IMFG
Institute on Municipal Finance & Governance

MUNK SCHOOL OF GLOBAL AFFAIRS

IMFG Papers on Municipal Finance and Governance

No. 20 • 2015

Can GTA Municipalities Raise Property Taxes? An Analysis of Tax Competition and Revenue Hills

Almos Tassonyi, Richard M. Bird, and Enid Slack
Institute on Municipal Finance and Governance

UNIVERSITY OF TORONTO

IMFG Papers on Municipal Finance and Governance

Can GTA Municipalities Raise Property Taxes? An Analysis of Tax Competition and Revenue Hills

By
Almos Tassonyi, Richard M. Bird, and Enid Slack

IMFG
Institute on Municipal Finance & Governance

MUNK SCHOOL OF GLOBAL AFFAIRS

UNIVERSITY OF TORONTO

Institute on Municipal Finance & Governance
Munk School of Global Affairs
University of Toronto
1 Devonshire Place
Toronto, Ontario, Canada M5S 3K7
e-mail contact: info.imfg@utoronto.ca
http://munkschool.utoronto.ca/imfg/

Series editor: Philippa Campsie

ISBN 978-0-7727-0939-4
ISSN 1927-1921

About IMFG

The Institute on Municipal Finance and Governance (IMFG) is an academic research hub and non-partisan think tank based in the Munk School of Global Affairs at the University of Toronto.

IMFG focuses on the fiscal health and governance challenges facing large cities and city-regions. Its objective is to spark and inform public debate, and to engage the academic and policy communities around important issues of municipal finance and governance. The Institute conducts original research on issues facing cities in Canada and around the world; promotes high-level discussion among Canada's government, academic, corporate, and community leaders through conferences and roundtables; and supports graduate and post-graduate students to build Canada's cadre of municipal finance and governance experts. It is the only institute in Canada that focuses solely on municipal finance issues in large cities and city-regions.

IMFG is funded by the Province of Ontario, the City of Toronto, Avana Capital Corporation, and TD Bank Group.

Bios

Richard M. Bird is Senior Fellow of the Institute on Municipal Finance and Governance, and Professor Emeritus, Department of Economics, at the Joseph L. Rotman School of Management, University of Toronto. Richard is a Research Fellow at the C.D. Howe Institute, Distinguished Visiting Professor at the Andrew Young School of Public Policy, Georgia State University, and Adjunct Professor at the Australian School of Taxation at the University of New South Wales. He has served with the Fiscal Affairs Department of the IMF, been a visiting professor in the United States, the Netherlands, Australia, and elsewhere, and been a frequent consultant to the World Bank and other national and international organizations. He has published extensively, especially on the fiscal problems of developing and transitional countries.

Enid Slack is the Director of the Institute on Municipal Finance and Governance, and an Adjunct Professor at the Munk School of Global Affairs at the University of Toronto. Enid has been working on municipal finance issues in Canada and abroad for 35 years. Prior to establishing the IMFG, she was a consultant specializing in municipal finance. Enid has worked with the World Bank, IMF, CIDA, UN Habitat, ADB, and IADB in countries around the world. She has published several books and articles on property taxes, intergovernmental transfers, development charges, financing municipal infrastructure, municipal governance, municipal boundary restructuring, and education funding. In 2012, Enid was awarded the Queen's Diamond Jubilee Medal for her work on cities.

Almos T. Tassonyi is Executive Fellow and Director, Urban Policy Program at the School of Public Policy, University of Calgary, and an Adjunct Professor of Economics, Ryerson University. Almos is an Adjunct Lecturer, Department of Geography and Planning, University of Toronto, and a Research Associate at the International Property Tax Institute. He has worked extensively in government, over thirty years as a Senior Economist with the Ontario Ministry of Finance, Provincial-Local Finance Division, the Ontario Ministry of Municipal Affairs and Housing, Municipal Finance Branch, and the Regional Municipality of Durham, and was seconded to the Ontario Fair Tax Commission. He has taught at the University of Toronto, Ryerson and Laurentian Universities. He has co-authored a book on property tax reform, and authored journal articles and chapters in several books on municipal budgeting, property taxation, and fiscal decentralization. He has lectured on local government finance and tax reform in China, India, and Hungary, working with the World Bank, the Asian Development Bank, the Forum of Federations, and the Canadian Urban Institute.

Acknowledgements

This paper is an updated version of a chapter in *A Tale of Two Taxes: Property Tax Reform in Ontario* (Cambridge, MA: Lincoln Institute of Land Policy, 2013). The authors would like to thank Andrey Tarasov and Cesar Furtado for research assistance on the earlier chapter and Philippa Campsie for making this paper as readable as possible.

Papers on Municipal Finance and Governance

1. *Are There Trends in Local Finance? A Cautionary Note on Comparative Studies and Normative Models of Local Government Finance,* by Richard M. Bird, 2011. ISBN 978-0-7727-0864-9
2. *The Property Tax—in Theory and Practice,* by Enid Slack, 2011. ISBN 978-0-7727-0866-3
3. *Financing Large Cities and Metropolitan Areas,* by Enid Slack, 2011. ISBN 978-0-7727-0868-7
4. *Coping with Change: The Need to Restructure Urban Governance and Finance in India,* by M. Govinda Rao and Richard M. Bird, 2011. ISBN 978-0-7727-0870-0
5. *Revenue Diversification in Large U.S. Cities,* by Howard Chernick, Adam Langley, and Andrew Reschovsky, 2011. ISBN 978-0-7727-0872-4
6. *Subnational Taxation in Large Emerging Countries: BRIC Plus One,* by Richard M. Bird, 2012. ISBN 978-0-7727-0874-8
7. *You Get What You Pay For: How Nordic Cities are Financed,* by Jorgen Lotz, 2012. ISBN 978-0-7727-0876-2
8. *Property Tax Reform in Vietnam: A Work in Progress,* by Hong-Loan Trinh and William J. McCluskey, 2012. ISBN 978-0-7727-0878-6
9. *IMFG Graduate Student Papers. Development Charges across Canada: An Underutilized Growth Management Tool?* by Mia Baumeister; *Preparing for the Costs of Extreme Weather in Canadian Cities: Issues, Tools, Ideas,* by Cayley Burgess, 2012. ISBN 978-0-7727-0880-9
10. *The Reform of Business Property Tax in Ontario: An Evaluation,* by Michael Smart, 2012. ISBN 978-0-7727-0882-3
11. *Hungary: An Unfinished Decentralization?* by Izabella Barati-Stec, 2012. ISBN 978-0-7727-0884-7.
12. *Economies of Scale in Fire and Police Services,* by Adam Found, 2012. ISBN 978-0-7727-0886-1
13. *Trading Density for Benefits: Toronto and Vancouver Compared,* by Aaron A. Moore, 2013. ISBN 978-0-7727-0901-1
14. *Merging Municipalities: Is Bigger Better?* by Enid Slack and Richard M. Bird, 2013. ISBN 978-0-7727-0903-5
15. *Public Finance and the Politics of Scale in Montréal: Will the Proposed Reforms Save the Megacity?* by Jean-Philippe Meloche and François Vaillancourt, 2013. ISBN 978-0-7727-0915-8

16. *Decentralization and Infrastructure in Developing Countries: Reconciling Principles and Practice*, by Roy Bahl and Richard M. Bird, 2013. ISBN 978-0-7727-0919-6

17. *Provincial-Municipal Relations in Ontario: Approaching an Inflection Point,* by André Côté and Michael Fenn, 2014. ISBN 978-0-7727-0923-3

18. *A Better Local Business Tax: The BVT*, by Richard M. Bird, 2014. ISBN 978-0-7727-0921-9

19. *Cooperation and Capacity: Inter-Municipal Agreements in Canada,* by Zachary Spicer, 2015. 978-0-7727-0934-9

Can GTA Municipalities Raise Property Taxes? An Analysis of Tax Competition and Revenue Hills

Almos Tassonyi, Richard M. Bird, and Enid Slack

Abstract

Municipalities in Canada exhibit a reluctance to raise property taxes, because residents resist paying higher taxes and politicians and municipal staff fear that higher taxes mean that property owners will move to jurisdictions with lower tax burdens. Two empirical questions related to property taxation by local governments in the Greater Toronto Area (GTA) are addressed in this paper. First, have municipalities raised their property tax rates to the point at which they are likely to lose tax revenue? In other words, will further tax rate increases lower the size of the tax base? Second, how important is tax competition between municipalities in the GTA? To answer the first question, we estimated changes in the size of the tax base in response to an increase in the average effective tax rate for Toronto, the regional municipalities of the GTA, and their principal area municipalities from 1977 to 2005. We found that for a few municipalities, a further increase in the tax rate might reduce the size of the tax base, but most municipalities would not experience that decline. To answer the second question, we tested the presence of tax-competition effects among the municipalities as well as, more unusually, the presence of tax-base effects between the residential and commercial/industrial property classes. The findings show that there is some evidence of tax competition among GTA municipalities. We conclude that, while it is worth considering supplementary sources of municipal revenues, the property tax is a good local tax and has the capacity to meet the fiscal needs of the GTA to a greater extent than it does now.

Keywords: property taxes, metropolitan finance

JEL Codes: H22, H71, R13, R51

Can GTA Municipalities Raise Property Taxes? An Analysis of Tax Competition and Revenue Hills

1. Introduction

Property taxation is currently the only major field of taxation available to municipalities in Canada. As the principal source of revenue for Canadian cities, it accounts for 35 percent of total revenues and 67 percent of own-source revenue, on average, across the country (Statistics Canada 2014).[1] The extent to which this restriction to property taxation constrains city fiscal sustainability continues to be debated. Most cities in Canada claim they are hard pressed to find additional funds. Invariably, however, municipalities are reluctant to raise property taxes, partly because of popular resistance to tax increases and partly because politicians and municipal staff fear that higher taxes will drive people and businesses to relocate to municipalities with lower tax rates.

This paper addresses two empirical questions related to the revenue prospects of property taxation for local governments in the Greater Toronto Area (GTA), which comprises the City of Toronto (home to 45 percent of the total population of 6.1 million in the region in 2011), and four neighbouring regional or upper-tier municipalities (Durham, Halton, Peel, and York), within which are 24 lower-tier cities, towns and townships.

First, have municipalities raised their property tax rates to the point at which they are likely to lose tax revenue? In other words, will further tax rate increases lower the size of the tax base?[2] Second, does tax competition exist between municipalities in the GTA and if so, how important is it to their fiscal health?[3]

2. Background

While newspaper headlines regularly trumpet the imminent fiscal crisis facing Canadian cities,[4] this alarmism is neither new nor well founded (Slack and Côté 2014). In the aftermath of the recession of the early 1990s, the Board of Trade of Metropolitan Toronto raised concerns that the relative "over-taxation" of business

1.Calculated from Cansim 385-0032 Government Finance Statistics using numbers derived for local general governments. (Statistics Canada 2014, accessed at http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=3850032&paSer=&pattern=&stByVal=1&p1=1&p2=-1&tabMode=dataTable&csid=, November 11, 2014).

2. Popularized in the United States some years ago as the Laffer curve (Laffer 1979). The nonlinear relationship between tax rates and tax revenues has long been understood in the economics literature, going back at least to Dupuit in the early 19th century.

3. The empirical analysis in the present paper is largely reproduced from Chapter 8 of Bird, Slack, and Tassonyi (2012). Although resource limitations made it impossible to update this analysis, it remains relevant to the current discussion of the capacity of municipalities in the GTA to increase property taxes to finance expenditures and is reproduced here in part to make it more widely accessible.

4. For example, see Lorinc (2011) on alternative revenue sources used elsewhere.

would turn Toronto into the "hole in the doughnut" as businesses left Metro and moved to the lower-taxed adjoining suburbs (Board of Trade of Metropolitan Toronto, 1994). This report followed numerous studies recommending assessment reform and the realignment of responsibilities for financing local services between the province and municipalities, a situation referred to in an official report (Municipality of Metropolitan Toronto 1989) as the "Crumbling Financial Partnership."

In a recent study, Nelles (2012, 122) quotes the following comment by a local official on tax competition in the GTA: "While there is certainly still competition between municipalities for investment, with few exceptions it has been nowhere near as venomous as prior to 1992." Municipalities have, it seems, soldiered on by responding flexibly to changing economic circumstances as well as to provincial initiatives that reformed both fiscal arrangements and the property tax system (Slack and Côté 2014).

Dahlby (2012) recently argued that the residential property tax is a good local tax with capacity for expansion.[5] Like other researchers (for example, Bird, Slack, and Tassonyi 2012), Dahlby (2012) is sceptical about the role of the non-residential property tax and the extent to which taxation on this part of the base is justifiable based on the benefits received by businesses from local services.

Yet the search for additional sources of tax income continues. In the GTA, the City of Toronto has begun another round of budget politicking, Metrolinx (the provincial agency charged with planning an integrated regional transit plan) has released a study of alternative sources of transit financing,[6] and a panel on transit funding has weighed in on new revenue tools (Transit Investment Strategy Advisory Panel 2014). Notwithstanding this search for new revenues, this paper emphasizes that the property tax system has some spare capacity and will continue to play a significant role in the financing of municipal expenditures in the GTA.

