Essays in Municipal Finance

by

Adam Found

A thesis submitted in conformity with the requirements for the degree of Doctor of Philosophy
Department of Economics
University of Toronto

© Copyright by Adam Found 2014
Abstract

Chapter 1

I analyze economies of scale for fire and police services by considering how per-household costs are affected by a municipality’s size. Using 2005-2008 municipal data for the Province of Ontario, I employ a partial-linear model to non-parametrically estimate per-household cost curves for each service. The results show that cost per household is a U-shaped function of municipal size for each service. For fire services, these costs are minimized at a population of about 20,000 residents, while for police services they are minimized at about 50,000 residents. Based on these results, implications are drawn for municipal amalgamation policy.

Chapter 2

I review how the literature has continued to exclude the business property tax (BPT) from the marginal effective tax rate (METR) on capital investment for over 25 years. I recast the METR theory as it relates to the BPT and compute 2013 estimates of the METR for all 10 provinces in Canada with provincial BPTs included. Building on these estimates, I compute the METR inclusive of municipal BPTs for the largest municipality in each province. I find the BPT to be substantially damaging to municipal, provincial and international competitiveness. With the
business property tax representing over 60% of the Canadian METR, among the various capital
taxes it is by far the largest contributor to Canada’s investment barrier.

Chapter 3

I estimate the responsiveness of structure investment and the tax base to commercial property
taxes, taking a new step toward resolving the “benefit view” vs. “capital tax view” debate within
the literature. Using a first-difference structural model to analyze 2006-2013 municipal data for
the Province of Ontario, I improve upon past studies and build onto the literature in a number of
ways. I find that commercial structure investment and tax base are highly sensitive to the
property tax with Ontario’s assessment-weighted average tax elasticity (and tax-base elasticity)
ranging from -0.80 to -0.90 at 2011 taxation levels. The results support the capital tax view of
the business property tax, building onto the growing consensus that business property taxes
substantially impact investment in structures and the value of the tax base.
## Table of Contents

Table of Contents ........................................................................................................................... iv

List of Tables ................................................................................................................................... viii

List of Figures .................................................................................................................................. xi

List of Appendices ........................................................................................................................... xii

Chapter 1: Economies of Scale in Fire and Police Services in Ontario .......................................... 1

1.1 Introduction ................................................................................................................................. 1

1.2 Literature Review ....................................................................................................................... 2

1.3 Municipal Structure and Amalgamation Policy in Ontario ..................................................... 5

1.3.1 Municipal Structure ......................................................................................................... 5

1.3.2 Municipal Amalgamation Policy ....................................................................................... 8

1.4 Econometric Model .................................................................................................................... 12

1.5 Municipal Data .......................................................................................................................... 15

1.6 Results ....................................................................................................................................... 20

1.6.1 Fire Services ....................................................................................................................... 20

1.6.2 Police Services .................................................................................................................... 22

1.6.3 Limitations .......................................................................................................................... 23

1.7 Concluding Remarks ................................................................................................................. 24

References ....................................................................................................................................... 25

1.8 Appendix 1.1 - Partial-Linear Estimation Method ................................................................. 28

1.9 Appendix 1.2 - Estimation Output and Confidence Bands ...................................................... 31

Chapter 2: Business Property Taxes and the Marginal Effective Tax Rate on Capital ................. 34

2.1 Introduction ................................................................................................................................. 34

2.2 Literature Review ....................................................................................................................... 38

2.2.1 Taxing Capital in a Small Open Economy ......................................................................... 39
2.2.2 Studies Omitting the BPT ........................................................................................ 41
2.2.3 Studies Including the BPT .................................................................................... 45

2.3 The Business Property Tax Belongs in the METR .................................................. 49
  2.3.1 Benefit Taxation.................................................................................................... 50
  2.3.2 Capitalization of the Property Tax into Land Values ........................................ 52
  2.3.3 Incomplete Inclusion of the Property Tax across Levels of Government .......... 54

2.4 METR Model Framework ......................................................................................... 56
  2.4.1 Theoretical Assumptions .................................................................................. 56
  2.4.2 Rate of Return on Savings ............................................................................... 58
  2.4.3 Rate of Return on Investment ......................................................................... 60
  2.4.4 Corporate Income Tax ..................................................................................... 61
  2.4.5 Retail Sales Tax ................................................................................................. 62
  2.4.6 Corporate Wealth Tax ...................................................................................... 63
  2.4.7 Rate of Return on Inventory Investment ........................................................... 67
  2.4.8 Marginal Effective Tax Rate ............................................................................ 68

2.5 Empirical Assumptions and Data ........................................................................... 69
  2.5.1 Empirical Assumptions ..................................................................................... 69
  2.5.2 British Columbia and Vancouver BPT ............................................................... 70
  2.5.3 Alberta and Calgary BPT .................................................................................. 71
  2.5.4 Saskatchewan and Saskatoon BPT ................................................................. 73
  2.5.5 Manitoba and Winnipeg BPT .......................................................................... 75
  2.5.6 Ontario and Toronto BPT ............................................................................... 78
  2.5.7 Quebec and Montreal BPT .............................................................................. 80
  2.5.8 New Brunswick and Saint John BPT ................................................................. 81
  2.5.9 Nova Scotia and Halifax BPT ............................................................................ 83
  2.5.10 Prince Edward Island and Charlottetown BPT ............................................... 84
References ........................................................................................................................................ 148

3.7 Appendix 3.1 - Price Elasticity Estimation by Discount Rate ........................................... 150

3.8 Appendix 3.2 - Price Elasticity Estimation under Alternative Restrictions .................. 153
List of Tables

Table 1.3-1  Distribution of Municipal Structure in Ontario ...................................................... 6
Table 1.3-2  Municipal Amalgamation Waves in Ontario .......................................................... 9
Table 1.4-1  Variable Definitions .............................................................................................. 13
Table 1.5-1  Constituent Data Summary ................................................................................... 16
Table 1.5-2  Number of Households ........................................................................................ 18
Table 1.5-3  Land Area (Km²) ................................................................................................... 19
Table 1.5-4  Fire Costs Per Household ...................................................................................... 19
Table 1.5-5  Police Costs Per Household .................................................................................. 19
Table 1.6-1  Summary of Limitations ....................................................................................... 23
Table 1.9-1  Fire Partial-Linear Model Output ......................................................................... 31
Table 1.9-2  Fire Quadratic Model Output ................................................................................ 31
Table 1.9-3  Police Partial-Linear Model Output ...................................................................... 32
Table 1.9-4  Police Quadratic Model Output ............................................................................ 33
Table 2.5-1  British Columbia BPT Rates - 2013 ................................................................. 70
Table 2.5-2  Vancouver RPT and BPT Rates - 2013 ............................................................... 71
Table 2.5-3  Saskatchewan BPT Rates - 2013 ................................................................. 73
Table 2.5-4  Saskatoon RPT and BPT Rates - 2013 ............................................................... 74
Table 2.5-5  Manitoba BPT Rates - 2013 .............................................................................. 75
Table 2.5-6  Winnipeg RPT and BPT Rates - 2013 ............................................................... 76
Table 2.5-7 Winnipeg Local Statutory Education RPT and BPT Rates - 2013 ....................... 77
Table 2.5-8 Winnipeg Local Effective Education RPT and BPT Rates - 2013 ....................... 77
Table 2.5-9 Ontario BPT Rates - 2013 ..................................................................................... 79
Table 2.5-10 Toronto RPT and BPT Rates - 2013..................................................................... 80
Table 2.5-11 New Brunswick BPT Rates - 2013....................................................................... 82
Table 2.5-12 Nova Scotia BPT Rates - 2013 ............................................................................. 83
Table 2.5-13 Halifax Regional Municipality RPT and BPT Rates - 2013 ................................ 84
Table 2.9-1 National Parameter Values Common to All Capital Categories ......................... 99
Table 2.9-2 National Parameter Values Varying by Capital Category ..................................... 99
Table 2.9-3 Corporate Investment Shares .............................................................................. 100
Table 2.9-4 Combined Federal-Provincial PIT Rates ............................................................ 100
Table 2.9-5 Statutory Business Tax and ITC Rates .................................................................. 101
Table 2.9-6 Effective RST, BPT and ITC Rates ..................................................................... 101
Table 2.9-7 Net Effective Local BPT Rate for Largest Municipality in a Province .............. 101
Table 2.9-8 Selected Endogenous Values .............................................................................. 102
Table 3.4-1 Ranges of Sensitivity to the Property Tax .......................................................... 134
Table 3.4-2 CVA-Weighted Summary Statistics ................................................................... 139
Table 3.4-3 Detailed Unweighted Summary Statistics .............................................................. 140
Table 3.5-1 Price and Tax Elasticities and Other Provincial Estimates for 2011 .................. 142
Table 3.7-1 Discount Rate $r = 7\%$ .......................................................................................... 150
<table>
<thead>
<tr>
<th>Table Reference</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 3.7-2</td>
<td>Discount Rate ( r = 8% )</td>
<td>150</td>
</tr>
<tr>
<td>Table 3.7-3</td>
<td>Discount Rate ( r = 9% )</td>
<td>151</td>
</tr>
<tr>
<td>Table 3.7-4</td>
<td>Discount Rate ( r = 10% )</td>
<td>151</td>
</tr>
<tr>
<td>Table 3.7-5</td>
<td>Discount Rate ( r = 11% )</td>
<td>152</td>
</tr>
<tr>
<td>Table 3.8-1</td>
<td>Variation in the 2006-2007 Effective Tax Rate Differential Only</td>
<td>153</td>
</tr>
<tr>
<td>Table 3.8-2</td>
<td>Variation in the Rate of Levy Growth Only</td>
<td>154</td>
</tr>
<tr>
<td>Table 3.8-3</td>
<td>Variation in the 2007-2010 Tax Base Growth Only</td>
<td>155</td>
</tr>
<tr>
<td>Table 3.8-4</td>
<td>Reduced Form Model</td>
<td>156</td>
</tr>
</tbody>
</table>
List of Figures

Figure 1.5-1  Municipal Operating Costs in Ontario .......................................................... 16
Figure 1.6-1  Fire Costs: Partial-Linear Model vs. Quadratic Model ................................. 21
Figure 1.6-2  Police Costs: Partial-Linear Model vs. Quadratic Model ............................ 22
Figure 1.9-1  Fire Costs: Partial-Linear Model with 95% Confidence Band ..................... 32
Figure 1.9-2  Police Costs: Partial-Linear Model with 95% Confidence Band .................. 33
Figure 2.2-1  Taxing Capital in a Small Capital Market ..................................................... 40
Figure 2.2-2  Reproduction of Chat 3.10 from Canada (2008) ......................................... 43
Figure 2.6-1  Reproduction of Chart A2.3 from Canada (2012) ........................................ 86
Figure 2.6-2  2013 METR on Capital Investment for Canadian Provinces ....................... 87
Figure 2.6-3  2013 METR on Capital Investment for Largest Municipality in a Province .... 88
Figure 3.4-1  Variation in Change in Tax Base and Effective Tax Rate ............................. 140
Figure 3.5-1  Sensitivity to the Commercial Property Tax in Ontario ............................. 145
List of Appendices

Appendix 1.1 - Partial-Linear Estimation Method ................................................................. 28

Appendix 1.2 - Estimation Output and Confidence Bands .................................................... 31

Appendix 2.1 - List of Empirical Assumptions ................................................................. 95

Appendix 2.2 - Parameter Values and Selected Endogenous Values .................................. 99

Appendix 3.1 - Price Elasticity Estimation by Discount Rate ............................................. 150

Appendix 3.2 - Price Elasticity Estimation under Alternative Restrictions ....................... 153
Chapter 1
Economies of Scale in Fire and Police Services in Ontario

1.1 Introduction

Municipal amalgamation has touched almost every municipality in Ontario. Between 1991 and 2001, hundreds of municipalities were amalgamated, reducing the number from 839 to 448. At the time, the provincial government openly sought the reduction in the number of municipalities as a policy objective in itself (Bish, 2001; Sharma, 2003). Some amalgamations were forced directly, whereby the province imposed amalgamation either by special legislation or by delegating sweeping powers to single-person restructuring commissions (Sancton, 2000). In other cases, amalgamation was initiated locally to avoid the more contentious and extensive amalgamation forced by the province (Downey & Williams, 1998).

