and 1988, a map with 98 municipalities is used; the map for 1993 features 101 municipalities; there are 103 points on the map for 1998 and 2003.

There have also been a number of municipal amalgamations and boundary changes since 1983. The largest of these boundary changes was the formation of the city of Miramichi from five pre-existing municipalities and parts of several contiguous local service districts. We handle these amalgamations by constructing histories for each municipality with 2003 boundaries that resulted from an amalgamation of pre-existing municipalities during the study period. For example, our data set contains an entry on the city of Miramichi for the years before its creation. This entry contains appropriate weighted averages of values for the five municipalities that were included in the amalgamation. Because detailed fiscal and demographic information is not available for local service districts, it is impossible to perform a full reconstruction of these municipalities. However, the local service district component of each amalgamation was small. Thus, the aggregation procedure is unlikely to create large discrepancies.

Table 1
Summary Statistics

	1983	*1988*	*1993*	*1998*	*2003*
Unconditional Grant					
($1997 per household)					
First quartile	526	434	338	227	185
Median	644	573	435	283	234
Third Quartile	787	691	518	348	286
Tax Rate					
($ per $100 value)					
First quartile	0.685	0.825	0.967	1.120	1.200
Median	0.894	0.984	1.070	1.220	1.275
Third Quartile	1.036	1.124	1.210	1.330	1.407
Tax Base					
($1997 per household)					
First quartile	49 541	59 268	69 884	64 602	70 353
Median	67 668	73 681	82 918	83 162	91 236
Third Quartile	86 018	98 384	106 143	103 299	111 226

Table 2
The Tax Rate Equation

Explanatory Variable	GMM	GMM†	3SLS†
Tax base††	0.27**	0.13	0.07
	(0.08)	(0.09)	(0.10)
Grant††	-0.33**	-0.37**	-0.40**
	(0.03)	(0.03)	(0.04)
Neighbors' taxes†††	0.05		
	(0.04)		
Degrees	-0.06	-0.44	-0.70**
	(0.24)	(0.28)	(0.27)
Employment	-0.18	-0.29**	-0.25*
	(0.13)	(0.14)	(0.14)
French	0.94**	0.89**	0.90**
	(0.29)	(0.31)	(0.34)
Child	-0.46*	-0.24	-0.11
	(0.25)	(0.344)	(0.34)
No high school	0.03	-0.10	-0.13
	(0.14)	(0.16)	(0.13)
Seniors	-0.00	0.12	0.13
	(0.30)	(0.32)	(0.40)
Water	-0.02	-0.00	-0.00
	(0.02)	(0.02)	(0.02)
R2	0.74	0.73	0.72
Hansen's J p-value‡	0.11	0.56	
Moran p-value ‡‡	0.13	0.34	0.33

Notes: — Dependent variable is average tax rate.
— Number of observations = 503.
† — Excludes neighbors' variables
††— Variable in natural logarithmic form.
†††— Spatially weighted average, as defined in the Appendix.
‡— Two-sided test for instrumental validity.
‡‡— One-sided test for spatial correlation in residuals.
— The number below each coefficient is a standard error.
** significant at 95 percent * significant at 90 percent
— Data notes and units of measurement are contained in the Appendix

Table 3
The Tax Base Equation

Explanatory Variable	Baseline GMM		GMM †	3SLS †
	Own Variables	Neighbors' Variables††		
Average Tax Rate	-0.42	0.01	-0.53	-0.36
	(0.50)	(0.10)	(0.66)	(0.68)
Construction	-0.38	-0.35	-0.42*	-0.38
	(0.24)	(0.41)	(0.25)	(0.25)
Degrees	-1.05**	-0.26	-0.95**	-0.94
	(0.33)	(0.34)	(0.35)	(0.32)
Employment	-0.53*	-0.18	-0.67**	-0.58**
	(0.28)	(0.19)	(0.29)	(0.15)
No high school	-0.49**	-0.20	-0.49**	-0.45**
	(0.12)	(0.15)	(0.13)	(0.14)
Owners	-0.24	-0.00	-0.38*	-0.35**
	(0.20)	(0.15)	(0.20)	(0.17)
Primary	0.02	-0.33	0.22	0.26
	(0.27)	(0.31)	(0.30)	(0.29)
Service	-0.04	-0.40*	-0.03	0.01
	(0.19)	(0.24)	(0.19)	(0.18)
Manufacturing	0.28	-0.29	0.28	0.32
	(0.23)	(0.23)	(0.23)	(0.21)
Water	0.14**	-0.00	0.15**	0.14**
	(0.03)	(0.04)	(0.03)	(0.04)
1983	-0.45**		-0.50*	-0.44
	(0.21)		(0.29)	(0.29)
1988	-0.28*		-0.32	-0.26
	(0.16)		(0.22)	(0.22)
1993	-0.15		-0.18	-0.14
	(0.12)		(0.16)	(0.16)
1998	-0.13**		-0.17**	-0.15**
	(0.05)		(0.06)	(0.06)
R2		0.86	0.86	0.87
Hansen's J p-value‡		0.13	0.57	
Moran p-value ‡‡		0.21	0.13	0.17

Notes: — Dependent variable is the natural logarithm of per household tax base
— Number of observations = 503.
† — Excludes neighbors' variables
††— Spatially weighted average, as defined in the Appendix.
‡— Two-sided test for instrumental validity.
‡‡— One-sided test for spatial correlation in residuals
— The number below each coefficient is a standard error.
** significant at 95 percent * significant at 90 percent
— Data notes and units of measurement are contained in the Appendix.