3. Local taxation and revenue hills in the GTA

City taxes may be thought of as climbing a "revenue hill": as the rate of any tax increases, the revenue it yields will increase, at least at first. However, as rates rise, and individuals and companies adjust their behaviour accordingly, seeking to lower their tax liability through legal means (tax avoidance) and illegal means (tax evasion), revenues may increase in total but the rate of increase in revenue from a given rate increase will decrease. At some point—over the "top of the hill"—further increases in rates may reduce revenues. An important consideration for cities that need to increase revenue is how far up the revenue hill they can go or

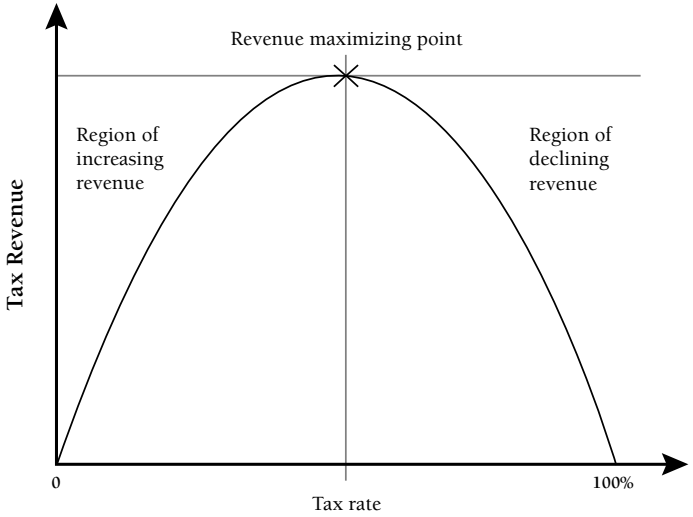
5. Dahlby (2012) cites a study by Vander Ploeg (2008) which shows falling trends in real per capita property taxes in western Canada as well as the 2012 Saskatchewan Budget showing average families paying less than $3,000 in property taxes in the major western Canadian cities. See also McMillan and Dahlby (2014).

6. See the reports provided to the Executive Committee of Toronto Council on September 24, 2012, accessed on October 3, 2012, at https://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2013/May_24/Reports/City_of_Toronto_Item.pdf

wish to go. The revenue-maximizing tax rate—the peak of the hill—is one way to think of the potential upper limit, since it is unlikely any city would raise its rates if it would lose revenues by doing so.

To the extent that taxpayers succeed in avoiding taxation, they reduce the taxable base. In theory, there is thus a tax rate that maximizes government revenue, the revenue-maximizing tax rate (RMTR). In effect, each tax rate climbs a "revenue hill": at rates lower than the RMTR, an increase in the tax rate will raise revenue; at rates higher than the RMTR, however, an increase in the tax rate will actually *lower* revenue. At the very top of the hill is the RMTR (shown in Figure 1), the rate that will maximize revenues.[7] It is hard to imagine that any local government would deliberately raise tax rates if the result were to reduce tax revenues. In this sense, in establishing an upper limit to feasible local tax rates, the RMTR is a useful concept in understanding local property tax policy.

Figure 1: A Revenue Hill



The peak of the hill, the RMTR, is where the rate-to-base elasticity is –1.0, that is, a 10 percent increase in the rate will result in a 10 percent reduction in revenues. If the rate-base elasticity is greater than this figure (for example, –0.5), then a small increase in the rate will increase revenues and the municipality is on the upward-sloping part of the curve. If it is less (for example, –1.3), it is on the downward-sloping part of the curve and a rate increase will actually reduce revenues.

7. Although the RMTR is usually higher than the tax rate that would minimize excess burden and maximize social welfare, those policy objectives, while central to public economic theory, are seldom explicitly considered by local governments in determining property tax policy.

The first objective of the present study is to determine whether local governments in the GTA maximize (both currently and historically) their property tax revenues when setting residential and commercial/industrial property taxes for local residents and businesses. This objective is modest: no attempt is made to estimate any optimizing model, let alone a complete general equilibrium model. The aim is simply to identify the location of historical property tax rates on the revenue hill curves for different GTA municipalities.

In fact, we examine two hills, since the elasticity of the municipal property tax base is analysed with respect to changes in property tax rates for both residential and non-residential property. Because our analysis shows that some but by no means all municipalities in the GTA region are near the top of the hill and one city (*not* Toronto) may be over the hill, we also look briefly at the extent to which tax competition may have influenced these results.

4. Studies of local taxes and revenue hills

Two earlier studies explored the revenue prospects of property taxes in the GTA, but came to quite different conclusions. The first, by the Conference Board of Canada, commissioned by the City of Toronto, argued that the City would face a substantial funding shortfall in the near future, a period in which it would have to deal with substantial infrastructural renewal needs (Conference Board of Canada 2005). This outlook was seen as especially dire with respect to property taxes. Owing to factors such as reduced household formation and an aging population, the study forecast a decelerating rate of growth in residential property taxes. At the same time, there was considerable pessimism about the City's ability to increase non-residential property taxes, which accounted for more than 60 percent of all property taxes at the time of the study. The City's share of the growth of this important component of the tax base in the GTA region was also decreasing—largely, the report argued, because of the higher average tax applied to such properties in the City. The authors of this study concluded that unless its responsibilities were reduced, the City would need an infusion of federal or provincial funds to be fiscally sustainable in the future.

Three comments may be made about this report. First, other regions in the GTA were and are even more dependent on property taxes than the City of Toronto is. In 2000, when Toronto's property taxes provided 45 percent of its operating revenues, the equivalent percentages in the other regions ranged from 46 percent in York to 59 percent in Halton (Slack and Bird 2004).[8] However, two factors singled out in the report as adversely affecting the City (lower rates of household formation and higher taxes on non-residential property) would seem to work the other way, at least for some of these governments (with higher rates of household formation and lower taxes on non-residential property). If this is the case, fiscal sustainability may be a problem only in the central city of the GTA.

8. Property taxes include equivalent payments-in-lieu of taxes (PILTs) from other levels of government.

A second comment is that the City seems to have accepted the argument that there is tax competition for the non-residential base. Once the path was set by provincial policy, the City of Toronto began reducing the relative burden of taxation on non-residential properties by reducing the tax ratios between the tax rates on non-residential and residential properties.[9] Achieving this goal does not seem to have been considered particularly urgent, however, since the target was to alter the ratio from the 4:1 ratio prevailing in 2004 to 2.5:1—close to the average in the rest of the GTA—by 2013 for small businesses and 2017 for all non-residential properties.

Third, the conclusions reached in the Conference Board of Canada's report reflect an important (but implicit) assumption: namely, that tax rates on both residential and non-residential property in the City of Toronto were already at their revenue-maximizing level; that is, they simply could not be increased any further. This line of argument is popular with local commentators. Some have gone so far as to argue not only that the property tax cannot sustain any increases in Toronto, but also that the whole system is so broken that the current market value–based tax was "a disaster" in the aftermath of major reforms begun in 1998[10] and should be replaced by something like a "unit value" system or even an assessment freeze until a property is sold (Barber 2007).[11]

A second study of the fiscal sustainability of local governments in the GTA reached quite different conclusions. Although Slack and Bird (2004) also noted that the region would face strong fiscal demands in the future and that all levels of government, in principle, should play an appropriate role in dealing with the problem, their study concluded that if property tax rates were raised by only 1 percent a year, the GTA could manage quite well under a business-as-usual scenario for the next few decades.[12] The (implicit) assumption in Slack and Bird (2004) is that the GTA, including the City of Toronto, was still on the upward-rising slope of the revenue hill.

Turning to other jurisdictions, Haughwout et al. (2004) estimate the effects of local taxation on local economic activity in four major U.S. cities—Houston, Minneapolis, New York City, and Philadelphia—in effect estimating where each city is on its respective revenue hill. This study concluded that, although Minneapolis is the only one of the cities studied that (like all GTA municipalities) imposes only a property tax, it is also the only one positioned comfortably down on the left side of the hill, with substantial unused revenue capacity. The rate-base

9. Upper-tier and single-tier municipalities can adjust the relative tax burden on the various classes of property by adjusting tax ratios in accordance with legislation and regulations.
10. See Bird, Slack, and Tassonyi (2012, 57–82) for a detailed explanation.
11. For a review of the alternatives, see Slack (2006). For an analysis of the implications of assessment limits in Ontario, see Slack (2010).
12. The notion of local fiscal sustainability is explored in more detail in Slack and Bird (2004) and Bird (2006). Both reports discussed in the text argued that new infrastructure could and should be financed largely through borrowing. Canadian cities in general, including those in the GTA, have considerable unrealized borrowing capacity, as Bird and Tassonyi (2001, 2003) explain.

elasticity of the property tax was found to be close to or less than –1.0 in Houston (ranging from –0.89 to –1.13), New York (–0.77 to –0.90), and Philadelphia (–0.41 to –0.80). In contrast, this elasticity (for the most recent tax base and rate) was only –0.16 to –0.36 in Minneapolis.

Arguably, although tax competition is not the only factor determining rate and base shifts, it may be more important in major metropolitan areas like the GTA and those studied by Haughwout et al. (2004) than in largely rural areas, such as those that were the focus of earlier Canadian studies in British Columbia (Brett and Pinske 2000) and New Brunswick (Brett and Tardif 2005). In addition, it should be easier to estimate pure behavioural responses in a simpler, more transparent system like that in Minneapolis or in the GTA than in the more complex U.S. cases, where it can be difficult to control adequately for the impact of other taxes.

Haughwout et al. (2004) estimated a model using time series data (for periods ranging from 27 to 41 years) for all four cities. Their analysis found that changes in the local property tax rate had an immediate, quantitatively important, and statistically significant negative effect on the tax base—that is, a reduction in property values. They argued that their findings reflected an immediate capitalization effect (reducing property values) rather than a longer-term investment effect. However, in land- and structure-intensive businesses in which local property tax differentials constitute a significant excise tax on employing capital in particular locations, some longer-term investment effects in terms of location or size of investment seem likely.[13]

5. Tax Competition

Although there have been many theoretical studies of tax competition in recent years (Wilson and Wildasin 2004), and several empirical studies, including some at the provincial level in Canada (Mintz and Smart 2004; Crisan 2007), until very recently there have been no Canadian empirical studies of local government competition for tax base along the lines of the many done in the more data-rich U.S. environment (for example, Brueckner and Saavedra 2001).[14] Three studies are summarized here.

13. For example, a recent study of the effects of reducing the excise tax imposed on investment by provincial retail sales taxes (by replacing them with a value-added tax) found significant evidence of investment shifts; see Smart and Bird (2009). In a subsequent study of the implications of the reform of business property taxes in Ontario, Smart (2012, 22–23) suggests that the low degree of mobility and the economically small impact of municipal property tax on business location is consistent with "the capitalization of local tax differentials." Muthitacharoen and Zodrow (2012) provide a recent analysis of the excise and capitalization effect of the property tax using aggregate U.S. input-output data and a simulation exercise concluding that taxes are shifted from residential to non-residential owners in the intermediate time period.

14. See Gaboury and Vaillancourt (2003) for a more extensive survey of the tax competition literature from a Canadian perspective and Blöchliger and Pinero-Campos (2011) for a global perspective.

The first such study in Canada, by Brett and Pinske (2000), focused on business property taxes in British Columbia. It analyzed these taxes for 147 municipalities for the years 1987 and 1991 and found some evidence of interjurisdictional tax competition: tax rates in one jurisdiction appeared to be affected by tax rates in neighbouring jurisdictions. However, when both tax base and tax rate determinants were investigated, the authors found no evidence of competition over tax base.

The model they used assumes that municipal governments simultaneously determine tax rates and tax bases in such a way as to maximize the combined utility local residents receive from public services and the (economic) rents accruing to private activities, with rents being assumed to depend on the total (not just the municipal) property tax rate. The capital tax base is assumed to be partly mobile, so the business capital stock in any municipality depends in part on the tax rates and characteristics of other municipalities. The influence of neighbouring jurisdictions depends partly on distance, given British Columbia's variety of municipalities in a large and unevenly populated area. Since business and residential rates are closely related (simple correlation of 0.70) and both rates are assumed to be determined by the same factors, only business tax rates were studied. Moreover, only the municipal (as distinct from the educational and regional) business rate was studied because it is assumed to be the most important variable facing municipalities. The researchers also assumed that municipalities view regional and school taxes as fixed when they make their own tax decisions.[15]

The independent factors Brett and Pinske use to explain the tax base include (1) median family income, to measure the attractiveness of the area for commercial activity as a proxy for a willingness to consume locally as well as willingness to pay local taxes; (2) the percentage of the workforce in primary industries, to take into account location-specific factors, important in the commodity-based rural sector of British Columbia; and (3) two measures of local infrastructure—metres of road per capita and hectares of parks per capita. The former is interpreted as a measure of infrastructure provision and the latter as a measure of both land availability and amenity value as well as a possible "shifter" of the willingness to pay for public services (Brett and Pinske 2000). In addition, they included the percentage of seniors as a proxy for the demand for public services—and possibly also for wealth.

A subsequent study by Brett and Tardif (2005) estimated a model of joint determination of local property tax rates and tax bases for about 100 New Brunswick municipalities at five-year intervals from 1983 to 2003. The researchers found some (though not much) evidence of spatial competition. More interestingly, they found that the elasticity of the tax base to own-tax rates was increasing over time, as tax rates increased. In other words, local governments in

15. This assumption differs from Locke and Tassonyi (1993), who assessed the interaction of the municipal and school taxing decisions as well as the implications of the characteristics of the local assessment base, grant entitlements, and income levels based on 1986 Ontario data. Their study did not analyze tax competition among municipalities.

New Brunswick appeared to be coming closer to the top of their revenue hills. In a later analysis of the same data by Brett and Tardif (2008), however, this conclusion was downplayed owing to the variability of the elasticity estimates. Instead, the later study concluded that because the rate-base elasticity remains small (less than –1.0), property tax rate increases remain economically—if not politically—feasible in New Brunswick.

Brett and Tardif (2005), unlike Brett and Pinske (2000), explicitly model "yardstick competition," in which voters punish politicians if the tax rates they set are too far out of line with those in neighbouring jurisdictions (Besley and Case 1995). Although the approach they follow is broadly the same as the one used in the earlier study, there are a number of interesting variations. *Tax rates* are modelled as a function of the local tax base, local characteristics, and the tax rates of nearby municipalities. *Tax bases* are modelled as a function of the local tax rate, local characteristics, and the tax rates and characteristics in nearby competing locations.