A consistent justification cited by provincial politicians, bureaucrats, and restructuring commissioners and advisors for forcing municipal amalgamations in Ontario was the promise of cost savings resulting from economies of scale. Such predictions, however, were largely based on anecdotes, unsubstantiated assertions and vague accounting analyses rather than econometric or research-based evidence (Armstrong & Kitchen, 1997; Farrow, 1999; Kitchen, 2000; Meyboom, 1997; O’Brien, 1999; Shortliffe, 1999; Thomas, 1999). Since Ontario’s municipalities spend about 5.5 percent of the provincial GDP, there is a public policy interest in examining municipal economies of scale to gain a sense of the extent to which cost savings from amalgamation have materialized in Ontario.

This study examines the extent to which economies of scale are present for two critical municipal services that together constitute more than one-fifth of municipal operating budgets in

---

1 Economies of scale in the classical sense are referred to as “technical economies”, and are concerned with the relationship between average costs and output. In contrast, economies of scale in the population sense are referred to as “population economies” as they pertain to the effect of population on costs, and are specifically concerned with the relationship between per-capita costs and population. It turns out that, in the context of congestible local public goods (e.g., municipal services), it can be shown that these two notions of economies of scale are equivalent. Thus, the present study accords with the literature in that it adopts the population economies notion of economies of scale.
Ontario: fire and police. I have used the current variation in the size of Ontario’s municipalities to estimate the relationship between per-household costs and the number of households served. The cost curves for both fire and police costs are U-shaped—that is, there is a particular population size at which these services can be provided at lowest cost per household, referred to as the minimum efficient scale. For fire services costs per household are minimized at 9,000 households (or about 20,000 residents), while for police services they are minimized at 21,000 households (about 50,000 residents).²

1.2 Literature Review

The literature on estimating municipal economies of scale can be broken into two somewhat overlapping groups: studies that omit output measures and those that employ fully parametric models.

Three studies that focus on Ontario—Bodkin & Conklin (1971), Kushner et al. (1996), and Jerrett et al. (2002)—rely on fully parametric modelling of the cost for various Ontario municipal services. These studies found that municipal services are subject to either constant returns to scale (scale efficiencies are neither lost nor gained as population increases) or diseconomies of scale. In addition, these studies do not include output measures in their analyses, which can bias the main estimates.

Several recent U.S. and other studies have estimated the extent of economies of scale in local government, but only with fully parametric models that do not include measures of output. Benton & Gamble (2003) focused on the merger of the City of Jacksonville and the County of Duval in Florida and used time-series data to conclude that the merger led to higher expenditures and taxes, assuming that service levels remained unchanged after the merger. Couch et al. (2004) found that duplication has not been wasteful for Alabama municipalities, and that economies of scale were essentially non-existent.

While considering two-tier local government structures in England, Andrews & Boyne (2009) found that municipal administration is subject to extensive economies of scale and recommend

² According to Statistics Canada's 2011 Census, the average household in Ontario contains 2.4 residents. This figure is used to convert the household numbers into populations rounded to the nearest 5,000 mark.
municipal amalgamation into unitary (single-tier) governments. Holcome & Williams (2008) analyzed 487 American municipalities with populations over 50,000 and found that, while density has a significant effect on costs, municipalities essentially operate under constant returns to scale. Hendrick et al. (2011) found that local government expenditures tend to rise with both vertical fragmentation (an increase in the number of government tiers) and centralization (a decrease in the number of local governments for a given geographic population). However, a comprehensive literature review by Byrnes & Dollery (2002) found that results are very mixed.

A few studies have analyzed economies of scale for fire and police services. These studies employ parametric models, but incorporate variables for levels of output (that is, service levels). Duncombe & Yinger (1993) studied the fire departments of municipalities in the State of New York and used output measures such as dollar loss due to fires and the number of emergency calls. They concluded that fire services are subject to constant returns to scale.

Gyimah-Brempong (1987), Finney (1997), and Southwick (2005) studied municipal police departments in the State of Florida, Los Angeles County, and the State of New York, respectively. All three studies used methods similar to Duncombe & Yinger (1993) and included police output measures such as number of arrests, crime rates, and motor vehicle accidents. The first two studies concluded that policing is subject to diseconomies of scale, while the third study found that policing is most efficiently provided to populations in the range of 22,000 to 36,000 residents.

Although he did not study municipal services per se, Yatchew (2000) found that local electricity distribution in Ontario exhibits a cost-per-customer curve that is “bathtub”-shaped. That is, there is a considerable range in the number of customers who can be served cost-effectively. This range begins at about 20,000 customers, so once at this size an electricity distributor has exhausted all available economies of scale. In particular, the largest utility in the sample—Toronto Hydro, with approximately 688,000 customers—was found to be the most inefficient in the province. Even though electricity distribution is not a municipal service in Ontario, Yatchew
(2000) is relevant in that his econometric approach is adopted by this paper for municipal services.³

In summary, a review of the literature raises two main issues:⁴

1. **Omission of Service Levels:** Measures of municipal service levels have been omitted from all Ontario-based studies and most other studies estimating municipal economies of scale, which may lead to estimation bias in the results. Including such measures, however, means dealing with difficulties in defining municipal output, identifying measures of municipal output, and acquiring data on such measures.

2. **Imposition of Parametric Specifications:** In principle, the per-capita or per-household cost curve may exhibit any profile, not necessarily a curve that implies a single, unique cost-minimizing population. By comparison, past studies on municipal economies of scale using fully parametric models have assumed particular cost curve profiles, thereby limiting the range of results obtained.

The present study explicitly includes some measures of service levels to strengthen the analysis. If service levels (such as response times or crime rates) and population are correlated, then an econometric analysis that omits service levels is unlikely to reveal the pure impact of population size on per-capita costs. There are various possible explanations for this correlation. For instance, if residents with strong preferences for low emergency response times tend to live in large cities, higher fire service costs would be observed for larger municipalities. By omitting response time

---

³ In Ontario, local electricity distributors are independent corporations typically owned at least in part by local municipalities. In this sense, local electricity distribution (a private good) is interpreted as a non-municipal service, meaning that Yatchew (2000) is not viewed here as a study of municipal economies of scale.

⁴ There are two additional but relatively peripheral issues with regard to the literature. First, municipalities may not operate in the same way as profit-maximizing firms. Estimating the cost of service provision for an economic entity is meaningful only if we are satisfied that the entity faces a problem to which the solution is cost-minimizing behaviour (that is, technical efficiency). Otherwise, we remain uncertain as to what exactly is being estimated. Second, municipal economies of scale are conceived in terms of per-capita cost rather than the average cost of output, without any comprehensive rationale for why the two conceptions may be equivalent. Although addressing these issues directly is beyond the scope of this paper, it is worth noting that they can be addressed by applying yardstick competition theory and club theory (in the context of a congestible club good subject to economies of scale), respectively.
data on fire services, previous analyses would have attributed these higher costs to diseconomies of scale, whereas they may reflect superior fire services.\(^5\)

With respect to the second issue, it cannot necessarily be assumed that costs per capita have a single optimal point (that is, a precise population at which costs per capita are minimized). For instance, the curve representing costs per capita may be “bathtub”-shaped, exhibiting constant returns to scale over a large range of population. This paper follows Yatchew (2000) in that the analysis may, in principle, capture a wide range of cost-per-capita curves. This approach should confirm whether a fully parametric model sufficiently captures the relationship between per-capita costs and municipal size.

Finally, virtually all studies analyze economies of scale with respect to operating costs only, and omit capital costs such as those for building, vehicle, and infrastructure investments. Although the quantity of capital is not needed to estimate costs, data on the price of capital and its condition are needed.\(^6\) The exclusion of capital costs in other studies is due to a widespread lack of data on the condition and amount of capital accumulated by municipalities. Indeed, this study faces the same problem, and thus adopts the prevailing practice of focusing on operating costs.

### 1.3 Municipal Structure and Amalgamation Policy in Ontario

In Ontario, municipalities are classified as lower-tier, upper-tier, or single-tier. It is important to understand the nature of and major differences among these types of municipal structure, especially in the context of Ontario’s history with amalgamation implementation and policy.

#### 1.3.1 Municipal Structure

The *Municipal Act* provides for a general demarcation of municipal services between upper- and lower-tier municipalities, in which each upper-tier municipality federates a unique set of

---

\(^5\) The question of what constitutes service quantity and quality remains open and commonly unaddressed in the literature. With output often characterized as complex and multi-dimensional, consensus on its definition is unlikely to be reached, since any particular definition of municipal output is usually incomplete.

\(^6\) The condition of a municipality’s capital stock will likely impact operating costs to the extent capital and operating inputs are substitutable and linked.
constituent (geographically contained) lower-tier municipalities.\textsuperscript{7} Out of the 444 municipalities in Ontario, 241 are lower tiers, 30 are upper tiers, and 173 are single tiers.\textsuperscript{8} In northern Ontario, all municipalities are single-tier. Table 1.3-1 outlines how municipal structure is distributed across Ontario’s municipalities.

### Table 1.3-1 Distribution of Municipal Structure in Ontario

<table>
<thead>
<tr>
<th>Group</th>
<th>Sub-Group</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Municipal Structures</td>
<td>Lower-Tier</td>
<td>241</td>
</tr>
<tr>
<td></td>
<td>Upper-Tier</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Single-Tier</td>
<td>173</td>
</tr>
<tr>
<td>Lower Tiers</td>
<td>Within a Region</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>Within a County</td>
<td>198</td>
</tr>
<tr>
<td>Upper Tiers</td>
<td>Region</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>County</td>
<td>22</td>
</tr>
<tr>
<td>Single Tiers\textsuperscript{9}</td>
<td>In Northern Ontario</td>
<td>144</td>
</tr>
<tr>
<td></td>
<td>In Southern Ontario</td>
<td>29</td>
</tr>
</tbody>
</table>

The \textit{Municipal Act} generally delegates services of a regional nature such as public health and arterial roads to upper-tier municipalities, and services of a local nature such as fire protection and zoning to lower-tier municipalities. It turns out this demarcation is such that an upper-tier municipality spends an amount roughly equal to the aggregate expenditure of its constituent lower-tier municipalities. An upper-tier municipality together with its constituent lower-tier municipalities constitutes a two-tier municipal system.