Yardstick competition is considered to exist when the local tax rate is significantly influenced by neighbouring tax rates. At the same time, if those rates affect tax bases, the results are seen to reflect tax base competition. Since this study is concerned primarily with relatively small and scattered municipalities—as in the earlier Brett and Pinske (2000) analysis—spatial weighting plays a prominent role in the analysis. Unlike the earlier study, however, because residential and commercial tax rates have a fixed relationship in New Brunswick (1:1.5), the focus is on *all* municipal taxes, not just business taxes. Moreover, provincial grants to municipalities are taken into account explicitly in the analysis.

Brett and Tardif (2005) found that tax bases seem to have little effect on tax rates, which are affected especially by the proportion of French speakers in a municipality (a factor they interpret as reflecting either higher service demand or higher locational cost) and education variables. As already mentioned, they found little "neighbour" effect on tax bases, although they did note some (statistically insignificant) effect of own-tax rates. Rate-base elasticities, evaluated at the mean tax rate, ranged from –0.76 to –0.63 in 2003 and from –1.01 to –0.84 when evaluated at the highest rate, suggesting that those with the highest rates were very close to the top of their revenue hills.

Further analysis of the data in Brett and Tardif (2008) found not only no evidence in support of yardstick competition or tax-base competition, but also no effect on the tax base. In this later study, although the elasticity of tax base to own-tax rates was found to have increased over time as tax rates increased, at the end of the period in 2003, the rate-base elasticity on the median (not mean) tax rate was still only –0.17 and on the highest rate was –0.71. As Brett and Tardif concluded in their earlier study, "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" (Brett and Tardif 2005, 11).

Recently, Smart (2012) estimated the responsiveness of business location decisions and employment to local tax differentials after changes in the factors

governing non-residential property taxation, using data from Ontario municipalities principally in the GTA on establishments and employment as well as municipal tax data from 2001 to 2006. His work consisted of two related empirical analyses. The first linked the suburbanization of business location and employment to a relative measure of tax burden: the tax ratio of the relevant commercial or industrial percentage tax rate in relation to the percentage residential rate. Using correlation analysis with the tax ratio as the dependent variable and an employment intensity index as the independent variable, he showed that tax-exporting municipalities, which tend to import labour, levy the highest relative tax rates. Smart suggested that "core city tax rates are higher than would be predicted by their employment intensity alone. This finding is consistent with the idea that cities that are fully built out, and where taxes are most likely to be capitalized into land values, are those that tax business properties at the highest rates" (2012, 14).

The study also assessed the impact of changes in business taxes on the location of business. The author studied the change in the number of business establishments in certain industrial groups (Manufacturing, Wholesale and Retail Trade, and Services) as related to changes in business taxes, using own-tax rates, neighbouring tax rates, population, and employment in 2000 as control variables. The dependent variable was defined as the number of establishments having 10 employees or more.

Smart (2012) also found an estimated own-tax elasticity of –0.25 and an estimated neighbourhood-tax elasticity of +0.18. He commented that "the neighbour-tax effect is (reassuringly) smaller than the own-tax effect, but the two are very similar and statistically indistinguishable." (2012, 20). This finding suggests that tax reductions in one municipality increase the number of businesses locating in that municipality over time, largely at the expense of its neighbours. Smart concluded that "the estimate of municipal property taxes on business location is statistically significant, but economically small... a 40 percent tax rate reduction by the average municipality would cause an increase in the number of business establishments locating there of about 10 percent. On the other hand, a 40 percent tax rate reduction by the municipality's closest neighbours would cause an offsetting decrease in business establishments of about 7 percent" (2012, 22). In his view, these estimates suggested that "businesses are relatively immobile in response to changes in local tax differentials."

6. The Model and Data

The primary aim of this study is to estimate the relative positions on the revenue hills (rate-base elasticities) for Toronto, the regional municipalities of the GTA, and their principal area municipalities from 1977 to 2005, relating changes in the value of the tax base to the average effective tax rate. The secondary aim is to detect evidence, if any, of inter-jurisdictional tax competition. We also tested for tax-base effects between the residential and commercial/industrial property classes.

We estimated separate equations for each of the two broad property classes considered here: (1) residential and (2) commercial/industrial/business (CIB).[16] The equations are shown in the Appendix. In general, we employ a 29-year panel data set, including 25 lower-tier GTA municipalities, and the City of Toronto.[17] Since all relationships are estimated in one-period lagged differences, we had 28 time-series data points for each region/municipality.

It is assumed that property tax bases and rates are simultaneously determined, which requires two equations for each property class under consideration. The first equation is a *tax-base equation,* which estimates equalized assessment values as a function of property taxes, demand and supply factors in the real estate market, and other economic conditions and events likely to affect property values. The second equation is a *tax-rate equation,* which estimates the property tax rate as a function of government policy, the characteristics of the local tax base, and economic and market conditions likely to have an impact on local government policy, perhaps causing the government to respond by adjusting property tax rates.

All regressions are estimated in log-linear one-period lagged differences, for several reasons. First, this formulation is convenient because the coefficients in a log-linear differenced tax-base equation represent long-term tax elasticities, which is what we are trying to determine. Second, differencing is one approach to dealing with estimating problems arising from variations in the underlying data series, particularly with respect to some of the series exhibiting long-term trends. Third, differencing the series also helps resolve the autocorrelation problem as well as concerns over bias in estimates resulting from endogeneity.[18]

Endogeneity may also arise owing to tax competition between local governments and the interaction of tax rates and tax bases across different property classes. Most GTA municipalities are contiguous (or nearly so) and hence may compete for residents and businesses.[19] Moreover, changes in the values of one class of property—residential or commercial-industrial—may have an impact (negative or positive) on values in the other class. For example, rapidly increasing residential property values may, by increasing land prices, reduce the attractiveness of the jurisdiction for new industrial or commercial development.

16. As discussed earlier, the separate business property tax was abolished in Ontario in 1997. However, the CIB data include this tax for all pre-1998 observations. Over time, there have been changes in the composition and treatment of each of the two classes of property. Many of the complexities subsumed in the necessarily aggregated approach employed in this paper are discussed in Bird, Slack, and Tassonyi (2012).

17. The City of Toronto, created in 1998, was preceded by a two-tier arrangement consisting of an upper-tier regional government, Metropolitan Toronto, and six lower-tier jurisdictions (Etobicoke, East York, North York, Scarborough, Toronto, and York). Data from these jurisdictions have been aggregated as necessary to create a consistent time series.

18. In this context, endogeneity means that there may be a relationship among the various explanatory variables. See Wooldridge (2006, 862).

19. For this reason, distance factors are not explicitly modelled as they are in Brett and Pinske (2000).

Since tax-rate and tax-base data are available separately for residential and commercial-industrial property for all GTA municipalities, the presence of both tax competition and cross-category tax-base effects could be tested using regression analysis. However, if both factors are present, there may be endogenous and possibly strategic relationships among property tax rates across local jurisdictions. Moreover, values across different broad property classes within each jurisdiction may be simultaneously determined in the local real estate market and hence be subject to common shocks and policy changes.

After taking all these sources of potential endogeneity into account to the extent possible, the model consists of several equations that relate tax bases and tax rates both across broad property classes and across neighbouring local jurisdictions. However, not all simultaneous relationships may hold. Since separate ordinary least squares (OLS) regressions of key equations did not yield any significant correlation between error terms in these equations and potential endogenous variables, endogeneity problems might not be very serious. If so, the estimates might or might not be inconsistent or biased. To check the robustness of our results, we estimated the model using the two-stage least squares (2SLS) method, which takes into account the endogenous nature of relationships among several model variables. Using 2SLS one can account for endogeneity between tax rates and tax bases and between the two broad property classes (residential and commercial/industrial), as well as endogeneity in the determination of tax rates across jurisdictions.[20]

Although the difference between competition for tax bases and "tax mimicking" or "yardstick competition" is not discussed here, as Brett and Tardif (2005) note, when local tax rates are found to be significantly influenced by neighbouring tax rates, yardstick competition may be at work. If neighbouring rates significantly influence tax bases, the results may be interpreted as reflecting tax-base competition. In the end, however, after experimenting with model-fitting tests, these variables were found to be insignificant for the base equations, so we

20. Ordinary least squares (OLS) estimation may not be the best choice in the presence of several simultaneously determined variables, owing to endogeneity bias. If tax rates and tax bases are determined simultaneously, some common factors may have an impact on both, with the result that the error terms in the tax-base and tax-rate equations may be correlated with the endogenously determined variables on the right-hand sides of the equations. The result would then be inconsistent and biased regression coefficients under regular OLS estimation. A common way to estimate model parameters in a system with several endogenous variables is to use a simultaneous-equations approach using a two-stage least squares (2SLS) regression analysis. In the first stage of the 2SLS approach, tax rates and tax bases (endogenous variables) are estimated using a set of exogenous independent variables from the system equations and perhaps some additional exogenous instruments. At the second stage, the fitted values of endogenous variables, which are based on the first-stage estimates, are substituted back into the original system of equations and, along with the exogenous variables, are used to obtain more consistent and presumably less biased (albeit not highly efficient) regression coefficients.

report them here only for the rate equations, and our results do not really test explicitly for tax-base competition. Property assessment has been carried out province-wide in Ontario since 1998. For earlier years, assessed values—though assessed by a provincial ministry—were not as close to market value and were not done on a consistent base throughout the period under examination. Therefore the assessed values for years before 1998 have been adjusted by "equalization factors" for each property class at the level of each lower-tier municipality.[21]

The total nominal tax rate applying to any specific property class in Ontario is the sum of lower-tier, upper-tier, and education tax rates. Since 1998 these three rates have been imposed separately by lower-tier municipalities, by upper-tier municipalities (regions), and, with respect to education, by the provincial government. Before 1998, education rates were set by local school boards, within strong provincial limits. All three taxes are collected by lower-tier municipalities. The effective property tax rate used in this study is the total effective tax rate (including lower-tier, upper-tier, and education tax rates) imposed on a given property class. (Box 1 provides a list of the 2014 property tax classes.) To obtain this rate, we divided the appropriate property-tax revenue by the value of the equalized market assessment for each property class.

For some purposes, however, we ran separate analyses for each of the upper-tier regions (including Toronto), as well as for certain cities in each region. As Table 1 shows, the sample includes 24 lower-tier municipalities, excluding Toronto, that constitute the four upper-tier regional municipalities. For certain purposes, we used some data from the Toronto census metropolitan area (CMA); although the CMA has minor differences from the GTA in terms of municipal composition, it is a good proxy for the GTA.[22] Data on variables available only at the regional, Toronto CMA, or provincial levels were used to help capture changes over time rather than differences across municipalities and regions.

For each property class, we estimated the coefficients of the equations (as shown in the Appendix) at two levels of aggregation: municipal and regional. At the municipal level, we evaluated regression parameters for the largest municipality from each region, as measured by the size of its 2005 residential and CIB-equalized assessment. These were Toronto (the City of Toronto, an

21. The equalization factors used are percentages calculated by the (former) Property Assessment Division of the Ontario Ministry of Revenue for various purposes, including the allocation of provincial grants and cost-sharing within upper-tier municipalities and other intermunicipal entities such as conservation authorities and school boards. The factors measure the ratio between the assessed value of all of the taxable assessment in a class of property in a municipality and the estimated current market value of the properties in that class.

22. Essentially, the CMA includes, in addition to the GTA, the town of Orangeville and three largely rural municipalities north of the GTA boundary, but excludes Burlington (which is included in the neighbouring Hamilton region), Oshawa, and four other municipalities in Durham Region.

Box 1
The Classified Ontario Property Tax: Property Classes and Subclasses

1. Residential
2. Residential farmland awaiting development, Phase 1
3. Residential farmland awaiting development, Phase 2
4. Resort condominiums
5. Multiresidential, occupied
6. Multiresidential farmland awaiting development, Phase 1
7. New multiresidential
8. Commercial, occupied
9. Commercial, excess land
10. Commercial, vacant land
11. Commercial farmland awaiting development, Phase 1
12. Commercial farmland awaiting development, Phase 2
13. Office buildings
14. Office buildings, excess land
15. Office buildings, vacant land
16. Shopping centres
17. Shopping centres, excess land
18. Shopping centres, vacant land
19. Parking lots and vacant land
20. Parking lots and vacant excess land
21. Professional sports facilities
22. Professional sports facilities, excess land
23. Professional sports facilities, vacant land
24. Industrial, occupied
25. Industrial, excess land
26. Industrial, vacant land
27. Industrial farmland awaiting development, Phase 1
28. Industrial farmland awaiting development, Phase 2
29. Large industrial
30. Large industrial, excess land
31. Large industrial, vacant land
32. Pipelines
33. Farmlands
34. Managed forests
35. Railway rights of way
36. Hydro rights of way

Source: Ontario Regulation 282/98 under the *Assessment Act*.

Table 1: Greater Toronto Area Population, Assessment, and Effective Tax Rates, 2005 (C=city, T=Town, M=Municipality, Tp=Township)

	Population	Residential assessment per capita (dollars)	CIB assessment per capita (dollars)	Effective residential tax rate	Effective Non-residential tax rate
Toronto	2,498,922	78,746	21,592	0.9067	4.4946
Durham Region	550,318	68,800	10,021	1.4685	3.7707
Oshawa C	141,083	53,902	10,714	1.7281	4.2411
Ajax T	86,885	70,761	8,929	1.4253	3.5325
Clarington M	76,222	66,125	7,298	1.3738	3.9293
Pickering T	87,699	79,934	14,264	1.3805	3.5549
Whitby T	106,429	73,664	10,258	1.4259	3.5617
Brock Tp	12,006	65,722	4,155	1.6263	3.8626
ScugogTp	21,185	80,527	5,875	1.4118	3.3236
Uxbridge Tp	18,809	91,637	8,204	1.2893	3.3465
Halton Region	426,453	94,674	17,272	1.0870	2.9671
Burlington C	161,700	85,330	18,397	1.1173	3.0011
Halton Hills T	53,868	85,490	8,437	1.0802	3.0326
Milton T	49,447	86,255	20,184	0.9715	2.7738
Oakville T	161,438	109,678	18,200	1.0930	2.9882
Peel Region	1,125,318	73,584	21,415	1.1106	2.8675
Brampton C	412,132	64,085	15,254	1.2398	3.0186
Mississauga C	657,425	76,773	26,059	1.0533	2.8168
Caledon T	55,761	106,191	12,196	1.0231	2.7481
York Region	859,685	102,070	20,719	1.0995	2.6264
Vaughan C	227,498	110,011	34,552	1.0723	2.6245
Aurora T	46,135	98,389	13,304	1.1660	2.6822
Markham T	250,983	99,941	20,896	1.0679	2.5904
Newmarket T	72,592	79,581	15,525	1.1782	2.7743
Richmond Hill T	156,570	108,556	13,771	1.0709	2.5942
Whitchurch-Stouffville T	23,912	112,766	13,015	1.0933	2.6413
East Gwillimbury T	20,967	93,128	9,010	1.1845	2.6455
Georgina T	41,731	74,211	4,276	1.4063	2.9585
King Tp	19,297	133,652	6,781	1.1378	2.6632
GTA total/average	**5,460,696**	**87,402**	**13646**	**1.2209**	**3.1360**

Note: The effective tax rate is the total for municipal and education purposes. Figures shown for the regional governments are, for population, the total of the lower-tier municipalities and, for the other columns, the average assessment and tax values for those municipalities.
Source: Ministry of Municipal Affairs and Housing, Financial Information Returns.

amalgamated single-tier municipality), Oshawa (Durham Region), Oakville (Halton Region), Mississauga (Peel Region), and Vaughan (York Region). At the regional level, we estimated equation parameters for the "average" municipality

Table 2: Tax Rate to Base Elasticity for the Sample Period, 1977–2005					
	Toronto	**Durham**	**Halton**	**Peel**	**York**
Commercial/ industrial	–0.90	–0.86 Oshawa –0.92	–0.56 Oakville –0.53	–0.88 Mississauga –0.89	–0.73 Vaughan –0.46
	Toronto	**Durham**	**Halton**	**Peel**	**York**
Residential	–0.83	–1.00 Oshawa –1.04	–0.88 Oakville –0.92	–0.96 Mississauga –0.98	–0.93 Vaughan –0.67
	Toronto	**Durham**	**Halton**	**Peel**	**York**
Total	–0.85	–0.98	–0.83	–0.97	–0.90

Notes and Source: The figures shown for the five regions in the Greater Toronto Area are estimates for 1977–2005 from Table 8. 3 (p. 199) of Bird, Slack, and Tassonyi (2012). The "total" figure is only illustrative because it is a weighted average based on the relative importance in 2005 of the residential and non-residential components of the tax base (which are subject to different tax rates) in the different regions (based on assessment data shown in Table 2). The base composition in fact changed substantially in the different regions over the period for which the elasticities were calculated.

within each region: Toronto, Durham, Halton, Peel, and York. For comparative purposes, Toronto is treated as both an upper-tier and a lower-tier jurisdiction.

7. Elasticity and the Revenue Hill

As noted earlier, rate-based elasticity provides a measure of how far up its respective revenue hill a city is. At the peak of the hill (the equilibrium point in Figure 1), the rate-to-base elasticity is –1.0. If the elasticity is greater (that is, since this is a negative number, less than -1), then a small increase in the rate will increase revenues and if it is smaller, it will reduce revenues.

Table 2 compares the rate-base elasticities[23] for the commercial and residential property tax bases of the City of Toronto, the four GTA upper-tier municipalities, and the largest lower-tier municipality in each of those four regions, for the period 1977 to 2005. The relationships between tax rates and tax assessment in all cases as indicated by the estimated coefficients were negative and highly significant.

As Table 2 shows, no region in the GTA is at the peak of the property tax hill for residential property: all could increase revenue by raising the effective tax rate. However, there are considerable differences in the amount of property tax "room"

23. The results reported in Table 2 (from Bird, Slack, and Tassonyi 2012) are based on a simplified version of an analytical approach first developed by Haughwout, Inman, Craig, and Luce (2004).

available to the different regions. Halton is in a much better position to increase revenue from this source than the other regions, followed by Toronto, where residential taxes are markedly lower than anywhere else. On the other hand, Peel and Durham are already close to the top of the hill and, indeed, Durham seems to be at the peak with respect to residential taxes.

The City of Toronto and Durham and Peel Regions are very close to the top of their respective revenue hills in taxing non-residential property, with elasticities at or near –0.90. By contrast, the Regions of York and Halton are well below the peak of the hill.

These regional results are also replicated in the large lower-tier municipalities, although Vaughan appears to be considerably lower on the hill than the Region of York in which it is located.

These results are broadly consistent with concerns raised by the business community over the relative tax burdens faced by the business sector in the City of Toronto compared with its neighbouring regions. In 1998 the province established transitional tax ratios to set a maximum relative relationship among the tax rates applicable to the various business property classes, relative to residential taxes in the regions and Toronto. Table 3 shows the comparatively heavy tax burden historically imposed on commercial and industrial properties in Toronto and Durham (for the large industrial class) relative to the other GTA regions. By 2002 the business-residential difference in Toronto—but not in Durham—had been considerably reduced, owing to reassessment and many policy changes. These reductions have since continued, at least in Toronto, after 2005.

However, there are really *two* revenue hills in Ontario's property tax. As Table 3 shows, the result of Toronto's pushing higher up the non-residential hill than its neighbours is that it has much more room to advance up the residential hill than they do. The residential rate-base elasticities show that all of the GTA regions are closer to the peak of their respective revenue hills than Toronto. The Region of Durham, according to these estimates, is at its revenue-maximizing rate on the residential side: any tax rate increases will result in the loss of revenue.

In large lower-tier cities in the GTA other than Toronto, only the City of Vaughan in York Region is well below the peak, which means that the remaining municipalities in York Region must be further up the hill. In contrast, the City of Oshawa is actually over the hill; to increase revenue from residential property taxes it would need to decrease tax rates.

This result—which strongly influences the peak position of Durham Region in general—reflects Oshawa's unfortunate position in a number of respects. It is a relatively mature city with an old (and not thriving) industrial base in the automobile industry, as well as an especially large share of (more highly taxed) multi-residential properties and unusually costly expenditure responsibilities for local transit and other services during the study period.[24] Torontonians may

24. Responsibility for local transit was transferred to the regional level in Durham in 2006.

Table 3: Business Tax Ratios by Region and Property Type, 1998, 2002, 2005, 2011

	1998 regulated tax ratios				
	Commercial	Office building	Shopping centre	Industrial	Large industrial
Toronto	4.2759			5.9685	
Durham	1.4819	2.2960	1.2078	2.0907	3.8036
Halton	1.4565			2.3599	
Peel	1.2971			1.5986	
York	1.1190			1.3427	
	2002 adopted tax ratios				
Toronto	3.8000			5.3000	
Durham	1.4819	1.4819	1.3300	2.2598	2.9000
Halton	1.4565			2.3599	
Peel	1.2971			1.5986	
York	1.1000			1.3000	

	2005 adopted tax ratios				
	Commercial	Office building	Shopping centre	Industrial	Large industrial
Toronto	3.7549			4.2135	
Durham	1.4500	1.4500	1.4500	2.2598	2.5950
Halton	1.4565			2.3599	
Peel	1.2971			1.4700	
York	1.2070			1.3737	
	2011 adopted tax ratios				
Toronto	3.1340			3.2365	
Durham	1.4500	1.4500	1.4500	2.2598	2.2598
Halton	1.4565			2.3599	
Peel	1.2971			1.4700	
York	1.1430			1.3305	

Source: Ministry of Municipal Affairs and Housing, Financial Information Returns, 1988, 2002, 2005, and 2011.

complain more about property taxes than their regional neighbours, but on the whole Toronto appears to be in a considerably better position with respect to the past, present, and probable future of both the residential and non-residential components of the tax than Oshawa.

Moreover, as Table 3 shows, Toronto's neighbour to the west, Mississauga, although a newer, larger, and more diverse city than Oshawa, seems not only to be comparable to Toronto and Oshawa in terms of its limited leeway to push non-residential property taxation much further but also, unlike Toronto, to be comparable to Oshawa in terms of pressure on its residential property tax.

The data reported here suggest that Oshawa has a serious problem of fiscal sustainability if it continues to rely on property taxes to finance local services to the extent it does now. Other cities, like Mississauga, may be moving in the same direction. In short, a good case can be made for continuing to explore alternatives to property tax for financing urban growth in the GTA, and in Ontario as a whole. For a discussion of an alternative to non-residential property tax, see Bird, Slack, and Tassonyi (2012) as well as Bird (2014) in which a case is made for a locally administered business value-added tax.

Our results are broadly consistent with those of Blöchliger and Pinero-Campos (2013) who reviewed taxes in OECD countries. They note that, despite policy debates, there is little good evidence of tax-induced migration. In their words, "direct long-term elasticities… the percentage reaction of the tax base to a percentage of sub-central government's (SCGs) own tax rate tend to be low and often well below unity, except for firms with respect to changes in business tax rates… The relatively sluggish reaction of households and firms to tax policy changes also implies that most SCGs are located on the rising slope of their revenue hill, i.e. SCGs do not appear to maximize tax revenues. If they wished to maximize tax revenues, they would have to raise rather than lower tax rates" (Blöchliger and Pinero-Campos, 2013, 9).

This study provides some evidence for the existence of yardstick competition in the GTA. Local tax rates imposed on both the residential and non-residential sectors, especially the latter, do appear to be sensitive to the rates in nearby jurisdictions. Large differentials were evident, particularly in Toronto. Under Ontario's classified property tax, the higher rate imposed on non-residential property in effect acts as a relief mechanism for homeowners, enabling governments to shift some of the tax burden away from the group that Fischel (2001) has accurately called "home voters."

As Lee and Wheaton (2010) have recently argued, when a classified system gives communities the choice to tax business or residents, most will choose business if their circumstances permit. In particular, as Hill (2008) discusses, built-up urban agglomerations such as the City of Toronto are able to shelter their residents by shifting more of the tax burden to the business sector, since the additional burden is absorbed by the "rents" arising from agglomeration economies and will likely not result in base shifting as a consequence of the migration of business.[25]

Despite the overriding importance of the provincial government in shaping and directing local property taxation in Ontario, and its efforts to reduce the differences between residential and non-residential tax rates—and despite evidence of some rate shifting in the GTA—substantial variations in this

25. For example, recent studies in Spain (Jofre-Monseny 2010) and Germany (Koh and Riedel 2010) find strong evidence that local business taxes are higher in municipalities with higher firm and industry agglomeration.

differential seem likely to persist among Ontario municipalities, perhaps especially between Toronto and its neighbours, for years to come.

8. Discussion of Results on Tax Competition

In this section, we look at four outcomes of the analysis. First, we present in summary form the results of the estimates of the various independent variables in the equations, and relate them to the earlier discussion. Second, we interpret the responsiveness or core elasticity results for both the residential and business property taxes. Third, we consider the implications of this analysis for our initial question: the potential risk involved in further rate increases to the revenue that can be raised from property taxes in the GTA. Fourth, we conclude with some remarks on the nature and extent of local tax competition in the GTA.

In the Appendix, Tables A1 through A8 show the principal regression results. Given the differences between residential and commercial and industrial/business property taxation in the Ontario system, the two components of the classified property tax system have been treated separately.[26] The regional levels of government (including the City of Toronto) and the larger local governments in each region (also including the City of Toronto) are also considered separately.

Table A1 contains the results for the commercial/industrial assessment base (CIB) equation (Equation 1) for the upper-tier local governments (Toronto and the four regional municipalities). Table A2 contains the results for the same equation for Toronto and the largest lower-tier municipality in each of the regions. Tables A3 and A4 present regional and local results for the CIB rate equation (Equation 2). The remaining four tables follow the same sequence with respect to the two residential equations (Equation 3 and Equation 4).

8.1 Non-residential assessment base

The first equation tests the relationship between the commercial/industrial assessment base and corresponding tax rates. At the upper-tier level (Table A1), the effect of changes in the tax rate on non-residential assessment as shown by the estimated coefficients is, as expected, universally negative and highly significant[27] for each of the five regions.[28] The results are similar when the regression is run using data for Oshawa, Oakville, Mississauga, and Vaughan, the principal lower-tier municipalities in each regional municipality (see Table A2).

These results are both expected and reassuring, as this coefficient measures the impact of a change in the tax rate on the tax base: increases in rates tend to decrease the base, and vice versa. These results may be explained by simple capitalization theory, since an increase in the property tax rate, if the capitalization rate remains unchanged, automatically reduces the return on investment in real

26. The residential and multi-residential classes are combined into the residential class, and all remaining classes into the non-residential or CIB class. See Box 1 for a list of property classes.
27. In this discussion, the term "significance" refers to the concept of statistical significance.
28. This discussion is based on data using the mean values of the variables for the period.

property, and hence its value.[29] If any real increases (or, less likely, decreases) in investment in CIB properties occur as a result of rate differentials, they would be reflected in this measure, but there is no way to separate them from the capitalization effect.