\textsuperscript{7} The \textit{Municipal Act} rules out the possibility of an upper-tier municipality with only one constituent lower tier; a lower-tier municipality that belongs to more than one upper-tier municipality; and an upper-tier municipality within which there is an area that is not within the jurisdiction of a lower tier.

\textsuperscript{8} Since 2001, when the number of municipalities stood at 448, (i) the Township of Dack and the Town of Charlton amalgamated on January 1, 2003, to form the Municipality of Charlton and Dack, (ii) the Town of New Liskeard, the Town of Haileybury, and the Township of Dymond amalgamated on January 1, 2004, to form the City of Temiskaming Shores, and (iii) the Township of Gordon and the Township of Barrie Island amalgamated on January 1, 2009, to form the Township of Gordon-Barrie Island. These voluntary amalgamations have brought the total number of municipalities down to the current 444. However, since the last-mentioned amalgamation occurred after 2008, the 2005–2008 dataset used for the present study has a total of 445 municipalities.

\textsuperscript{9} A single-tier municipality may be surrounded by a county or by a number of counties and/or other single-tier municipalities.
Lower-tier municipalities are usually called Village, Township, Town, City, or Municipality, and each one is federated with neighbouring lower-tier municipalities under a unique upper-tier municipality. Examples include the Village of Oil Springs, the Township of East Hawkesbury, the Town of Oakville, the City of Owen Sound, and the Municipality of Leamington.  

Upper-tier municipalities are either a county, such as the County of Lennox and Addington, or a regional municipality, such as the Regional Municipality of Halton. Counties and regional municipalities (or simply “regions”) have different legal powers and responsibilities.  

Legislatively, regions have a greater scope of power and responsibility than do counties. A defining feature of regional municipalities is that they always contain cities as constituent municipalities, whereas counties do not, except in rare cases.  

Overlap occurs within a two-tier system if the upper tier provides a municipal service that is also provided by at least one of its constituent lower tiers, that is, upper and lower tiers are given joint responsibility for a service under the Municipal Act, or there is delegation of responsibility for a service between the upper tier and a subset of its lower tiers. This sort of overlap is not uncommon for general government services, libraries, planning, and waste management.  

Lower tiers may choose to delegate authority to the upper tier, in which case upper-tier provision of a delegated service is exclusive to households within the delegating lower tier. Given this type of overlap, standard financial reports may not accurately reflect the number of households actually served. This problem is most apparent if an upper tier is delegated authority to provide a service by only a subset of its constituent lower tiers, so that the upper tier’s financial reports overstate the number of households served. Fortunately, there is no service overlap for fire or

10 Historically, a city by definition was automatically a single-tier municipality. However, the creation of regional municipalities as upper tiers in the late 1960s and early 1970s meant that cities within their boundaries became lower-tier municipalities, causing them to give up about half of their responsibilities to regional government. Such cities remained the only cities with a lower-tier structure until three exceptions developed starting in the 1990s: The City of Sarnia became part of the County of Lambton (1991); the City of Clarence-Rockland was formed by the amalgamation of lower tiers in the County of Prescott and Russell and inherited the lower-tier status of the amalgamating municipalities (1998); and the City of Owen Sound became part of the County of Grey (2001).  

11 There are two exceptions. The District of Muskoka and the County of Oxford are the legal equivalents of a regional municipality.
police services within any two-tier system in Ontario—one good reason to focus on these two services.

Single-tier municipalitites are responsible for providing the entire spectrum of municipal services to residents, and thus their expenditures are generally twice those of comparable upper or lower tiers. Single-tier municipalities are not federated under an upper-tier municipality, although they may be geographically surrounded by an upper-tier municipality or by one or more other single-tier municipalities.

Single-tier municipalities may be called Village, Town, Township, City, County, or Municipality. Examples are the County of Prince Edward, the City of Pembroke, and the Municipality of Whitestone. Northern Ontario has only single-tier municipalities, loosely federated in very large geographic areas known as districts. A district is not a municipality, and serves only as a resource-pooling agent for soft regional services such as public health and social assistance. There are no corresponding districts in southern Ontario.

1.3.2 Municipal Amalgamation Policy

Within Ontario’s history, two distinct waves of municipal amalgamation can be identified. These waves are summarized in Table 1.3-2. During the latter half of the second amalgamation wave, various provincial responsibilities (and their costs)—such as court security, social services, social housing, provincial offences administration, rural policing, certain provincial highways, and property tax rebates for the farmland property class—were reassigned to municipalities. This move was officially dubbed “Local Services Realignment” and was a commonly cited justification for forcing municipal amalgamations. The Province claimed that small municipalities would lack the necessary fiscal capacity to take on these new responsibilities effectively and efficiently, even though for two-tier systems they were largely reassigned to upper tiers rather than the much smaller lower tiers.12

12 Amalgamating an upper tier with its constituent lower tiers clearly does not change the scale nor tax base on which an upper-tier service is provided. With respect to the provincial services downloaded onto upper tiers, total amalgamation of two-tier systems would not affect scale efficiency nor the extent of the tax base, so it interesting to note that the most radical amalgamations forced by the province occurred in two-tier systems, many of which were heavily urbanized by population.
Table 1.3-2  Municipal Amalgamation Waves in Ontario

<table>
<thead>
<tr>
<th>Wave</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Wave (1953–1974)</td>
<td>Metropolitan Toronto was created in 1953. Twelve additional regional municipalities were created between 1968 and 1974. Except for Metropolitan Toronto and the District of Muskoka, all regional municipalities were created using the boundaries of former counties. The creation of regional governments coincided with mergers at the lower-tier level and resulted in the incorporation of previously separated cities into the new regional two-tier systems as lower tiers. There was also a transfer of greater municipal responsibility to the new upper tiers.</td>
</tr>
<tr>
<td>Second Wave (1991–2001)</td>
<td>Hundreds of Ontario’s municipalities were amalgamated, reducing the number of municipalities in the province from 839 to 448. Many of these mergers were imposed by the Province itself. Others were forced indirectly, whereby amalgamation was initiated locally to avoid an amalgamation directly forced by the province. In this wave, a number of upper tiers were completely amalgamated with their constituent municipalities to form mega city-regions or city-county single tiers.</td>
</tr>
</tbody>
</table>

As Local Services Realignment coincided with many of the amalgamations, it would be extremely difficult to determine the fiscal impact of amalgamation with before-and-after analysis. This difficulty is exacerbated because of the lack of data on service levels before amalgamation and because several amalgamations occurred in mid-year. Hence, an empirical strategy to identify the effects of amalgamation by directly comparing merged municipalities before and after amalgamation is not readily apparent. Such a strategy would allow researchers to estimate the effect of amalgamation on costs directly, rather than having to infer this effect by estimating per-household cost curves using the current variation in the size of municipalities left by the 1991–2001 amalgamations.

Between 1995 and 2001, laws were passed by the provincial government that led to the amalgamation of hundreds of municipalities. The first was the Savings and Restructuring Act, which contained a so-called “single municipality trigger” for municipal restructuring. The effect of this legislative feature was that the municipal amalgamation process for an entire two-tier system could be irreversibly set in motion by the request of just one member municipality of that two-tier system.

---

13 Metropolitan Toronto was carved out of the County of York and the District of Muskoka was not previously a county.

14 In the case of the Municipality of Chatham-Kent (1998), the separated (single-tier) City of Chatham was merged with the County of Kent and its constituent lower-tier municipalities. Also, when the Regional Municipality of Haldimand-Norfolk was restructured, all lower-tier municipalities were dissolved and the former Counties of Haldimand and Norfolk were recreated, but as single-tier counties.
system. Once such a request was made, a restructuring commissioner was appointed by the provincial government without local input or consent, and was delegated sweeping powers to override the will of locally elected municipal councils.\footnote{For example, the \textit{Savings and Restructuring Act} was used in 1997 to amalgamate the County of Kent with its 21 constituent municipalities, along with the separated City of Chatham, to form Ontario’s first city-county single-tier municipality: the Municipality of Chatham-Kent.}

The second major piece of restructuring legislation was the \textit{City of Toronto Act}, which was specifically drafted to amalgamate the Municipality of Metropolitan Toronto with its six constituent municipalities to form the single-tier (new) City of Toronto, referred to at the time as the “megacity.” This imposed amalgamation remains the largest municipal amalgamation in Canadian history; it faced extensive and bitter public opposition and filibustering in the Ontario Legislature throughout 1997, during the lead-up to amalgamation.

The Ontario Legislature also passed the \textit{Fewer Municipal Politicians Act}, which led to the provincial appointment of special advisors to study and report on restructuring alternatives for four regional municipalities: Sudbury, Ottawa-Carleton, Hamilton-Wentworth, and Haldimand-Norfolk. By early 2000, each of the four special advisors filed reports recommending complete amalgamation of these regions into large single-tier municipalities. These recommendations were accepted and implemented by the province without local consent, creating the single-tier municipalities of the City of Greater Sudbury, the (new) City of Ottawa, the (new) City of Hamilton, the County of Haldimand, and the County of Norfolk.

Underlying these restructurings were the policy objectives held by the provincial government at the time. These objectives were advanced as justifications for implementing municipal amalgamations without local consent, and were reflected in the terms of reference of restructuring commissioners and special advisors on restructuring. The policy objectives were based on assuming or asserting that fewer and larger municipalities would:

- Reduce municipal bureaucracy and inefficiency, and make municipal governance more streamlined and effective;
• Realize cost savings from economies of scale (e.g., by reducing duplication and overlap in service provision);

• Provide clear lines of accountability by capturing costs and benefits within the same jurisdiction;

• Accommodate provincial downloading by pooling assessment, increasing fiscal capacity, and creating “strong” or “viable” municipalities.

Provincial officials, bureaucrats, consultants, restructuring commissioners, and special advisors typically stated that cost savings arising from economies of scale were a justification for implementing and forcing municipal amalgamations. All of the reports of restructuring commissioners and special advisors contained sections dedicated to quantifying cost savings predictions; however, these sections were often vague about how the cost savings would actually be achieved by the amalgamated municipality.

By 2002, all municipal restructuring law was eventually consolidated into the Municipal Act. Potent features such as the single municipality trigger were removed, and shortly thereafter the provincial government announced it would no longer impose amalgamations. Under the current legislation, a necessary condition for obtaining provincial approval of locally initiated municipal restructuring is the express consent of all the affected municipalities through their elected councils.  