Matters are not quite so clear for the results of the second-stage equations, however, since the relationship between CIB rates and non-residential assessment bases is significantly negative only for Toronto (Table A1).

The hypothesized relationship of mutually reinforcing growth between the commercial/industrial assessment base and the residential assessment base is also supported by the evidence. In the first stage regressions, at the upper- and lower-tier levels, the coefficients are consistently positive and significant, as we would expect: growth in the commercial/industrial base is positively related to residential assessment growth. In the second stage regressions, the coefficients for Toronto and Oakville are similarly positive and significant.

A plausible explanation for this interaction may lie in expansions to the rail and road network of the GTA, which link new residential subdivisions to work opportunities. In addition, in the municipalities studied, local zoning policies have often linked permission to build residential housing to the provision of land for commercial and industrial uses.[30] Finally, differences in development charge policies (see Bird, Slack, and Tassonyi 2012), may also have an impact on the process and pattern of land development.

Turning to the other variables, as expected, net intraprovincial migrants as a share of population proved to have a positive and statistically significant effect on the growth of the non-residential tax base in every region except Toronto, although only in Durham did this coefficient have statistical significance at the second stage of the regression analysis (Table A1). Given the substantial population growth in the GTA outside Toronto during the study period, this result is not surprising.

In contrast, although changes in the number of non-residential building permits per capita might be expected to have a more generalized impact on the rate of change to the business property assessment base, it is only in the OLS estimates for Toronto, Oshawa, and Mississauga that this coefficient is significant and negative. That is, additional non-residential buildings may have the long-run impact of reducing the prices of business property. Interestingly, it also appears that the amalgamation of Toronto had a negative impact on property values in two regions to the west (Halton and Peel). However, Toronto's amalgamation had no

29. Estimates by Smart (2012, 14) show that tax rates are higher than would be suggested by employment intensity alone. Moreover, cities that are fully built out, in which taxes are most likely to be capitalized into land values, are those that tax business properties at the highest rates.

30. For example, developers had to set aside land for commercial purposes such as a local shopping centre as a condition of subdivision approval for major subdivisions in Durham Region in the 1980s.

significant effect in the lower-tier municipalities, with the exception of Mississauga (Table A2).

Finally, the effect of the 1998 reassessment on property values was negative and statistically significant in Toronto, Durham, Peel, and York (Table A1). Given the tax policy limits placed on Toronto and the limitations on increasing taxes on commercial property, as well as the internal differences in assessment-year bases before the reassessment among municipalities in the three regions, this result is perhaps to be expected, although it is puzzling that no such effect is seen in Halton.

Furthermore, the results shown in Tables A1 and A2 pass other econometric tests where instruments may be weak,[31] for the upper-tier governments (Table A1) and also for all the lower-tier governments except Vaughan (Table A2). On the whole, the results with respect to non-residential assessment are reassuring, suggesting strongly that change in the commercial/industrial assessment base is affected not only by tax rate changes within a jurisdiction, but also by growth in the residential base.

8.2 Non-residential tax rates

Equation 2 (CIB rates) tests the effects on effective commercial and industrial tax rates of the following: changes in total grants per capita, provincial GDP per capita, the proportion of migrants in the population, the impact of the amalgamation of Toronto, changes in the business assessment base, and changes in commercial and industrial tax rates in neighbouring jurisdictions. The results are shown in Tables A3 and A4 for the regional and local levels, respectively.

The OLS coefficients for the commercial and industrial assessment base were, again as expected, consistently negative and highly significant at the regional level in the GTA (Table A3) confirming an inverse relationship. That is, as base CIB property values rise, tax rates may be reduced. The results are broadly similar at the lower-tier level, as shown in Table A4. In effect, increases in the CIB base appear to have been offset by rate reductions (in line with provincial policy on education rates) as well as, perhaps, local political pressures.

Turning to tax competition effects, at the regional level, the coefficients for changes in tax rates in neighbouring municipalities were negatively and significantly related to non-residential tax rates at the 1-percent level of significance in Toronto and were also significant at the 10-percent level of significance in Peel and York. At the lower-tier level, similar results held for Vaughan and Oakville. Based on these findings, there does appear to be at least some competition between Toronto and some of its GTA neighbours in levels of non-residential tax rates.

Within regions, however, the results are different. Although the competition coefficient was significant for Oakville and Vaughan, its sign was positive, meaning

31. Haughwout et al. (2004, 577) comment that "the recent literature on weak instruments cautions that first-stage F-statistics should be 3 or larger and ideally have values above 10."

that CIB rates in those cities move together with the rates in other municipalities in the same region. No such association was found for the cities of Mississauga or Oshawa, however, perhaps because their positions in Peel and Durham Regions are more dominant than those of Vaughan and Oakville in York and Halton, respectively. On the whole, however, changes in the CIB rates in neighbouring jurisdictions emerge as one of the most significant drivers of business property tax rates in the GTA. Yardstick competition, it seems, is alive and well in the GTA.[32]

Interestingly, the coefficients on the provincial-grants variable were positive and significant for Toronto, Durham, Peel, and York—that is, CIB tax rates and grants increased or decreased in tandem with provincial grants. This result may simply reflect the fact that local spending was changing even more, for other reasons. In particular, since the most significant driver of provincial grants for municipal purposes is social services, and local governments in Ontario have to finance a portion of such services, this result is not very surprising.

The coefficients for reassessment were negative and significant in Durham, Halton and Peel. In other words, the 1998 reassessment was most strongly associated with effective tax rate decreases in those three regions. Similarly, Toronto amalgamation had a negative and significant effect on tax rates, not only in Toronto but also in both Peel and York, suggesting that these neighbouring regions reacted in similar ways, for competitive reasons,[33] by not allowing effective tax rate increases.

8.3 Residential assessment base

A parallel analysis for residential assessment at the regional and municipal level was carried out, as shown in Tables A5 and A6. Again, the coefficient of the residential effective tax rate was negative and highly significant for Toronto and the neighbouring upper-tier and large lower-tier municipalities (such as Oshawa and Oakville) in the GTA. This result confirms the inverse relationship between the residential assessment base and the relevant residential tax rates during the study period.

In the lower-tier second-stage estimates, the coefficient for Oshawa and Oakville of the residential tax rate was negative and significant, in contrast to other large municipalities. On the whole, the residential tax rate emerges as the most important variable in terms of explaining variation in the residential assessment base.

The relationship between the residential assessment base and the commercial tax base—see Boxes 2 and 3—was decidedly less important. At the upper-tier level, only the (negative) coefficient for Durham Region has statistical significance

32. Blöchliger and Pinero Campos (2011, 17) note that empirical evidence of yardstick competition has been found for Italian municipalities, but not Finnish ones.
33. As noted earlier, the non-residential assessment base was also negatively affected by reassessment in Peel, though not in Halton, and both dummy variables (amalgamation and reassessment) negatively affected this base in these two regions.

below the conventional 10-percent limit, in the equation. Levels of significance are also found for Oakville and Vaughan and in the 2SLS equation for Vaughan.

In addition, as expected, the coefficient for per-capita expenditures on schooling was positive and significant in Oshawa. Similarly, the proportion of net migration in the population in Mississauga, Peel Region, and York Region was significantly and positively related to changes in residential assessment.

On the other hand, the coefficient for average residential housing completions in the Toronto CMA was significantly and negatively related to residential assessment in Mississauga (as well as Peel and York), presumably reflecting a stronger short-term impact on residential values in that city than in others. The coefficients for the 1998 reassessment dummy variables were negative and significant in Mississauga and in Durham, Peel, and York Regions, again suggesting a negative short-term capitalization impact on the base. Neither the crime rate nor the employment rate was found to have a statistically significant effect on residential assessment.[34]

8.4 Residential tax rates

Tables A7 and A8 show that, as for the CIB-rate equation, at the upper-tier level, the coefficients on the equalized residential assessment base with respect to residential tax rates are negative and highly significant, again confirming the inverse relationship between rates and the tax base. However, for the lower-tier cities of Oshawa, Oakville, and Vaughan, the lower-tier regression, which includes tax-rate variables for the neighbouring municipalities inside and outside their respective regions, resulted in insignificant coefficients for the assessment-base variable with respect to the residential rate. Rate increases in the neighbouring jurisdictions appear to have a more statistically significant relationship to increases in their own rates than on their own tax base. In contrast, in Mississauga, the coefficient on assessment was negative and significant with respect to its residential rate and the coefficients with respect to the rates in neighbouring municipalities were not significant. In Oshawa and Oakville, only changes in tax rates in other municipalities in the same region had a significant effect on their own residential rates.

At the regional level (Table A7), the coefficients on school-age population were, contrary to expectations, found to have a negative and significant effect on tax rates in two regions (Peel and Halton). Paralleling the result for CIB rates, the effect of grants on tax rates was significant and positive only in Toronto and Durham. Finally, the effects of reassessment were found to be significant only for CIB rates in Mississauga, and for residential rates in both Durham and Peel Regions. The effects of Toronto's amalgamation significantly affected tax rates only in Toronto and Oshawa.

34. Again in this equation, in general the F-statistics appear to meet the weak instrument threshold in the OLS regressions; however, in the second-stage estimates, the F-statistics for Toronto and Mississauga are below the threshold noted earlier.

9. Conclusion

During the years covered by the data analysed in this study, the revenue-raising capacity of the property tax in the GTA was stretched by local and provincial decisions. There is evidence of tax competition among the GTA municipalities. In terms of revenue hills, only Oshawa went over the top of the hill for residential property taxes during the period under review. Both Durham Region and the City of Toronto have more recently shifted more of the burden of the property tax away from non-residential properties, but the full impact of these initiatives is not reflected in the data analysed here.

The political pressure to seek alternative sources of general revenue may suggest that from the perspective of taxpayers, the top of the revenue hill has already been reached. While alternatives and supplementary sources of revenue merit consideration, the property tax is a good local tax and there is capacity to meet the needs of the GTA to a greater extent than it currently does.

10. Works cited

Barber, J. (2007). The failure of a flawless public-policy machine (March 15:A11 ed.). Toronto: *Globe and Mail*.

Besley, T., & Case, A. (1995). Incumbent Behaviour: Vote Seeking, tax-setting, and yardstick competition. *American Economic Review, 85*, 415–426.

Bird, R. M. (2006). Fiscal Flows, fiscal balance and fiscal sustainability. In R. M. Bird, *Perspectives on Fiscal Federalism* (pp. 81–97). Washington, D.C.: World Bank.

Bird, R. M. (2014). *A Better Local Business Tax: The BVT.* Toronto: Institute on Municipal Finance and Governance.

Bird, R. M., & Tassonyi, A. (2001). Constraints on provincial and municipal borrowing in Canada: Markets, rules and norms. *Canadian Public Administration, 44*, 84–109.

Bird, R. M., & Tassonyi, A. (2003). Constraining subnational fiscal behaviour in Canada: Different approaches, similar results? In J. A. Rodden, *Fiscal Decentralization and the challenge of hard budget constraints* (pp. 85–133). Cambridge, MA: MIT Press.

Bird, R. M., & Wallace, S. (2005). Revenue-maximizing tax rates. In J. R. Cordes, *The encyclopedia of taxation and tax policy* (pp. 347–349). Washington, D.C.: Urban Institute Press.

Bird, R. M., Slack, E., & Tassonyi, A. (2012). *A tale of two taxes: Property Tax Reform in Ontario.* Cambridge, MA: Lincoln Institute of Land Policy.

Blochliger, H., & Pinero-Campos, J. M. (2011). *Tax Competition between Sub-Central Governments.* OECD Economics Department. Paris: OECD Publishing.

Board of Trade of Metropolitan Toronto. (1994). *Killing the Golden Goose: How high business taxes are suppressing Metropolitan Toronto's economic recovery and what needs to be done about it.* Toronto: Board of Trade of Metropolitan Toronto.

Brett, C., & Pinske, J. (2000). The determinants of municipal tax rates in British Columbia. *Canadian Journal of Economics, 33*(3), 695–714.

Brett, C., & Tardif, C. (2005). *Yardstick Competition and tax base competition in local tax setting in New Brunswick.* Unpublished paper, Mount Allison University, Sackville, N.B.

Brett, Craig, & Tardif, C. (2008). The grants are falling! The grants are falling! How municipal governments changed taxes in response to provincial support in New Brunswick, 1983–2003. *Canadian Public Policy, 34*(4), 441–456.

Brueckner, J. K., & Saavedra, L. A. (2000). Do local governments engage in strategic property tax competition? *National Tax Journal, 54*(2), 203–229.
Conference Board of Canada. (2005). *Measuring Toronto's Fiscal Capacity.* Toronto: Conference Board of Canada.
Council, E. C. (2012, September 24). *Executive Committee of Toronto Council Agenda.* Retrieved October 3, 2012, from Toronto.ca: https://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2013/May_24/Reports/City_of_Toronto_Item.pdf.
Crisan, I. (2007). *An empirical investigation of tax competition between Canadian provinces.* Calgary: Institute for Advanced Policy Research.
Dahlby, B. (2012). *Reforming the Tax Mix in Canada.* Calgary: School of Public Policy, University of Calgary.
Fischel, W. A. (2001). Homevoters, municipal corporate governance, and the benefit view of the property tax. *National Tax Journal, 54*(1), 157–173.
Gaboury, G., & Vaillancourt, F. (2003). *Tax competition and tax mimicking by sub-national entities: A summary of the literature.* Kingston, ON: Institute of Inter-Governmenal Relations, Queen's University.
Haughwout, A., Inman, R., Craig, S., & Luce, T. (2004). Local revenue hills: Evidence from four U.S. cities. *Review of Economics and Statistics, 86*(20), 570–585.
Hill, B. C. (2008). Agglomeration and Strategic Tax Competition. *Public Finance Review, 36*(6), 651–677.
Jofre-Monseny, J. (2010). *Is agglomeration taxable?* Barcelona: Institut de Economia de Barcelona.
Koh, H.-J., & Riedel, N. (2010). *Do governments tax agglomeration rents?* Barcelona: Institut de economia de Barcelona.
Laffer, A. B. (1979). Statement prepared for the Joint Economic Committee. In A. B. Laffer, *The economics of the tax revolt: A reader.* New York: Harcourt, Brace Jovanovich.
Lee, N. J., & Wheaton, W. C. (2010). *Property Taxes under "classification": Why do firms pay more?* Department of Economics, Massachusetts Institute of Technology.
Locke, W., & Tassonyi, A. (1993). Shared Tax Bases and Local Public Expenditure Decisions. *Canadian Tax Journal, 42*(5), 941–957.
Lorinc, J. (2011, October 11). Cash-strapped cities face funding breaking point. *Globe and Mail*. Toronto, Ontario, Canada.
McMillan, M., & Dahlby, B. (2014). *Do local governments need alternative sources of tax revenue? An assessment of the options for Alberta cities.* University of Calgary, The School of Public Policy. Calgary, Alberta: The School of Public Policy.
Metrolinx. (2013). *The Big Move Baseline Monitoring Report.* Toronto: Government of Ontario.
Mintz, J. M., & Smart, M. (2004). Income shifting, investment, and tax competition: Theory and evidence from provincial taxation in Canada. *Journal of Public Economics, 8*, 1140–1168.
Municipality of Metropolitan Toronto. (1989). *The Crumbling Financial Partnership: Metropolitan Toronto's Response to Provincial Retrenchment.*
Muthitacharoen, A., & Zodrow, G. R. (2012). Revisiting the Excise Tax Effects of the Property Tax. *Public Finance Review, 40*(5), 555–583.
Nelles, J. (2012). *Comparative Metropolitan Policy.* London: Routledge.

Nooregard, J. (2013). *Taxing Immovable Property.* Washington, D.C.: International Monetary Fund.

Slack, E. (2006). Alternative approaches to taxing land and property. In R. M. Bird, & F. Vaillancourt, *Perspectives on Fiscal Federalism* (pp. 197–223). Washington. D.C.: World Bank.

Slack, E. (2010). *Assessment Limits for Ontario: Can We Live With The Consequences?* Toronto: Association of Municipalities of Ontario.

Slack, E., & Bird, R. M. (2004). *The fiscal sustainability of the Greater Toronto Area.* University of Toronto. Toronto: International Tax Program, Rotman School of Management.

Slack, E., & Côté, A. (2014). *Is Toronto Fiscally Healthy? A Check-up on the City's Finances.* Toronto: Institute on Municipal Finance and Governance.

Smart, M. (2012). *The Reform of Business Property Tax in Ontario: An Evaluation.* Toronto: Institute on Municipal Finance and Governance.

Smart, M., & Bird, R. M. (2009). The impact on investment of replacing a retail sales tax by a value-added tax: Evidence from Canadian experience. *National Tax Journal, 62*(4), 591–609.

Statistics Canada. (2014). *Cansim 385-0032 Government Finance Statistics.* Retrieved November 11, 2014, from Cansim:
http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=3850032&paSer=&pattern=&stByVal=1&p1=1&p2=-1&tabMode=dataTable&csid=

Transit Investment Strategy Advisory Panel. (2014). *Making the Move: Choices and Consequences.* Toronto: Government of Ontario.

Treff, K., & Perry, D. (2008). *Finances of the Nation 2007.* Toronto: Canadian Tax Foundation.

Vander Ploeg, C. (2008). *Problematic Property Tax: Why the Property Tax Fails to Measure Up and What to do about it.* Western Cities Project, Canada West Foundation.

Wilson, J. D., & Wildasin, D. E. (2004). Capital tax competion: Bane or boon? *Journal of Public Economics, 88*, 1065–1091.

Wooldridge, J. M. (2006). *Introductory Econometrics.* Mason, OH: Thomson South-Western.

Appendix

Two sets of equations are estimated, each consisting of two equations for tax base and tax rate for two broad property classes, residential and non-residential (CIB), as follows:

Equation 1: CIB tax base

$$\Delta C = \alpha^C + \beta^C \Delta\tau + \gamma^C \Delta R^* + M^C \mu^C + \upsilon$$

Equation 2: CIB tax rate

$$\Delta\tau = \alpha^\tau + \beta^\tau \Delta C + \eta^\tau \Delta\tau^* + M^\tau \mu^\tau + \varepsilon,$$

Equation 3: Residential tax base

$$\Delta R = \alpha^R + \beta^R \Delta t + \gamma^R \Delta C + M^R \mu^R + u,$$

Equation 4: Residential tax rate

$$\Delta t = \alpha^t + \beta^t \Delta R + \eta^t \Delta t^* + M^t \mu^t + \varepsilon$$

Where:

- superscripts C and τ indicate that variables or parameters belong to the CIB tax-base or tax-rate equation;
- superscripts R and t indicate that variables or parameters belong to the residential property tax-base or tax-rate equation;
- ΔC is a linear lagged difference of equalized CIB tax assessment per capita and ΔR is a lagged difference in per capita residential equalized assessment;
- $\Delta\tau$ is a linear lagged difference of the effective average CIB property tax rate and Δt is a lagged difference in the effective average residential property tax rate;
- $\Delta\tau^*$ is a linear lagged difference in the weighted-average effective tax rate of the neighbouring GTA municipalities/regions;
- $\Delta\tau^*$ is a tax competition component that includes: (1) a lagged difference in the across-regions average effective tax rate in regional-average equations, and (2) lagged differences in the same-region average and across-regions average tax-rate components in equations for the largest-municipalities;
- M^C and M^R are vectors of market characteristics and shift factors in the tax-base equations;
- M^τ and M^t are vectors of market characteristics and shift factors in the tax-rate equations.

The benchmark estimation was done using the regular OLS method. The standard tests indicated that the estimated regressions did not have any significant problems associated with endogeneity bias, multicollinearity, cointegration, or autocorrelation. To check that the OLS results were reasonably robust, the same relationships were also estimated using the simultaneous-equations approach and

2SLS regression analysis. At the first stage of 2SLS estimation, adjusted/fitted values of both residential and CIB tax bases and own and neighbouring tax rates were obtained by regressing these variables on a set of exogenous variables used in the tax-base and tax-rate equations (see box 3) plus three additional exogenous variables derived from the equations estimated for neighbouring regions.

The objective of the first-stage estimation was to obtain fitted values for the endogenous variables of interest: own and neighbours' tax variables and own tax base for each broad property class. At the second stage, these fitted values were substituted for the original values of the endogenous variables in both the tax-base and tax-rate equations, along with the original values of the exogenous independent variables, and the resulting regressions were run to get the estimated 2SLS regression coefficients.

Equalized Assessment as a Proxy for Market Value Assessment

The Province calculated equalization factors for each class in each municipality based on the estimated market values and assessed values of all properties in the class sold in arm's-length transactions. If sales numbers were insufficient in classes of property in which the sales method of assessment was used, estimates of market value were made, based on a 10 percent sample. For properties in multiresidential, commercial, and industrial classes, for which values were assessed on the basis of an income-capitalization or depreciated-replacement cost approach, sampling was also used.

Until 1989, equalization factors were prepared annually. The 1989 factors were also applied to assessments for 1990, 1991, and 1992, and new factors were then calculated for 1993. Although the Province had intended to revise the factors every four years, this plan was overtaken by the major assessment and tax reforms of 1998. To obtain consistent time series data for every municipality in the GTA over the entire period, therefore, we have interpolated equalization factors for the missing years.

Box 2: Independent Variables Used in Estimations

Variable	Rationale and Interpretation	Expected Sign
Effective Average Residential Tax Rate (%)	Measures direct own-tax effect on the residential tax base.	Negative & Significant
Effective Average CIB Tax Rate (%)	Measures direct own-tax effect on the CIB tax base. Used to measure tax elasticity of the CIB property tax base.	Negative & Significant
CIB-equalized assessment per capita ($1,000)	Measure of effect on same jurisdiction own category of the tax base. In the CIB rate equation, growth in non-residential assessment may be linked to reductions in CIB tax rates	Negative
	Measure of effect on same jurisdiction cross category of the tax base. If residential and CIB broad class values are complements and reinforce each other or CIB assessment may relieve taxation pressure on residential property with a positive impact on values.	Positive
	If residential and CIB broad class values are substitutes, higher levels of CIB may induce out-migration and falling residential values.	Negative
Residential equalized assessment per capita ($1,000)	Measure of the feedback from changes in residential values to changes in tax rates. If residential taxes are lowered with higher growth rates in the base, negative coefficient; if other factors impact decision, coefficient may be positive.	Negative or positive
	In the CIB equations, measures cross-category base effect-new residents attract new business.	Positive

Box 3: Exogenous Variables Used in First Stage of 2SLS Estimation

Variable	Rationale and Interpretation	Expected Sign
Residential Housing Completions in Toronto CMA (1,000 units)	Proxy for current residential supply in the Toronto census metropolitan area (CMA). Short-run impact may be negative; long-run, positive	Negative or Positive
Assessment-weighted average tax rate (%) at the regional level for both residential and CIB categories	The assessment-weighted average tax rate based on the tax rates in the neighbouring GTA regions using the share of each region's equalized assessment in the sum of equalized assessments for all regions. Assesses the presence of tax competition.	Positive
Assessment-weighted average tax rate (%) at the municipal level for both residential and CIB categories	The assessment-weighted average tax rate based on the tax rates in the remaining lower-tier municipalities in a region using the share of each municipality's equalized assessment in the sum of equalized assessments for the region. Assesses the presence of tax competition. If spatial contiguity is significant, one might expect a stronger effect of the same-region rates.	Positive
Employment Rate in Toronto CMA (%)	Proxy for labour market and purchasing power of local residents.	Positive
Net intraprovincial migrants as a share of population by region (%)	Inflow of residential/labour (amenities/ employment attractiveness), increasing demand for local housing and locally provided goods and services from CIB.	Positive
Breaking & entering (residential) crime rate per person, Toronto CMA	Reflects the attractiveness of the area in terms of security of person and property as well as effectiveness of publicly provided policing.	Negative
School board expenditure per capita, Ontario ($1,000)	Reflects levels of public education services. An indicator of long-term expenditure trends on local services.	Positive
Dummy for the 1998 reassessment (1 for 1998; 0 otherwise)	Dummy used to control for the impact of the province-wide assessment reform implemented in 1998 in both base and rate equations.	No prior expectation
Dummy for Toronto's amalgamation since 1998 (1 in 1998 to 2005; 0 otherwise)	Controls for the impact that the 1998 amalgamation of Metro Toronto's six lower-tier municipalities and the upper tier into one single tier, the City of Toronto, on property values in Toronto and the rest of the GTA.	No prior expectation
Share of residents under 19 in the regional population (%)	Proxy for local demand for education and youth-related local public services, including cultural and recreation services, social housing, public health, day nurseries and childrens' aid programs.	Positive
Total provincial and federal grants per capita, by municipality or region ($1,000)	Measures (or reflects) the extent to which local governments need to raise extra revenue from higher taxes in the residential rate equation. If grants increase at least proportionately to local spending reacting to demographic or other pressure, the coefficient may be positive.	Negative
Five-year average residential mortgage lending rate (%)	Falling mortgage rates may enhance consumers' ability to use credit for purchases and to pay for existing housing. Increases in interest rates may reduce the demand for housing.	Negative
Per capita value of non-residential (CI) building permits. Ontario ($1,000)	Proxy for the demand for commercial/industrial property. May also reflect a greater supply of such property in the future.	Negative or positive
Chartered bank prime business rate (%)	Indicates the ability to finance leases and purchases of non-residential property. Credit costs may affect demand for non-residential property and value of CIB assessment.	Negative
Per capita provincial GDP, Ontario ($1,000)	General indicator of the market for CIB property. Also reflects the level of local public services and incentives for new business.	Negative or positive

Note: All variables are regressed in lagged differences, except dummies. CMA = census metropolitan area.