Ontario Regulation 216/96 outlines the types of municipal restructuring the province is willing, as well as unwilling, to permit under the Municipal Act. One ominous clause in the regulation states that the province will not consider “a restructuring that results in an increase in the number of local municipalities.” (O. Reg. 216/96) Although the term “municipal restructuring” in principle encompasses several possible types of reform, it is clear that municipal restructuring

16 For example, a locally initiated referendum was held during the October 2010 Ontario municipal election on whether or not the neighbouring cities of Kitchener and Waterloo should formally undertake “amalgamation discussions.” The referendum passed with a 2:1 margin in Kitchener, but lost by the same margin in Waterloo. The fact that Waterloo is assessment-rich compared to Kitchener, so that a merger would have shifted taxes onto Waterloo residents to maintain service levels, may have played a role in the referendum results. Since Waterloo has rejected amalgamation with Kitchener, the current provincial government’s policy is not to force an amalgamation.
in Ontario has been, and continues to be a one-way street in the direction of fewer and larger municipalities.

In Ontario and other jurisdictions, municipal restructuring has become synonymous with amalgamation in much the same way that “fiscally strong” municipal government has become synonymous with “large” municipal government. Indeed, such equivalencies continue to be asserted by policymakers and restructuring officials. This study tests the validity of such assertions.

1.4 Econometric Model

I have adopted the methods used by Yatchew (2000), who estimated economies of scale in Ontario’s local electricity distribution industry. The approach he used can capture a range of scale effects, such as one in which per-customer costs fall initially, but then rise after some threshold number of customers are served. Since we do not know the shape of the curve for per-household costs in advance, it is ideal to allow for the possibility of various shapes, including flat, linear, and other profiles.

Implementation of the Yatchew (2000) model follows a two-step procedure tailored to the present study. First, the collective effect of the non-scale variables that could affect costs is removed from the cost-per-household variable, leaving a residual variance in the cost-per-household variable that cannot be explained by the non-scale variables. Second, this residual variance is regressed non-parametrically on the scale variable (the number of households), permitting the scale effect to be determined without imposing any functional form or profile onto the resulting curve. For more detail on Yatchew’s method, please see Appendix 1.1.

\[\text{Yatchew (2000) used a semi-parametric, partial-linear model.}\]

\[\text{In a partial-linear model, all variables affecting municipal costs per household (the dependent variable) are assumed to have a linear relationship with those costs, except for the number of households (the scale variable).}\]

\[\text{Population for this study is measured by number of households for statistical analysis. Thus, the terms “population” and “households” are largely interchangeable, as are the terms “per capita” and “per household.”}\]
Below is the econometric model tailored to each of the two municipal services considered, where the subscripts are defined as \(m\) = municipality, \(f\) = fire, and \(p\) = police. Definitions of each of the variables (without the subscripts) are shown in Table 1.4-1.

\[
\ln C_{fm} = f_f(\ln H_m) + \beta_{1f} \ln D_m + \beta_{2f} \ln W_{fm} + \gamma_{1f} ST_m + \gamma_{2f} North_m + \delta_{1f} \ln Calls_m \\
+ \delta_{2f} \ln Response_m + \delta_{3f} FT_m + \delta_{4f} V_m + \delta_{5f} \ln Income_m + e_f m
\]

\[
\ln C_{pm} = f_p(\ln H_m) + \beta_{1p} \ln D_m + \beta_{2p} \ln W_{pm} + \gamma_{1p} ST_m + \gamma_{2p} North_m + \delta_{1p} \ln Crime_m \\
+ \delta_{2p} \ln Accidents_m + \delta_{3p} \ln Income_m + e_p m
\]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Operating costs per household</td>
</tr>
<tr>
<td>H</td>
<td>Number of households</td>
</tr>
<tr>
<td>f(H)</td>
<td>Non-parametric scale effect</td>
</tr>
<tr>
<td>D</td>
<td>Household density (households/km2)</td>
</tr>
<tr>
<td>W</td>
<td>Hourly wage for civil servant</td>
</tr>
<tr>
<td>ST</td>
<td>Indicator for single-tier status</td>
</tr>
<tr>
<td>North</td>
<td>Indicator for being located in northern Ontario</td>
</tr>
<tr>
<td>Calls</td>
<td>Number of emergency calls for fire services per household</td>
</tr>
<tr>
<td>Response</td>
<td>Average response time for fire services</td>
</tr>
<tr>
<td>FT</td>
<td>Indicator for being a full-time fire department</td>
</tr>
<tr>
<td>V</td>
<td>Indicator for being a volunteer fire department</td>
</tr>
<tr>
<td>Crime</td>
<td>Number of criminal offences per household</td>
</tr>
<tr>
<td>Accidents</td>
<td>Number of vehicular accidents/collisions per household</td>
</tr>
<tr>
<td>Income</td>
<td>Average household income</td>
</tr>
</tbody>
</table>

As shown in Table 1.4-1, the model includes non-scale variables that have potential impacts on costs, capturing differences across municipalities that may or may not be related to municipal size. For example, the household density of a municipality can have an effect on service costs, because dense and congested cities may face longer emergency response times, more difficulty in locating and capturing criminals, or a higher risk of the spread of fire between neighbouring structures. Also, wages are included, because they directly affect the costs of service provision. I have included an indicator for single-tier status to capture the effect of providing both regional and local municipal services as opposed to providing just one set or the other. I have also
included an indicator for being located in northern Ontario because materials and other inputs tend to cost more in northern Ontario, given higher transportation costs.

For fire services, the specific output measures used are emergency calls per household and average response time. Emergency calls for fire services are made through Ontario’s 911 system, and the Office of the Fire Marshal requires municipalities to record data for each call. Calls may pertain to fires, explosions, gas leaks, vehicle extrication, medical resuscitation, and those eventually deemed false alarms. Municipalities are also required to record the response time achieved by their fire department for each emergency call, measured as the number of minutes elapsed between when the fire department is notified of (that is, dispatched to) an emergency and when fire trucks or other responding resources first arrive on the scene. Accordingly, more emergency calls per household and lower response times will represent higher service levels delivered.

The composition of a fire department (e.g., full-time, volunteer, hybrid) is considered here as a proxy for unavailable output variables. For instance, full-time fire departments are better able to deliver dispatch, public education, and fire prevention services compared with volunteer fire departments. A fire department is classified as “full-time” if all of its firefighters are either full- or part-time employees, “volunteer” if all of its firefighters are employed as volunteer, and “hybrid” if a combination of full-time, part-time, and volunteer firefighters are employed. Given the differences between full-time and volunteer fire departments, indicator variables on fire department composition are included to capture service level differences.

There are two output variables for police services: crime rates and vehicle collisions on public roads. The level of crime in a municipality affects policing costs, and a stronger criminal presence will likely mean the need for a stronger police presence to provide community safety (although crime rates are at least partly affected by policing service levels). The crime rate is, in a sense, a composite proxy for various types of policing output (e.g., beat patrols, traffic stops, crime prevention activities, etc.), data for which are not readily available—the higher the incidence of crime, presumably the greater the level of policing output required. Similar to the

---

20 In Ontario, firefighters are volunteers if they are not compensated for 24/7 standby services; however, they are usually compensated on an hourly basis for training and for each emergency call to which they respond.
effect of calls for fire service, the number of police-reported vehicle collisions on municipal roads is expected to affect policing costs.

Municipal output is difficult to define completely, so these primary output measures may be seen as deficient. I have therefore included a general proxy for municipal output to mitigate any deficiencies in the primary output measures. Since municipal output is at least partly driven by local demand, which in turn depends on local wealth, average household income is included as an explanatory variable to help capture features that may be underrepresented or missed by the primary output measures.

1.5 Municipal Data

I chose to study fire and police services in particular because these services are uniformly defined across service-providing municipalities, there is a direct connection between costs and population served (especially as congestion sets in), responsibilities are clearly assigned within two-tier systems, and service level data are readily available. Moreover, these services together account for more than 20 percent of municipal operating costs in Ontario, as indicated in Figure 1.5-1.

Data have been assembled for the 445 municipalities in Ontario that existed between 2005 and 2008 and averaged over the four years by municipality. The data are from the Ministry of Municipal Affairs and Housing, the Office of the Fire Marshal (Ontario), the Ministry of Finance, the Ministry of Transportation, and Statistics Canada. Table 1.5-1 summarizes the constituent data used to form the variables appearing in the model, as well as the corresponding sources.

---

21 Social assistance is excluded from the total operating expenditure base, as the costs are currently being phased in as an upload to the provincial government. The phase-in is scheduled to be completed in 2018. Environmental services are composed of water, wastewater, and waste management. The Ministry of Municipal Affairs and Housing defines general government services as governance services (councillors, council support, elections, etc.) and corporate management services (city manager, budgeting, taxation, etc.).

22 Like many other public-sector organizations and institutions dominated by the budgetary process and relatively insulated from economic shocks, municipalities do not dramatically change financial course over time. Data averaged over four years paints a reasonably accurate picture of the state of a municipality's finances.
Figure 1.5-1  Municipal Operating Costs in Ontario

Table 1.5-1  Constituent Data Summary

<table>
<thead>
<tr>
<th>Constituent Data Summary</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Costs</td>
<td></td>
</tr>
<tr>
<td>Number of Households</td>
<td>Ministry of Municipal Affairs and Housing</td>
</tr>
<tr>
<td>Labour Costs</td>
<td></td>
</tr>
<tr>
<td>Municipal Structure</td>
<td></td>
</tr>
<tr>
<td>Geographic Location in Ontario</td>
<td></td>
</tr>
<tr>
<td>Criminal Offences</td>
<td></td>
</tr>
<tr>
<td>Firefighter Staffing</td>
<td></td>
</tr>
<tr>
<td>Emergency Fire Calls</td>
<td></td>
</tr>
<tr>
<td>Average Fire Response Time</td>
<td></td>
</tr>
<tr>
<td>Fire Department Type</td>
<td></td>
</tr>
<tr>
<td>Household Income</td>
<td>Ministry of Finance</td>
</tr>
<tr>
<td>Vehicular Accidents</td>
<td>Ministry of Transportation</td>
</tr>
<tr>
<td>Land Area in km²</td>
<td>Statistics Canada</td>
</tr>
<tr>
<td>Police Officer Staffing</td>
<td></td>
</tr>
</tbody>
</table>

The Ministry of Municipal Affairs and Housing requires municipalities to submit standardized financial information returns and performance measurements annually. These reports contain
information on total service costs, labour costs, households, municipal structure, geographic location, and criminal offences.

The Office of the Fire Marshal requires fire departments to file annual reports on departmental characteristics (e.g., firefighter staffing) and quarterly reports on incidents requiring emergency response (including data used to calculate response times). Staffing levels are divided into total labour costs to obtain average wage rates for firefighters using weights of 0.24 and 0.18 for part-time and volunteer positions, respectively. The Office of the Fire Marshal’s dataset contains data on the number of annual emergencies responded to and the corresponding annual average response time.

As with fire services, police officer staffing levels are divided into total labour costs (reported in the financial information returns) to generate average wages. Households are divided into the number of criminal offences to obtain crime rates per 1,000 households.

Rather than using conventional population statistics (that is, the total number of residents), I have chosen to use the number of households to measure municipal size. Municipalities tend to report their population according to the most recent census (2005 for these data). Many municipalities used their 2005 population for reports from 2005 through 2008, so the population information is often out of date. By comparison, the Municipal Property Assessment Corporation tracks annual changes in the number of households in each municipality as it must continuously update the assessment roll for every municipality, a service critical to maintaining the provincial property tax system. Therefore its numbers are more accurate and up to date. According to Statistics Canada's 2011 Census, the average household in Ontario contains 2.4 residents.

The Ministry of Municipal Affairs and Housing disaggregates the expenditures detailed in the financial information returns into the following standardized categories:

1. Salaries, wages, and employment benefits
2. Long-term debt charges in terms of interest

---

23 These are the standard full-time equivalent (FTE) weights applicable to these positions (Brad Patton, Fire Chief of the Township of Centre Wellington, 2011).
3. Materials

4. Contracted services

5. Rents and financial expenses

6. Long-term debt charges in terms of principal

7. Transfers to own funds (transfers from the revenue fund to other funds)

8. Inter-functional adjustments (internal transfers that sum to zero in the aggregate)

9. Allocation of program support (allocation of overhead costs to each function)

10. Amounts for unfunded liabilities

According to the Ministry of Municipal Affairs and Housing, the definition of operating costs is the sum of the expenditures listed above, minus debt charges (interest and principal) and transfers to own funds. This is therefore the definition adopted here.

Tables 1.5-2 to 1.5-5 show the averaged data for 2005 to 2008. Within any given two-tier system, fire services are provided only by lower-tier municipalities, while police services may be provided either by the upper or the lower tiers. For fire and police operating costs (Tables 1.5-4 and 1.5-5), only the municipalities for which the requisite data for analysis is complete are summarized.

Table 1.5-2  Number of Households

<table>
<thead>
<tr>
<th>Municipalities</th>
<th>Count</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Tiers</td>
<td>241</td>
<td>9,334</td>
<td>20,380</td>
<td>192</td>
<td>222,800</td>
</tr>
<tr>
<td>Upper Tiers</td>
<td>30</td>
<td>75,691</td>
<td>90,156</td>
<td>13,610</td>
<td>380,000</td>
</tr>
<tr>
<td>Single Tiers</td>
<td>174</td>
<td>15,612</td>
<td>85,504</td>
<td>48</td>
<td>1,052,945</td>
</tr>
<tr>
<td>All Municipalities</td>
<td>445</td>
<td>16,262</td>
<td>62,737</td>
<td>48</td>
<td>1,052,945</td>
</tr>
</tbody>
</table>

24 Except for the County of Oxford (which is legally equivalent to a regional municipality), all regional municipalities provide policing. Out of Ontario’s 22 counties, only the County of Wellington and the County of Stormont, Dundas, and Glengarry have been delegated policing responsibility by their lower-tier municipalities.
Table 1.5-3  Land Area (Km²)

<table>
<thead>
<tr>
<th>Municipalities</th>
<th>Count</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Tiers</td>
<td>241</td>
<td>363</td>
<td>259</td>
<td>2</td>
<td>1,474</td>
</tr>
<tr>
<td>Upper Tiers</td>
<td>30</td>
<td>2,916</td>
<td>1,375</td>
<td>967</td>
<td>7,382</td>
</tr>
<tr>
<td>Single Tiers</td>
<td>174</td>
<td>387</td>
<td>587</td>
<td>2</td>
<td>3,201</td>
</tr>
<tr>
<td>All Municipalities</td>
<td>445</td>
<td>544</td>
<td>837</td>
<td>2</td>
<td>7,382</td>
</tr>
</tbody>
</table>

Table 1.5-4  Fire Costs Per Household

<table>
<thead>
<tr>
<th>Municipalities</th>
<th>Count</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Tiers</td>
<td>227</td>
<td>$144</td>
<td>$90</td>
<td>$36</td>
<td>$502</td>
</tr>
<tr>
<td>Single Tiers</td>
<td>151</td>
<td>$167</td>
<td>$97</td>
<td>$26</td>
<td>$438</td>
</tr>
<tr>
<td>All Municipalities</td>
<td>378</td>
<td>$153</td>
<td>$93</td>
<td>$26</td>
<td>$502</td>
</tr>
</tbody>
</table>

Table 1.5-5  Police Costs Per Household

<table>
<thead>
<tr>
<th>Municipalities</th>
<th>Count</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper/Lower Tiers</td>
<td>30</td>
<td>$562</td>
<td>$82</td>
<td>$389</td>
<td>$722</td>
</tr>
<tr>
<td>Single Tiers</td>
<td>29</td>
<td>$620</td>
<td>$133</td>
<td>$363</td>
<td>$933</td>
</tr>
<tr>
<td>All Municipalities</td>
<td>59</td>
<td>$591</td>
<td>$113</td>
<td>$363</td>
<td>$933</td>
</tr>
</tbody>
</table>

Only those municipalities served by a local police force are included in the police analysis. Municipalities served by the Ontario Provincial Police (OPP) are excluded because the OPP is engaged in policing at the provincial level rather than the municipal level. In addition to its hundreds of municipal policing contracts, the OPP polices provincial highways, waterways, government buildings, native reserves, and casinos, and deals with large-scale issues such as organized crime and terrorism. The OPP also provides specialized services and assistance (e.g., forensic analysis, air support, emergency management, explosive device response, cold case review, etc.) to municipal police forces when the need arises. Moreover, the Police Services Act requires the OPP to heavily discount payable rates for municipalities meeting certain criteria and even requires the OPP to provide policing free of charge to certain municipalities. Since the OPP operates in a way that is completely different from that of local police forces, municipalities procuring its services have been excluded from the police analysis.
1.6 Results

The results for each service are shown in Figures 1.6-1 and 1.6-2, where the graphs show cost per household on the vertical axis and a logarithmic scale for the number of households on the horizontal axis (the logarithmic scale is used to narrow the wide range of municipal size). These graphs plot (i) the residualized cost for each municipality once the non-scale effects are removed, (ii) the per-household cost curve non-parametrically fitted to these residualized costs, and (iii) an alternative quadratic curve representing a parametric quadratic model (the conventional type of model typically used in the literature).

The estimates of the coefficients for both the partial-linear model and the quadratic model as well as confidence bands for the partial-linear model’s cost curves are provided in Appendix 1.2. The presence of economies of scale has been checked using the V-statistic and the competing quadratic model has been tested against the partial-linear model using a V-test. The V-test determines whether the quadratic model can fit the data as well as the partial-linear model. The V-statistic and the V-test are defined in Appendix 1.1.

1.6.1 Fire Services

It is clear that calls per household and response times have a statistically significant effect on costs. A 10 percent increase in the number of calls per household raises costs per household by about 2.7 percent, whereas achieving a 10 percent decrease in average response time raises costs per household by about 2.6 percent. Also, the average wage in a fire department affects costs as expected, in that a 10 percent increase in the wage increases costs per household by about 2.2 percent. Full-time fire departments appear to have a cost premium of about 35 percent compared with mixed full-time/volunteer fire departments, whereas volunteer fire departments’ costs are about 74 percent as high. These results imply that volunteer fire departments are about 55 percent as costly as full-time fire departments. Whether a municipality is located in the north or is of a single-tier structure does not appear to affect fire costs.
The graph in Figure 1.6-1 suggests a strong and significant scale effect as represented by the U-shaped cost curve. This relationship is supported by the large V-statistic of 8.3, which indicates that these services do not operate under constant returns to scale. Moreover, the V-test, with a test statistic of 1.9, shows that the fit of the partial-linear model is more congruent with the data than that of the quadratic model. The partial-linear model results suggest that the cost of fire services falls from about $300 per household for a small village to about $110 per household for a medium-sized town with a minimum efficient scale (MES) of approximately 9,000 households. These results suggest that the lowest fire costs are achieved by medium-sized towns and large townships, such as the Town of Grimsby or the Township of Scugog, where the population is about 20,000 residents.

25 This figure compares to an MES of about 14,000 households for the quadratic model.
1.6.2 Police Services

Some of the non-scale variables affect the cost of police services. Density appears to have a statistically significant effect on costs, in that a 10 percent increase in density increases costs by 0.66 percent. Also, a 10 percent increase in the crime rate is associated with a 1.8 percent increase in costs per household. The number of vehicle accidents, the average police department wage, and average household income appear to have no impact on costs. The fact that wages do not seem to affect costs suggests data or reporting inconsistencies for the constituents of this variable are present. Although a single-tier municipal structure does not seem to affect police costs, northern municipalities do seem to experience a cost premium in the order of 10 percent. Overall, the police analysis is not as strong as that for fire services, especially considering that only 59 observations were left once the OPP-contracting municipalities (including those using a hybrid of local and OPP policing) were omitted.

Figure 1.6-2 Police Costs: Partial-Linear Model vs. Quadratic Model

![Graph showing police costs comparison](image-url)
The partial-linear model generates a U-shaped per-household cost curve in which predicted per-household costs fall from $650 to $530 at a MES of about 21,000 households, and eventually rise again to $650.\textsuperscript{26} Although the V-statistic of 2.9 indicates that police services do not exhibit constant returns to scale, the V-test indicates that the partial-linear model is not necessarily superior to the quadratic model, probably because there are only 59 observations available for the police analysis. Indeed, the partial-linear model regression line for police is less smooth than that of fire services, since the former service has far fewer observations than the latter. The partial-linear model results suggest that the lowest police costs are achieved by small cities, such as the City of North Bay or the City of Belleville, which have populations of about 50,000 residents.

\textbf{1.6.3 Limitations}

Given this study’s reliance on municipally reported data and the need to combine information from separate databases held by different organizations, it was inevitable that some limitations would be encountered. These limitations are summarized in Table 1.6-1.

\begin{table}[h]
\centering
\begin{tabular}{|c|p{0.7\textwidth}|}
\hline
\textbf{Summary of Limitations} & \\
\hline
\textbf{Limitation} & \textbf{Description} \\
\hline
FIR Reporting Inconsistencies & Municipal FIR reporting may not be standardized in practice, even though in theory the rules and guidelines for FIR reporting are standardized. \\
\hline
Data Reporting Errors & Municipalities and other organizations may report incorrect or internally/mutually inconsistent data. For instance, there is evidence of such inconsistency with wage and staffing data, which may explain why dividing total staffing into aggregate wages sometimes yields questionable average wages, especially for police services. \\
\hline
Absence of Capital Costs & Capital costs could not be included; only operating costs were analyzed. Since the quality of capital equipment and structures can affect operating costs, economies of scale inferred from only operating costs may not reflect those for total costs. \\
\hline
Low Number of Local Police Services & Only 59 observations were available for police services, whereas fire services had 378 observations, which is why the partial-linear model curve for police is less smooth than that of fire and is also likely why the quadratic model could not be rejected for police services. \\
\hline
Relationship between Crime Rates and Police Expenditures & Since a component of the level of crime in a municipality is likely affected negatively by policing expenditures (via deterrence, diminished opportunity to commit crime, etc.), there may be a downward bias on the crime effect, thereby potentially affecting the results for economies of scale. \\
\hline
\end{tabular}
\end{table}

\textsuperscript{26} This figure compares to an MES of about 35,000 households for the quadratic model.
1.7 Concluding Remarks

The debate as to whether municipalities in Ontario enjoy economies of scale has been at the heart of this paper and its analyses of fire and police services, which together account for more than one-fifth of total municipal operating costs. A featured approach of the paper was to estimate the scale effect for these services in a manner that would remove the need to make any prior assumptions about the functional profile and shape of the cost per household curve. Another feature was the inclusion of municipal output measures for fire and police services (such as response times and crime rates), which had not been undertaken in any prior Ontario-based study on municipal economies of scale.