Table A1: CIB Equalized Assessment, OLS and 2SLS Regression Estimates by Region's Municipal Average
Dependent variable: Commercial/industrial (CIB) equalized assessment per capita

Independent variables		Toronto		Durham		Halton		Peel		York	
		OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Effective total tax rates, CIB	Coefficient	–0.904	–0.620	–0.864	–0.806	–0.563	–0.261	–0.878	0.000	–0.729	–0.395
	Std. error	0.039	0.203	0.137	1.018	0.106	0.872	0.081	2.395	0.094	0.270
	Significance	***	***	***		***		***		***	
Equalized residential/ multiresidential assessment	Coefficient	0.315	0.778	0.137	–0.136	0.250	0.780	0.157	0.700	0.297	0.487
	Std. error	0.098	0.390	0.051	0.371	0.058	0.913	0.067	0.906	0.079	0.433
	Significance	***	*	*		***		**		***	
Net intraprovincial migrants as a share of population, region	Coefficient	–0.229	–0.912	0.872	1.422	0.487	–0.243	0.614	0.462	0.702	0.567
	Std. error	0.307	0.802	0.213	0.519	0.237	1.372	0.326	2.709	0.332	0.779
	Significance			***	**	*		*		**	
Non-residential (CIB) building permits value per capita, Ontario	Coefficient	–0.110	–0.154	–0.051	–0.011	–0.055	–0.088	–0.066	–0.042	–0.069	–0.086
	Std. error	0.046	0.092	0.037	0.071	0.037	0.118	0.045	0.273	0.056	0.078
	Significance	**									
Chartered bank prime business interest rate (%)	Coefficient	0.040	0.058	0.039	0.011	0.042	0.088	0.054	0.008	0.018	–0.012
	Std. error	0.050	0.120	0.040	0.103	0.039	0.131	0.046	0.278	0.059	0.083
	Significance										
1998 reassessment dummy	Coefficient	–0.171	–0.343	–0.132	0.075	0.020	–0.233	–0.244	0.046	–0.141	–0.038
	Std. error	0.057	0.196	0.063	0.246	0.068	0.560	0.069	1.463	0.079	0.285
	Significance	***	*	**				***		*	
Dummy for Toronto pre-amalgamation, prior to 1998	Coefficient	0.033	–0.002	–0.011	–0.037	–0.040	0.046	–0.046	0.000	–0.030	–0.022
	Std. error	0.021	0.057	0.016	0.048	0.019	0.152	0.023	0.139	0.025	0.064
	Significance					**		*			
Constant	Coefficient	0.050	0.020	0.071	0.091	0.068	0.016	0.080	0.023	0.066	0.046
	Std. error	0.013	0.036	0.009	0.040	0.010	0.092	0.014	0.103	0.016	0.048
	Significance	***		***	**	***		***		***	
R-squared		0.987	0.952	0.922	0.774	0.965	0.754	0.952	0.650	0.932	0.889
Adjusted R-squared		0.983	0.936	0.894	0.695	0.952	0.667	0.935	0.527	0.909	0.850
F-statistic		217.797	26.347	33.595	8.033	77.966	7.797	56.198	3.535	39.432	9.952
p value for F		***	***	***	***	***	***	***	**	***	***

Note: CIB = commercial/industrial/business; OLS = ordinary least squares; 2SLS = two-stage least squares; *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

Table A2: CIB Equalized Assessment, OLS and 2SLS Regression Estimates by Region's Largest Lower-Tier Municipality
Dependent variable: CIB equalized assessment per capita

Independent variables		Toronto		Oshawa (Durham)		Oakville (Halton)		Mississauga (Peel)		Vaughan (York)	
		OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Effective total tax rates, CIB	Coefficient	–0.904	–0.620	–0.915	0.522	–0.533	–0.272	–0.892	–2.262	–0.459	0.663
	Std. error	0.039	0.203	0.125	1.980	0.139	0.391	0.065	17.872	0.173	0.997
	Significance	***	***	***		***		***		***	
Equalized residential/ multiresidential assessment	Coefficient	0.315	0.778	0.132	–0.027	0.171	0.252	0.151	–0.367	0.508	1.080
	Std. error	0.098	0.390	0.055	0.303	0.059	0.116	0.063	8.359	0.103	0.655
	Significance	***	*	**		***	**	**		***	
Net intraprovincial migrants as a share of population, region	Coefficient	–0.229	–0.912	0.721	1.012	0.360	0.223	0.395	1.045	0.000	–0.603
	Std. error	0.307	0.802	0.267	0.879	0.231	0.296	0.291	11.822	0.319	0.793
	Significance			**							
Non-residential (CIB) building permits value per capita, Ontario	Coefficient	–0.110	–0.154	–0.093	–0.016	–0.076	–0.080	–0.089	–0.026	–0.063	–0.077
	Std. error	0.046	0.092	0.038	0.153	0.046	0.052	0.045	1.107	0.095	0.178
	Significance	**		**				*			
Chartered bank prime business interest rate (%)	Coefficient	0.040	0.058	0.067	0.045	0.000	–0.011	0.075	0.094	0.009	–0.033
	Std. error	0.050	0.120	0.039	0.114	0.049	0.060	0.046	0.243	0.100	0.191
	Significance										
1998 reassessment dummy	Coefficient	–0.171	–0.343	–0.050	0.866	0.046	0.130	–0.286	–0.701	–0.146	0.251
	Std. error	0.057	0.196	0.099	1.289	0.089	0.212	0.061	4.455	0.147	0.436
	Significance	***	*					***			
Dummy for Toronto pre-amalgamation, prior to 1998	Coefficient	–0.033	–0.002	–0.013	–0.091	–0.029	–0.019	–0.040	–0.082	0.009	0.069
	Std. error	0.021	0.057	0.019	0.120	0.021	0.026	0.021	0.769	0.043	0.106
	Significance							**			
Constant	Coefficient	0.050	0.020	0.070	0.070	0.067	0.056	0.077	0.129	0.017	–0.073
	Std. error	0.013	0.036	0.010	0.028	0.012	0.017	0.014	0.862	0.026	0.096
	Significance	***		***	**	***	***	***			
R-squared		0.987	0.952	0.939	0.520	0.857	0.825	0.945	0.524	0.804	0.316
Adjusted R-squared		0.983	0.936	0.917	0.352	0.807	0.764	0.925	0.324	0.735	0.076
F-statistic		217.797	26.347	43.604	4.617	17.168	11.386	48.740	1.820	11.686	1.698
p value for F		***	***	***	**	***	***	***		***	

Note: CIB = commercial/industrial/business; OLS = ordinary least squares; 2SLS = two-stage least squares; *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

Table A3: CIB Effective Tax Rate, OLS and 2SLS Regression Estimates by Region's Municipal Average
Dependent variable: CIB effective tax rate

Independent variables		Toronto		Durham		Halton		Peel		York	
		OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
CIB equalized assessment per capita, region	Coefficient	–0.927	–0.806	–0.707	–1.109	–0.886	–2.394	–0.880	–1.114	–0.754	–2.008
	Std. error	0.033	0.113	0.091	0.500	0.121	2.547	0.068	1.666	0.095	2.231
	Significance	***	***	***	**	***		***		***	
Neighbouring regions' weighted average CIB tax rate	Coefficient	–0.200	–0.504	0.001	–0.062	–0.041	0.622	–0.112	–0.086	–0.204	0.234
	Std. error	0.081	0.304	0.051	0.139	0.091	1.145	0.058	0.627	0.098	0.884
	Significance	**						*		*	
Net intraprovincial migrants as a share of population, region	Coefficient	–0.396	–0.876	0.198	0.855	0.363	2.794	0.165	0.650	–0.214	2.711
	Std. error	0.251	0.516	0.297	0.947	0.399	4.161	0.373	4.295	0.496	5.373
	Significance										
Total municipal grants per capita, Ontario	Coefficient	0.418	0.428	0.174	0.152	0.064	0.300	0.179	0.198	0.275	0.153
	Std. error	0.073	0.100	0.071	0.110	0.084	0.464	0.065	0.115	0.093	0.381
	Significance	***	***	**				**	*	***	
Provincial GDP per capita, Ontario)	Coefficient	0.002	–0.221	0.064	0.008	0.159	0.653	–0.028	0.031	0.224	–0.534
	Std. error	0.201	0.338	0.186	0.293	0.295	1.238	0.239	1.032	0.342	1.770
	Significance										
1998 reassessment dummy	Coefficient	0.012	–0.060	–0.125	0.002	–0.187	0.612	–0.182	–0.069	–0.058	0.380
	Std. error	0.065	0.181	0.049	0.165	0.094	1.381	0.058	0.632	0.085	0.848
	Significance			**		*		**			
Dummy for Toronto pre-amalgamation, prior to 1998	Coefficient	–0.054	–0.083	–0.022	–0.039	–0.046	–0.139	–0.063	–0.087	–0.061	–0.155
	Std. error	0.018	0.035	0.016	0.031	0.028	0.190	0.021	0.122	0.028	0.201
	Significance	***	**					***		**	
Constant	Coefficient	0.029	0.032	0.045	0.077	0.062	0.186	0.061	0.084	0.032	0.220
	Std. error	0.014	0.020	0.016	0.045	0.023	0.223	0.019	0.163	0.031	0.345
	Significance	*		**	**	**		***			
R-squared		0.992	0.985	0.927	0.837	0.940	0.472	0.966	0.943	0.929	0.235
Adjusted R-squared		0.989	0.980	0.901	0.780	0.918	0.288	0.954	0.923	0.905	–0.032
F-statistic		345.580	76.419	36.273	12.965	44.417	3.877	80.670	28.749	37.629	1.870
p value for F		***	***	***	***	***	***	***	***	***	***

Note: CIB = commercial/industrial/business; OLS = ordinary least squares; 2SLS = two-stage least squares; *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

Table A4: CIB Effective Tax Rate, OLS and 2SLS Regression Estimates by Region's Largest Lower-Tier Municipality
Dependent variable: CIB effective tax rate

Independent variables		Toronto		Oshawa (Durham)		Oakville (Halton)		Mississauga (Peel)		Vaughan (York)	
		OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
CIB equalized assessment per capita, region	Coefficient	–0.927	–0.806	–0.813	0.778	–0.451	–0.310	–0.895	–0.055	–0.155	–2.021
	Std. error	0.033	0.113	0.151	2.319	0.167	0.623	0.098	3.589	0.069	7.601
	Significance	***	***	***		**		***		**	
Neighbouring regions' weighted average CIB tax rate	Coefficient	–0.200	–0.504	.078	0.188	0.130	0.241	-0.046	-0.324	-0.177	1.457
	Std. error	0.081	0.304	.078	0.384	0.097	0.186	0.083	2.453	0.096	6.126
	Significance	**								*	
Same regions' weighted average CIB tax rate	Coefficient	0.000	0.000	–0.001	0.265	0.333	0.506	0.087	–0.199	0.613	1.182
	Std. error		.	0.141	1.341	0.102	0.270	0.193	5.876	0.114	2.886
	Significance		.			***	**			***	
Net intraprovincial migrants as a share of population, region	Coefficient	–0.396	–0.876	0.964	–0.582	0.389	0.422	0.620	–0.513	0.127	1.404
	Std. error	0.251	0.516	0.335	2.623	0.248	0.485	0.340	6.311	0.171	4.917
	Significance			***				*			
Total municipal grants per capita, Ontario	Coefficient	0.418	0.428	0.052	0.003	0.052	0.036	0.016	–0.046	0.039	0.217
	Std. error	0.073	0.100	0.028	0.127	0.042	0.078	0.023	0.327	0.038	0.970
	Significance	***	***	*							
Provincial GDP per capita, Ontario)	Coefficient	0.002	–0.221	0.085	–0.108	0.342	0.387	0.102	–0.331	0.075	–1.151
	Std. error	0.201	0.338	0.238	0.910	0.252	0.393	0.311	1.776	0.276	5.524
	Significance										
1998 reassessment dummy	Coefficient	0.012	–0.060	–0.139	–0.943	–0.094	–0.022	–0.196	–0.552	–0.064	1.243
	Std. error	0.065	0.181	0.085	1.228	0.089	0.325	0.096	3.569	0.120	5.567
	Significance							*			
Dummy for Toronto pre-amalgamation, prior to 1998	Coefficient	–0.054	–0.083	0.004	0.116	–0.008	–0.001	–0.054	–0.034	–0.052	–0.072
	Std. error	0.018	0.035	0.024	0.166	0.022	0.029	0.025	0.092	0.023	0.272
	Significance	***	**					**		**	
Constant	Coefficient	0.029	0.032	0.062	–0.042	0.028	0.019	0.073	0.009	0.031	0.222
	Std. error	0.014	0.020	0.019	0.154	0.023	0.068	0.021	0.275	0.021	0.778
	Significance	**		***				***			
R-squared		0.992	0.985	0.923	0.406	0.904	0.889	0.944	0.524	0.957	0.827
Adjusted R-squared		0.989	0.980	0.891	0.156	0.863	0.842	0.920	0.324	0.939	0.350
F-statistic		345.580	76.419	28.589	3.077	22.338	15.978	39.627	1.820	53.247	0.701
p value for F		***	***	***	**	***	***	***		***	

Note: CIB = commercial/industrial/business; OLS = ordinary least squares; 2SLS = two-stage least squares;*** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

Table A5: Residential Equalized Assessment, OLS and 2SLS Regression Estimates by Region's Municipal Average
Dependent variable: Residential equalized assessment per capita

Independent variables		Toronto		Durham		Halton		Peel		York	
		OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Effective total tax rates, residential/ multiresidential region	Coefficient	–0.832	–0.964	–0.998	–0.828	–0.882	–0.411	–0.957	–0.760	–0.928	–0.694
	Std. error	0.119	0.971	0.059	0.149	0.105	0.543	0.070	0.509	0.116	0.608
	Significance	***		***	***	***		***		***	
Equalized assessment, CIB	Coefficient	0.037	–0.484	0.237	0.578	0.231	1.472	0.080	0.665	0.164	–0.199
	Std. error	0.044	1.282	0.122	0.453	0.193	1.159	0.081	0.565	0.131	1.073
	Significance			*							
Residential housing completions, CMA	Coefficient	–0.059	–0.229	–0.066	–0.013	–0.044	0.032	–0.092	–0.064	–0.174	–0.117
	Std. error	0.060	0.433	0.048	0.081	0.062	0.145	0.051	0.134	0.084	0.169
	Significance							*		*	
Employment rate, CMA	Coefficient	1.246	8.036	0.453	0.109	0.339	1.951	0.649	2.394	0.499	–2.654
	Std. error	1.272	14.891	0.931	1.213	1.755	5.720	0.958	2.950	1.409	5.906
	Significance										
Net intraprovincial migrants as a share of pop., region	Coefficient	0.503	2.556	0.629	0.094	0.287	–0.542	0.676	0.165	1.161	1.400
	Std. error	0.520	4.444	0.332	0.805	0.378	1.030	0.353	0.866	0.554	1.579
	Significance							*		*	
Res. crime rate per capita	Coefficient	–0.135	–0.670	–0.001	0.027	–0.068	–0.177	0.075	0.018	0.060	0.351
	Std. error	0.150	1.225	0.110	0.141	0.156	0.468	0.122	0.287	0.201	0.542
	Significance										
School board expenditures per capita		0.557	–0.512	0.063	0.177	0.315	–0.448	0.321	–0.194	–0.318	0.777
		0.338	2.522	0.273	0.353	0.348	1.325	0.265	0.825	0.500	1.628
1998 reassessment dummy	Coefficient	–0.105	–0.772	–0.177	–0.139	–0.122	–0.538	–0.227	–0.379	–0.209	0.239
	Std. error	0.075	1.591	0.065	0.104	0.099	0.752	0.073	0.462	0.111	0.471
	Significance			**				***		*	
Dummy for Toronto pre-amalgamation, prior to 1998	Coefficient	–0.019	–0.019	–0.010	–0.016	–0.038	0.005	–0.033	–0.020	–0.035	–0.039
	Std. error	0.027	0.091	0.019	0.024	0.030	0.071	0.026	0.056	0.036	0.062
	Significance										
Constant	Coefficient	0.041	0.172	0.057	0.028	0.045	–0.025	0.067	0.047	0.100	0.080
	Std. error	0.026	0.296	0.019	0.041	0.025	0.075	0.023	0.054	0.035	0.078
	Significance			***		*		***		***	
R-squared		0.918	0.060	0.980	0.969	0.976	0.915	0.973	0.890	0.940	0.819
Adjusted R-squared		0.878	–0.411	0.971	0.953	0.963	0.873	0.960	0.835	0.910	0.729
F-statistic		22.498	1.311	99.604	46.738	79.654	13.390	73.281	9.715	31.457	5.182
p value for F		***		***	***	***	***	***	***	***	***