Overall, the evidence indicates that economies of scale certainly do exist for fire and police services, but it also indicates that these economies are limited. These services exhibited scale effects inconsistent with constant returns to scale, unlimited increasing returns, and global decreasing returns.

Specifically, fire services exhibited U-shaped per household costs, which were minimized at about 20,000 residents. The cost of a fire department was clearly affected by the number of calls received and average response time. Police services also exhibited U-shaped per-household costs, which were lowest for a municipality of about 50,000 residents. Population density and crime rates were found to significantly affect policing costs.

This general cost structure is inconsistent with the unqualified promise of cost savings typically advanced by municipal amalgamation proponents, at least for these two services. Indeed, the data do not support a premise of unlimited capacity to realize municipal economies of scale.
References


1.8 Appendix 1.1 - Partial-Linear Estimation Method

Following Yatchew (2000) and suppressing subscripts, the general model employed is of a partial-linear structure: 27

\[ y = f(x) + z\beta + e \]

Here, the non-parametric variable \( x \) is the log of households and the vector \( z \) comprises the various covariates entering the model parametrically. Given this specification’s additive separability, it is amenable to differencing techniques, where differencing may be of any order \( m \geq 1 \). Thus, a two-step estimation process can be used, where the parametric effect \( \beta \) is estimated first using differencing and parametric techniques, followed by the estimation of the non-parametric effect \( f(x) \) using non-parametric (e.g. local averaging) techniques.

The essential requirement for the validity of the differencing estimators is that the average distance between the ordered \( x' \)’s asymptotically approaches zero sufficiently fast either with the order of differencing or the sample size, both of which decrease the variance of \( \hat{\beta} \) (which may be obtained by ordinary least squares) as they grow. With this requirement satisfied, it can be shown that the parametric estimator generated by differencing is asymptotically Normal, where

\[
\hat{\beta} \sim N(\beta, \left(1 + \frac{1}{2m}\right)\frac{\sigma_e^2}{n}\Sigma_{z|x}^{-1})
\]

where \( m \) is the order of differencing, \( n \) is the sample size, \( \sigma_e^2 \) is the variance of \( e \), and \( \Sigma_{z|x} \) is the expected value of \( Cov(z|x) \), where \( \sigma_e^2 \) and \( \Sigma_{z|x} \) can be estimated consistently. Notice that the variance of \( \hat{\beta} \) decreases in both the order of differencing and number of observations. Second-order differencing (i.e. \( m = 2 \)) is used for both fire and police analyses, but it should be noted that each order of differencing necessarily results in the loss of an observation. See Yatchew (1998, 2000) for details on differencing procedures and the asymptotic properties of the parametric estimator.

---

27 The discussion that follows is consistent with consideration of a cross-section of data, and so references to variables should be interpreted accordingly.
This estimation process requires the data to be ordered according to the non-parametric variable $x$, thus ensuring that the $x$'s are “close” to one another, so that differencing the data removes the non-parametric effect. With the non-parametric effect removed, the parametric effect can be isolated and estimated using conventional techniques (e.g. ordinary least squares) on the differenced data to obtain the estimator $\hat{\beta}$. Subsequently, the predicted parametric effect $z\hat{\beta}$ can be removed from $y$ to allow for pure non-parametric estimation of $f(x)$ by using a smoothing or local averaging procedure on the approximation

$$y - z\hat{\beta} = z(\beta - \hat{\beta}) + f(x) + e \cong f(x) + e$$

For this analysis, the local averaging procedure “Running” is used once the parametric effect is removed, which is a running line smoothing technique and a type of Symmetric Nearest Neighbour Smoother (SNNS).\(^{28}\) Essentially, Running estimates each point in the dataset by running a locally weighted least squares regression on the ordered data points that lie within a symmetric local neighbourhood of the point of estimation. Each data point captured in this local neighbourhood is assigned a weight proportional to its distance from the point of estimation so that points farther away receive lower weights, while points outside of the local neighbourhood receive zero weight.

For the SNNS Running, a local neighbourhood is defined as a proportion $\mu$ of the number of observations $n$, so that each local regression uses the closest $\mu n$ points (rounded up to the nearest integer) to the point of estimation. In this sense, $\mu \in (0,1]$ represents a bandwidth, so that larger values of $\mu$ lead to greater degrees of smoothing as larger bandwidths of the data are used for local estimation. A bandwidth of 75 percent is applied to both fire and police services to implement the local smoother Running.

As discussed in Yatchew (2000), various parametric hypotheses can be tested against the partial-linear specification using the V-statistic (under the null hypothesis)

\(^{28}\) One advantage of using Running is that it is capable of producing 95 percent confidence bands around the smoothed function. See Lokshin (2003) for a treatment of partial-linear regression and Cleveland and Devlin (1988) for a more general treatment of local averaging techniques.
\[ V = \sqrt{mn} \left( \frac{S_R^2 - S_{PL}^2}{S_{PL}^2} \right) \rightarrow N(0,1) \]

where \( S_R^2 \) is the estimate of the residual variance of the parametric model (an alternative hypothesis), \( S_{PL}^2 \) is the estimate of the residual variance of the partial-linear model (the null hypothesis), \( m \) is the order of differencing, and \( n \) is the number of observations used for the partial-linear model.

An alternative hypothesis will comprise a parametric specification of \( f(x) \), such as a constant, linear, or quadratic functional form with respect to \( x \), as well as a parametric estimation method (e.g., ordinary least squares). Testing against such an alternative is one-sided since the partial-linear model should always be able to explain more than an analogous parametric model \((S_R^2 > S_{PL}^2)\), meaning that a V-statistic above 1.65 will be considered significant at the conventional 5 percent level.

The default alternative hypothesis tested is \( f(x) \) specified as a constant function (i.e., the default alternative hypothesis is constant returns to scale), thus the V-statistic can be viewed as test for the presence of economies of scale. However, it will prove worthwhile also to test against an analogous fully parametric quadratic model, as this functional form is ubiquitous throughout the literature. The test comparing the partial-linear model against the quadratic model is called the V-test.

---

29 Differencing is generally not used for such an alternative hypothesis.

30 For analyses with a relatively low number of observations, differencing may actually cause the partial-linear model to have less explanatory power than a fully parametric alternative model, since each order of differencing necessitates the loss of an observation.

31 By default, the partial-linear output tables are generated indicating explanatory power in relation to variation in the differenced data as opposed to the original data. Therefore, R-squared numbers in the partial-linear output tables have been adjusted after estimation so that they indicate explanatory power in relation to the original data.
### 1.9 Appendix 1.1 - Estimation Output and Confidence Bands

#### Table 1.9-1 Fire Partial-Linear Model Output

<table>
<thead>
<tr>
<th>Partial Linear regression model with Yatchew's weighting matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
</tr>
<tr>
<td>Model</td>
</tr>
<tr>
<td>Residual</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

| Variable   | Coef.     | Std. Err. | t    | P>|t| | [95% Conf. Interval] |
|------------|-----------|-----------|------|--------|---------------------|
| logfire    | -.0628581 | .0177167  | -3.55| 0.000  | -.097697 -.0280191  |
| logdensity | .0733865  | .0781503  | 0.94 | 0.348  | -.080292 .2270651  |
| st         | -.0119259 | .089107   | -0.13| 0.894  | -.1871503 .1632985 |
| north      | .2688715  | .0284471  | 9.45 | 0.000  | .2129317 .3248113  |
| logfirecalls| .0733865  | .0781503  | 0.94 | 0.348  | -.080292 .2270651  |
| logresponse| -.2632686 | .0699239  | -3.77| 0.000  | -.4007704 -.1257667 |
| ft         | .3459411  | .0284471  | 9.45 | 0.000  | .2891537 .4017286  |
| v          | -.2592917 | .0552934  | -4.69| 0.000  | -.3680234 -.1505599 |
| logfirewage| .2200775  | .0296871  | 7.41 | 0.000  | .1616994 .2784556  |
| logincome  | .0306574  | .0289153  | 1.06 | 0.290  | -.026203 .0875179  |

Significance test on loghouse: V = 8.281 P>|V| = 0.000

---

#### Table 1.9-2 Fire Quadratic Model Output

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>Number of obs = 378</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>80.1277941</td>
<td>11</td>
<td>7.28434491</td>
<td>F(11, 366) = 69.62</td>
</tr>
<tr>
<td>Residual</td>
<td>38.2938378</td>
<td>366</td>
<td>.104627972</td>
<td>R-squared = 0.6669</td>
</tr>
<tr>
<td>Total</td>
<td>118.421632</td>
<td>377</td>
<td>.314115734</td>
<td>Root MSE = .32346</td>
</tr>
</tbody>
</table>

| Variable   | Coef.     | Std. Err. | t    | P>|t| | [95% Conf. Interval] |
|------------|-----------|-----------|------|--------|---------------------|
| loghouse   | -.9642936 | .1093619  | -8.82| 0.000  | -1.17935 -.749237  |
| loghousesq | .0503322  | .0061404  | 8.20 | 0.000  | .0382572 .0624071 |
| logdensity | -.0603023 | .0162382  | -3.71| 0.000  | -.0923841 -.0283705 |
| st         | .1111031  | .071628   | 1.55 | 0.122  | -.029751 .2519572 |
| north      | .0110219  | .0832479  | 0.13 | 0.895  | -.1526823 .174726 |
| logfirecalls| .2618448  | .0272675  | 9.60 | 0.000  | .2082241 .3154655 |
| logresponse| -.2947016 | .0664848  | -4.43| 0.000  | -.4254417 -.1639615 |
| ft         | .5008758  | .0796265  | 6.29 | 0.000  | .3442929 .6574586 |
| v          | -.2150697 | .0482405  | -4.46| 0.000  | -.3099331 -.1202064 |
| logfirewage| .2139126  | .028063   | 7.62 | 0.000  | .1587276 .2690977 |
| logincome  | .0486264  | .0260867  | 1.86 | 0.063  | -.0026723 .0999251 |
| _cons      | 8.120401  | .622935   | 13.04| 0.000  | 6.89542 9.345382  |