Note: CIB = commercial/industrial/business; CMA = census metropolitan area;OLS = ordinary least squares; 2SLS = two-stage least squares; *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

Table A6: Residential Equalized Assessment, OLS and 2SLS Regression Estimates by Region's Largest Lower-Tier Municipality
Dependent variable: Residential equalized assessment per capita

Independent variables		Toronto		Oshawa (Durham)		Oakville (Halton)		Mississauga (Peel)		Vaughan (York)	
		OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Effective total tax rates, residential/ multiresidential region	Coefficient	–0.832	–0.964	–1.039	–1.078	–0.917	–1.125	–0.982	–0.357	–0.667	–0.377
	Std. error	0.119	0.971	0.062	0.123	0.087	0.249	0.065	1.614	0.140	0.273
	Significance	***		***	***	***	***	***		***	
Equalized assessment, CIB	Coefficient	0.037	–0.484	0.092	–0.156	0.410	0.343	0.025	1.071	0.658	0.859
	Std. error	0.044	1.282	0.140	0.634	0.222	0.547	0.066	2.066	0.155	0.461
	Significance					*				***	*
Residential housing completions, CMA	Coefficient	–0.059	–0.229	–0.005	–0.024	0.013	–0.019	–0.095	–0.015	–0.055	0.072
	Std. error	0.060	0.433	0.050	0.061	0.080	0.118	0.053	0.321	0.129	0.204
	Significance							*			
Employment rate, CMA	Coefficient	1.2463	8.0360	–0.5737	–0.6298	–0.0520	1.3464	1.0829	1.1868	–1.7111	–1.4120
	Std. error	1.2720	14.8911	0.7485	1.0722	2.1810	3.0871	1.0591	4.9971	1.9741	2.4941
	Significance										
Net intraprovincial migrants as a share of pop., region	Coefficient	0.503	2.556	0.524	0.703	0.296	0.184	0.721	0.660	0.770	0.485
	Std. error	0.520	4.444	0.328	0.566	0.389	0.542	0.347	1.368	0.534	0.640
	Significance							*			
Res. crime rate per capita	Coefficient	–0.135	–0.670	–0.110	–0.110	–0.099	–0.195	0.055	–0.078	–0.030	–0.108
	Std. error	0.150	1.225	0.115	0.143	0.190	0.278	0.126	0.567	0.295	0.487
	Significance										
School board expenditures per capita		0.557	–0.512	0.638	0.752	0.342	0.118	0.354	–0.284	–0.059	0.353
		0.338	2.522	0.262	0.533	0.427	0.586	0.282	1.642	0.569	0.728
				**							
1998 reassessment dummy	Coefficient	–0.105	–0.772	–0.046	0.073	–0.182	–0.332	–0.236	–0.028	–0.250	–0.055
	Std. error	0.075	1.591	0.118	0.450	0.118	0.301	0.076	0.936	0.161	0.286
	Significance							***			
Dummy for Toronto pre-amalgamation, prior to 1998	Coefficient	–0.019	–0.019	–0.001	–0.009	–0.034	–0.027	–0.035	–0.041	–0.053	–0.059
	Std. error	0.027	0.091	0.022	0.034	0.031	0.037	0.025	0.099	0.052	0.063
	Significance										
Constant	Coefficient	0.041	0.172	0.031	0.041	0.034	0.043	0.070	0.029	0.071	0.036
	Std. error	0.026	0.296	0.017	0.026	0.030	0.046	0.024	0.140	0.046	0.059
	Significance			*				***			
R-squared		0.918	0.060	0.973	0.966	0.948	0.929	0.971	0.548	0.903	0.879
Adjusted R-squared		0.878	–0.411	0.959	0.949	0.921	0.894	0.956	0.322	0.854	0.819
F-statistic		22.498	1.311	71.807	47.071	36.059	16.409	66.063	2.443	18.543	7.842
p value for F		***		***	***	***	***	***	**	***	***

Note: CIB = commercial/industrial/business; CMA = census metropolitan area;OLS = ordinary least squares; 2SLS = two-stage least squares; *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level

Table A7: Residential Effective Tax Rate, OLS and 2SLS Regression Estimates by Region's Municipal Average
Dependent variable: Residential effective tax rate

Independent variables		Toronto		Durham		Halton		Peel		York	
		OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Residential equalized assessment per capita, region	Coefficient	–0.850	–0.755	–0.941	–0.982	–0.957	–0.892	–0.936	–0.161	–0.797	–1.134
	Std. error	0.067	0.131	0.085	0.202	0.079	0.163	0.105	1.076	0.133	0.502
	Significance	***	***	***	***	***	***	***		***	**
Neighbour regions' weighted average residential tax rate	Coefficient	–0.025	–0.113	–0.165	–0.172	0.009	0.222	0.026	1.594	0.096	–0.695
	Std. error	0.044	0.137	0.160	0.504	0.155	0.289	0.181	2.403	0.262	1.118
	Significance										
Net intraprovincial migrants as a share of population, region	Coefficient	–0.362	–0.648	0.151	0.247	0.657	0.860	0.585	1.970	0.332	–0.334
	Std. error	0.257	0.353	0.311	0.764	0.364	0.608	0.364	2.723	0.459	1.136
	Significance		*			*					
Share <19 years in population	Coefficient	–0.527	–0.008	–0.782	–0.893	–2.691	–2.894	–2.520	–4.735	2.902	1.885
	Std. error	0.631	0.805	0.764	0.821	1.290	1.692	1.402	5.791	2.816	3.741
	Significance					*		*			
Total municipal grants per capita, Ontario	Coefficient	0.383	0.410	0.271	0.257	0.012	–0.012	0.080	–0.364	0.170	0.394
	Std. error	0.081	0.094	0.096	0.239	0.081	0.091	0.083	0.689	0.116	0.334
	Significance	***	***	**							
Average residential mortgage rate,5-year rate	Coefficient	–0.068	–0.082	0.008	0.001	0.026	0.060	0.058	0.358	0.171	0.018
	Std. error	0.060	0.087	0.060	0.102	0.084	0.100	0.076	0.456	0.130	0.260
	Significance										
1998 reassessment dummy	Coefficient	0.058	0.010	–0.110	–0.090	–0.120	–0.074	–0.222	–0.233	–0.128	–0.126
	Std. error	0.064	0.134	0.045	0.056	0.081	0.189	0.059	0.274	0.088	0.159
	Significance			**				***			
Dummy for Toronto pre-amalgamation, prior to 1998	Coefficient	–0.047	–0.054	–0.028	–0.031	–0.029	–0.026	–0.037	0.037	–0.035	–0.092
	Std. error	0.017	0.024	0.017	0.032	0.027	0.035	0.024	0.112	0.033	0.088
	Significance	**	**								
Constant	Coefficient	0.017	0.013	0.048	0.051	0.044	0.043	0.049	0.045	0.093	0.083
	Std. error	0.011	0.015	0.012	0.017	0.020	0.022	0.020	0.047	0.032	0.043
				***	***	**	*	**		***	*
R-squared		0.946	0.930	0.983	0.982	0.977	0.975	0.977	0.886	0.944	0.917
Adjusted R-squared		0.924	0.901	0.976	0.975	0.967	0.964	0.967	0.838	0.920	0.882
F-statistic		41.860	20.678	138.663	107.317	100.928	54.874	100.373	12.819	40.003	15.968
p value for F		***	***	***	***	***	***	***	***	***	***

Note: OLS = ordinary least squares; 2SLS = two-stage least squares; *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

Table A8: Residential Effective Tax Rate, OLS and 2SLS Regression Estimates by Region's Largest Lower-Tier Municipality
Dependent Variable: Residential effective tax rate

Independent variables		Toronto		Oshawa (Durham)		Oakville (Halton)		Mississauga(Peel)		Vaughan (York)	
		OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Residential equalized assessment per capita, region	Coefficient	–0.850	–0.755	–0.070	–0.289	–0.033	–0.229	–0.395	0.657	0.016	0.047
	Std. error	0.067	0.131	0.202	0.526	0.123	0.401	0.164	2.655	0.056	0.130
	Significance	***	***					**			
Neighbour regions' weighted average residential tax rate	Coefficient	–0.025	–0.113	0.216	0.131	0.259	0.081	0.027	–0.320	–0.093	0.171
	Std. error	0.044	0.137	0.108	0.573	0.102	0.411	0.120	1.969	0.104	0.405
	Significance			*		**					
Same regions' weighted average residential tax rate	Coefficient	0.000	0.000	0.679	0.485	0.601	0.443	0.578	1.727	1.113	1.091
	Std. error			0.188	0.380	0.076	0.240	0.166	2.933	0.073	0.235
	Significance			**		***	*	***		***	***
Net intraprovincial migrants as a share of population, region	Coefficient	–0.362	–0.648	0.372	0.437	–0.072	–0.057	0.375	–0.609	–0.042	0.015
	Std. error	0.257	0.353	0.249	0.444	0.166	0.606	0.235	3.718	0.096	0.159
	Significance		*								
Share <19 years in population	Coefficient	–0.527	–0.008	0.894	0.530	–0.662	–0.789	–1.735	1.418	–0.353	–0.293
	Std. error	0.631	0.805	0.701	1.046	0.465	0.623	1.038	10.060	0.392	0.564
	Significance										
Total municipal grants per capita, Ontario	Coefficient	0.383	0.410	0.012	0.025	–0.012	–0.015	0.001	–0.033	0.028	0.015
	Std. error	0.081	0.094	0.020	0.036	0.029	0.075	0.015	0.132	0.024	0.040
	Significance	***	***								
Average residential mortgage rate, 5-year rate		–0.068	–0.082	0.017	0.024	–0.067	–0.048	0.039	–0.063	0.037	0.079
		0.060	0.087	0.051	0.083	0.050	0.097	0.062	0.420	0.062	0.118
1998 reassessment dummy	Coefficient	0.058	0.010	0.038	–0.018	0.094	–0.034	–0.085	0.105	0.018	0.051
	Std. error	0.064	0.134	0.050	0.132	0.049	0.150	0.062	0.339	0.079	0.134
	Significance										
Dummy for Toronto pre-amalgamation prior to 1998	Coefficient	–0.0473	–0.0538	0.0277	0.0207	–0.0017	–0.0046	–0.0196	0.0094	–0.0077	–0.0008
	Std. error	0.0171	0.0237	0.0151	0.0303	0.0137	0.0201	0.0167	0.0808	0.0145	0.0256
	Significance	**	**	*							
Constant	Coefficient	0.017	0.013	0.015	0.027	–0.009	0.004	0.013	–0.064	–0.003	–0.001
	Std. error	0.011	0.015	0.015	0.027	0.013	0.041	0.018	0.217	0.008	0.016
R-squared		0.946	0.930	0.984	0.981	0.988	0.979	0.986	0.941	0.990	0.983
Adjusted R-squared		0.924	0.901	0.975	0.972	0.982	0.969	0.979	0.912	0.985	0.974
F-statistic		41.860	20.678	119.002	82.639	165.348	56.958	139.796	21.583	192.098	79.323
p value for F		***	***	***	***	***	***	***	***	***	***

Note: OLS = ordinary least squares; 2SLS = two-stage least squares;*** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

Data Sources

Variable	Source
Tax rates	Financial Information Returns, Ontario Ministry of Municipal Affairs and Housing
Population	Financial Information Returns, Ontario Ministry of Municipal Affairs and Housing
Assessment	Financial Information Returns, Ontario Ministry of Municipal Affairs and Housing
Share<19 yrs in population	Statistics Canada, Census data (2002, 2006 and 2011)
Taxable and weighted assessment base	Financial Information Returns, Ontario Ministry of Municipal Affairs and Housing
Housing completions in Toronto CMA	Statistics Canada
Employment rate in Toronto CMA	Statistics Canada
Breaking & entering (residential) crime rate per person, Toronto CMA	Statistics Canada Statistics Canada
Net intraprovincial migrants as a share of population by region	Statistics Canada
School board expenditure per capita, Ontario	Ontario Ministry of Education
Total Provincial and federal grants per capita, by municipality or region	Financial Information Returns, Ontario Ministry of Municipal Affairs and Housing
Five-year average residential mortgage lending rate (%)	Bank of Canada reports
Chartered bank prime business rate (%)	Bank of Canada reports
Per capita provincial GDP, Ontario	Statistics Canada

ISBN 978-0-7727-0939-4
ISSN 1927-1921