---
Figure 1.9-1  Fire Costs: Partial-Linear Model with 95% Confidence Band

Table 1.9-3  Police Partial-Linear Model Output

|                | Coef. | Std. Err. | t    | P>|t|  | [95% Conf. Interval] |
|----------------|-------|-----------|------|------|----------------------|
| logpolice      | 0.065503 | 0.0178209 | 3.68 | 0.001 | 0.0297086 - 0.1012974 |
| logdensity     | -0.0089492 | 0.0513483 | -0.17 | 0.862 | -0.1120854 - 0.094187 |
| st             | 0.1130646 | 0.0612461 | 1.94 | 0.058 | -0.003952 - 0.2420808 |
| north          | 0.1842267 | 0.0702462 | 2.62 | 0.012 | 0.0431331 - 0.3253203 |
| logcrime       | -0.0451094 | 0.1335952 | -0.34 | 0.737 | -0.3134434 - 0.2232245 |
| logaccidents   | 0.0109172 | 0.0503341 | 0.22 | 0.829 | -0.0921818 - 0.1120161 |
| logpolicewage  | 0.0090741 | 0.122453 | -0.07 | 0.941 | -0.2550283 - 0.2368801 |

Significance test on loghouse: V = 2.900 P>|V| = 0.002
Table 1.9-4    Police Quadratic Model Output

### Police Quadratic Model Output

```stata
reg logpolice loghouse loghousesq logdensity st north logcrime logaccidents logpolicewage logincome if opp==0
```

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>Number of obs = 59</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>1.24821966</td>
<td>9</td>
<td>.138691074</td>
<td>F(  9,    49) = 8.30</td>
</tr>
<tr>
<td>Residual</td>
<td>.818939908</td>
<td>49</td>
<td>.016713059</td>
<td>Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td>Total</td>
<td>2.06715957</td>
<td>58</td>
<td>.035640682</td>
<td>Adj R-squared = 0.5311</td>
</tr>
</tbody>
</table>

| logpolice | Coef. | Std. Err. | t    | P>|t| | [95% Conf. Interval] |
|-----------|-------|-----------|------|-----|------------------|
| loghouse  | -.5385034 | .136062   | -3.96 | 0.000 | -.8119303 -.2650765 |
| loghousesq | .0257039 | .0065893  | 3.90  | 0.000 | .0124622 .0389456 |
| logdensity | .0498185 | .0164132  | 3.04  | 0.004 | .0168350 .0828020 |
| st       | -.0068305 | .0478953  | -0.14 | 0.887 | -.1030797 .0894188 |
| north    | .095564  | .0624555  | 1.53  | 0.132 | -.0299451 .221073 |
| logcrime | .2479792 | .0644371  | 3.85  | 0.000 | .1184881 .3774704 |
| logaccidents | -.0222573 | .0328578 | -0.68 | 0.501 | -.0882875 .0437728 |
| logpolicewage | -.0017426 | .1351331 | -0.01 | 0.990 | -.2733027 .2698176 |
| income | .0612438 | .119216  | 0.51  | 0.610 | -.1783298 .3008174 |
| _cons    | 6.860406  | 1.756178 | 3.91  | 0.000 | 3.331235 10.38958 |

Figure 1.9-2    Police Costs: Partial-Linear Model with 95% Confidence Band

![Partial-Linear Model with 95% Confidence Band](image)
Chapter 2
Business Property Taxes and the Marginal Effective Tax Rate on Capital

2.1 Introduction

Over the past decade, governments in Canada have taken measures to reduce the burden of business taxation and improve upon tax and investment competitiveness inter-provincially and internationally (Canada, 2013). Significant reductions have been made to federal and provincial corporate income tax (CIT) rates, the federal government eliminated its corporate capital tax (CCT) and four of the 10 provinces have either eliminated or refrained from imposing provincial CCTs; the remaining six provinces have restricted the provincial CCT to the banking sector only. Moreover, the retail sales tax (RST) of seven provinces is now harmonized with the federal Goods and Services Tax (GST), transforming those provincial RSTs from a distortionary multi-stage sales tax into an investment-neutral value-added tax.

To measure and document the progress of various federal and provincial tax reforms, Finance Canada (the federal Department of Finance) regularly publishes estimates of the marginal effective tax rate (METR) on capital investment at the provincial and national levels:

“The marginal effective tax rate is an internationally recognized comprehensive indicator of the tax burden on new business investment. It combines into a single measure the statutory income tax rate, deductions and credits associated with purchasing capital goods, and parameters related to the financial structure of firms and their cost of capital.” (Canada, 2013)

---

32 Portions of this chapter constitute original material composed by me during 2012-2013 and subsequently incorporated into parts of Found and Tomlinson (2012) and/or Found, Dachis and Tomlinson (2013), both of which are copyrighted publications of the C.D. Howe Institute. Since I am the sole author of such original material, permission to reproduce or otherwise adaptively incorporate it as part of this thesis without limitation has been expressly granted by the C.D. Howe Institute, the copyright holder. © C.D. Howe Institute.

33 Saskatchewan levies CCT rates of 3.25% and 0.70% for large and small financial corporations, respectively. Manitoba levies a CCT rate of 5.00% on large trust and loan corporations. New Brunswick levies a CCT rate of 4.00% on financial corporations, and so do Nova Scotia and Newfoundland and Labrador. Prince Edward Island levies a CCT rate of 5.00% on financial corporations.
In other words, the METR is the effective tax rate faced by the marginal investment and is a single summary measure of the tax burden imposed on new capital investments made by businesses. Throughout this paper, the term “METR” means the “METR on capital investment”.

The METR is the percentage difference between gross-of-tax and net-of-tax rates of return from new investment received by investing businesses, using the latter quantity as the base (McKenzie, et al., 1998). That is, the METR is the cumulative tax wedge driven between the return on investment and the return on savings for the marginal investment (King & Fullerton, 1984). Among economists and policy analysts, the METR is a widely-accepted basis on which to make summary inter-jurisdictional comparisons of tax competitiveness.

Since taxes included in the METR appear to receive considerable attention from governments and policymakers, it is no surprise that recent tax reforms in Canada have tended to target those taxes most heavily (McKenzie, 1994); (Chen & Mintz, 2006); (Mintz, 2009). A testament to this effect can be linked to Chen & Mintz (2006), in which Ontario draws severe criticism for its lack of tax competitiveness. Based on their inter-provincial METR analysis, the authors strongly suggest the following course of action for Ontario, the province with the highest projected 2010 METR at the time:

“If Ontario wishes to address its uncompetitive position, it needs to consider: phasing out its capital tax more rapidly (2012 is far too long to wait); reforming its sales tax by adopting a VAT; and reducing more dramatically its corporate income tax rate, which is high by international standards.” (Chen & Mintz, 2006)

Within four years of Chen & Mintz (2006), Ontario tackled each one of these METR-based recommendations. While Ontario’s progress is not definitive proof that METR analysis will always motivate jurisdictions to undertake desirable tax reform, it certainly supports the notion that jurisdictions pay attention to taxes represented in the METR.

In Ontario, and in other provinces such as Saskatchewan, the recent wave of Canadian tax reform has spilled into the realm of the business property tax (BPT). Since creating its province-wide BPT in 1998 by taking over the education property tax from local school boards, Ontario has implemented a number of BPT reductions with the most recent one taking place in 2012. In the 2008 Ontario budget, the provincial government made it clear that its 2007-2014 BPT reduction
program (currently suspended until the provincial deficit is eliminated) was intended to build on previous measures taken to improve Ontario’s investment climate and competitiveness:

“The BPT reductions are key elements in the government’s overall strategy to enhance Ontario’s investment climate. This initiative (the BPT reduction program) will also reduce the wide variation in BPT rates across the province. The variation in rates distorts efficient business location decisions, placing many regions of the province at a disadvantage and harming the provincial economy.” (Ontario, 2008)  

Like Ontario, eight other provinces in Canada have instituted a provincial BPT. While this tax appears to generally escape the heightened scrutiny and attention received by other business taxes such as the CIT and CCT, business advocates continue to deride the BPT as having “…the same attributes as a corporate capital tax – the most important being that it increases the cost of ownership and this cost is imposed whether or not a firm is profitable or has cash flow to meet it.” (Greater Saskatoon Chamber of Commerce and Regina and District Chamber of Commerce, 2009)

In the 2012 annual report on business tax rates and ratios for major urban centres in Canada, Altus Group noted that “The continued reduction of excessive property tax burdens on commercial and industrial properties will make cities more competitive, promote jobs and investment, result in increases to the property assessment base, and subsequently generate more stable and sustainable revenue.” (Altus Group, 2012)

Also, as Ontario noted in its 2007 budget, “Business representatives, including the Ontario Chamber of Commerce and Canadian Federation of Independent Business, have criticized high BPT rates as being unfair and as being a barrier to economic competitiveness.” (Ontario, 2007)

Finally, the Greater Saskatoon Chamber of Commerce recently noted that

---

34 In this quotation I have replaced the acronym BET (Business Education Tax) with BPT for consistency and clarity with respect to the general-revenue nature of the Business Education Tax despite its now obsolete and obviously misleading name.

35 For the same reasons as before, I have replaced the acronym BET (Business Education Tax) with BPT in this quotation.
“Property taxes are an important aspect in determining profitability and investment decisions. While they are not the only aspect, a poor property tax policy can offset the benefits of an otherwise positive investment environment while a competitive property tax policy can make a mediocre investment environment more attractive.” (Greater Saskatoon Chamber of Commerce, 2012)

All this evidence indicates there is a general consensus among governments and business advocates that BPTs impede the competitiveness of jurisdictions for investment. On top of provincial BPTs are municipal BPTs that are often levied at much higher rates, posing an even greater impediment to investing businesses than provincial BPTs.

The BPT however has unfortunately lacked the presence and careful treatment it deserves in METR studies. This is not just a Canadian problem as the BPT has been missing from METR studies and estimates for over 25 years. Indeed, to my knowledge, such a study has not included BPT since Daly & Jung (1987).36 While Finance Canada continues to publish official provincial and national METR estimates in federal budgets, these estimates have so far omitted the BPT entirely. Also, previous METR studies rarely quantify the contribution individual capital taxes make to the METR, rendering the results essentially useless for determining optimal tax reform strategies and targeting. Moreover, to my knowledge no previous METR study has computed BPT-inclusive METR estimates at either the subnational level or municipal level.

These holes in the literature are both surprising and troubling since, as one reputable public finance economist noted recently, “Property taxes on commercial and industrial property increase the marginal effective tax rate on capital, discouraging investment in structures, and reducing the competitiveness of the business sector.” (Dahlby, 2012) Indeed, the very essence and usefulness of the METR itself depend on the extent to which it captures the general level of taxation actually imposed on investing businesses. In line with the view of Dahlby (2012) and as the present study will reinforce, there is no question that provincial and municipal BPTs ought to be included in METR estimates, subject to accounting for potential benefit taxation at the municipal level.

36 Found and Tomlinson (2012) and Found, Dachis and Tomlinson (2013) are prior published adaptations/versions of the present study and hence inherit the present study’s contribution to the literature.
I hence extend the literature by (i) recasting the METR theory and tailoring it to Canada, (ii) using appropriate assessment and property tax regime data to considerably improve upon the calculation of effective BPT rates and (iii) computing updated 2013 BPT-inclusive METR estimates stratified by individual tax contribution for each of Canada’s 10 provinces and the largest municipality therein.

The rationale for the focus on the largest municipality only in a province is twofold. First, since the provincial METR will form the base onto which the METR contribution of any of its municipalities will add, investing businesses are much more likely to find municipal METRs more relevant to deciding where to specifically invest compared to provincial METRs. Second, data limitations currently preclude reliable calculation or approximation of province-wide average municipal BPT rates. The METR contribution of the largest municipality in each province is of interest also because it gives a sense of the general impact of municipal business taxation within a province and thereby improves inter-provincial comparability.

In brief, I find that BPTs contribute substantially to the METR, where provincial and municipal BPTs represent 9.7 and 19.5 percentage points, respectively, of the 47.8% Canadian METR. In some provinces and municipalities, the impact is far more damaging. With the combined Province of Ontario and City of Toronto BPT impact most similar to the nationwide average, their BPTs are estimated to contribute 37.5 and 32.3 percentage points, respectively, to the total (unweighted) METR on buildings of 83.9% for Toronto. I also find that relative competitiveness among provinces depends crucially on whether the BPT is included in the METR, reinforcing the need for governments and policymakers to begin reflecting the BPT in the METR.

2.2 Literature Review

METR analysis has its roots in the pioneering work of King & Fullerton (1984). The concept of the METR is quite intuitive: the METR is a measure of the tax wedge driven between the rate of return on savings and the rate of return on investment caused by taxes on capital. As it turns out, the METR literature has largely focused on the Canadian tax system and comparing it to other national jurisdictions. Before delving into the details of METR theory, it is helpful to describe a simplified version of it within the context of a Canadian province. Throughout, all rates of return, and other variables as applicable, are measured in real (as opposed to nominal) terms, unless otherwise indicated specifically.
2.2.1 Taxing Capital in a Small Open Economy

The general framework for METR theory is developed in King & Fullerton (1984), in which savers and corporations interact in a capital investment market. The discussion in this subsection is restricted to the so-called “fixed-r” case, as defined in King & Fullerton (1984), since the return on savings is assumed fixed and representable by a perfectly elastic capital supply curve. The alternative case noted in King & Fullerton (1984) is the so-called “fixed-p” case in which the return on investment is assumed fixed. Since the fixed-r (i.e. open economy) assumption is the alternative arbitrage assumption almost always applied in the literature and since it is representative of a “small” capital market, such as Canada, then it is the alternative adopted herein.

METR theory largely considers savers as domestic within the jurisdiction analyzed, which fits well with the fixed-r assumption since under it savers must earn a common rate of return net of personal income tax (PIT) if they are to demand a common gross-of-PIT rate of return. Savers earn this rate of return through a combination of corporate bond and share ownership. In equilibrium the return on debt and equity must be equal so that savers are indifferent about how their savings are apportioned across financing debt and financing equity. Under most PIT systems personal income earned by financing debt is usually taxed at a rate higher than that earned by financing equity to reflect the fact that corporate profits are subject to CIT prior to being capitalized into share values as retained earnings or divested as dividends. Since in METR theory the share of total savings financing debt is fixed for simplicity, the gross-of-PIT rate of return on financing debt will typically be higher than that of financing equity.

On the demand side of the market are corporations seeking to make capital investments in their operations in order to increase productivity and profit. With diminishing returns to capital, corporations will invest until the marginal revenue product of the last unit of investment is equal to the corresponding marginal cost. In the absence of capital taxes, the gross-of-depreciation marginal revenue product of the last unit of investment will be equal to the return on savings in a perfectly competitive capital market like that shown in Figure 2.2-1. In this environment, the hurdle rate of return for an investment to proceed is simply the return on savings. Taxes levied on capital, along with associated tax allowances and investment tax credits, however, affect the cost of capital. Overall, tax systems discourage investment because they raise the rate of return
required to proceed with any given investment above the return on savings. The higher is this gross-of-tax hurdle, the less economically viable is any given investment.

**Figure 2.2-1 Taxing Capital in a Small Capital Market**

![Taxing Capital in a Small Capital Market](image)

Since a Canadian province’s capital market is small in relation to the global capital market, its supply of capital can be represented by the perfectly elastic marginal cost function \(MC\) in Figure 2.2-1. The demand curve for capital \(D\) is the marginal revenue product \(MRP\) of capital as a function of capital invested annually \(K\), and is downward sloping as per convention to reflect diminishing returns. For simplicity and without loss of generality, depreciation, inflation and uncertainty are omitted from the diagram.

In an environment without capital taxes, the marginal cost faced by capital demanders (i.e. investing businesses) is \(MC\) which must be equal to the rate of return \(R\) for domestic capital supplied in alternative jurisdictions (i.e. the opportunity cost of investment). If capital suppliers cannot earn at least \(R\) in the province, they will invest elsewhere. All capital projects yielding at least \(R\) to investing businesses proceed. In the absence of capital taxes users face a marginal cost of \(R\) where market equilibrium is defined by \(R = MC = MRP\), where \(K^*\) units of capital are invested.

Federal and provincial taxes levied on capital users become incorporated into the marginal user cost of capital, causing the no-tax \(MC\) to shift upwards to the gross-of-tax \(MCG_t\). With the supply of capital perfectly elastic, the entire incidence of these taxes falls on investing businesses as
they are unable to shift any portion of the tax burden onto capital suppliers. The new equilibrium point occurs where $MRP = MC_t$ at the gross-of-tax rate of return $R_t$. Investing businesses no longer find it profitable to invest in capital projects that yield a marginal revenue product between $R_t$ and $R$. We see that capital taxes cause the equilibrium level of annual investment to fall to $K_t^*$ as investing businesses respond to the increased marginal user cost of capital. The shaded rectangle represents the tax revenue collected while the triangle adjacent to the right represents the deadweight loss to society caused by capital taxes – the value of forgone investment less tax revenue.

The METR is defined by the percentage increase in the marginal user cost of capital caused by capital taxes, hence the METR is equal to $(R_t - R)/R$. This means the METR represents the wedge driven between the rate of return on savings and the rate of return on capital investment as a percentage of the former. The literature is however somewhat divided over two possibilities regarding the denominator (i.e. base) in the METR calculation. Some studies use $R_t$ while others use $R$.

My view is that using $R$ for the METR base facilitates comparability of METRs between different types of capital that have different values of $R_t$ under the small open economy framework. In addition, it is conventional in the public finance literature to view a tax as a premium to be paid on top of the associated pre-tax cost. For instance, as a consumer in Ontario I spend $1.13 when I purchase a good for a price of $1.00 due to the HST levied in Ontario. The HST rate I therefore face as a consumer is $0.13/$1.00 = 13% as opposed to $0.13/$1.13 = 11.5%. The same principle applies to the purchase of capital goods subject to capital taxes – the intuitive and proper base on which to evaluate a tax rate is the pre-tax price. For the above reasons, since the METR is ultimately a tax applied to the base $R$, I align with the theoretical treatment in McKenzie et al. (1998) in that I adopt the convention of using $R$ as the METR base.

### 2.2.2 Studies Omitting the BPT

METR studies omitting the BPT date back to Boadway et al. (1984), which is to my knowledge the first application of METR analysis to the Canadian economy. Although this study omits sales taxes, corporate capital taxes and property taxes, it indicates that these taxes should too be in the METR. Ultimately, the study only considers the CIT and related aspects such capital cost allowances at the national level only. The authors extend the King & Fullerton (1984)
framework with regards to the return on savings, the return on equity and the return on inventory investment. With some simplifying assumptions, the present study largely adopts the Boadway et al. (1984) approach to constructing the rates of return on savings and equity as well as their approach to dividing capital into machinery, buildings, land and inventories categories.

For the 1972-1978 period and under the fixed-r approach, the authors calculate the average return on savings to be 4.6% and the average return on investment to be 6.0% based on assumptions made for Canada as a whole. Interestingly, Boadway et al. (1984) do not define the METR in the conventional way; they define it as simply the difference between the rates of return on savings and investment, in this case 6.0% - 4.6% = 1.4%. Had they expressed this difference as a percentage of the return on savings, as is conventional, the METR would instead be 1.4%/4.6% = 30%. Boadway et al. (1984) did not replicate the analysis for individual provinces, although it was followed by Boadway et al. (1987) in which METRs specific to the Ontario and Quebec mining industries in Canada are calculated, again with BPT excluded.

McKenzie (1994) extends the METR literature by introducing risk and investment irreversibility into the modelling framework. He shows that both these features increase the METR as calculated under certainty and fully reversible investment. He finds that risk and investment irreversibility raise the conventional METR (calculated as 31.7% for Canada) by at least 10 percentage points, however like in Boadway et al. (1984) only the CIT system was considered in his analysis.

Updating and expanding on earlier Canadian work, McKenzie et al. (1998) calculate national METRs on tangible capital, intangible capital and labour. Of particular importance is incorporation of CCTs and RSTs into the METR modelling framework, however the BPT is excluded with the authors citing wide variation in BPT rates across municipalities and data limitations. National METRs are calculated for various industries, capital categories and nations, where the overall METR for tangible capital investment in Canada is estimated to be 21.8%.

In Chen (2000), Canadian national METRs on capital are estimated for the broad capital categories of land, buildings, machinery and inventories. The methodology adopted closely mirrors that of McKenzie et al. (1998) and international comparisons are done with the United States and Mexico. The author estimates METRs of approximately 22% for buildings, 18% for
machinery, 35% for inventories and 24% for land. Property taxes are excluded from the analysis, and are mentioned only in passing as having a potential impact on capital investment.

**Figure 2.2-2** Reproduction of Chart 3.10 from Canada (2008)

---

Chart 3.10
METRs¹ on New Business Investment, by Component, in 2012

Note: The contribution of the tax components may not add up to the overall METR due to rounding.

1 Excludes resource and financial sectors and tax provisions related to research and development. The METR is computed using the federal statutory income tax rate and the corresponding provincial-territorial/state corporate income tax rate, sales tax rate and the capital tax rate. It is presented net of any investment tax credits and excludes any property taxes.

2 Manitoba’s 2007 budget announced the elimination of the general corporate capital tax, except for Crown corporations, as of December 31, 2010, subject to budget-balancing requirements.

3 Quebec’s value-added tax contributes to its METR, as well as Canada’s, because some tax is still imposed on certain capital inputs.

4 The federal corporate income tax METR component is negative due to the Atlantic Canada investment tax credit and a high share of eligible sectors in New Brunswick compared to other Atlantic provinces.

5 The provincial capital tax component represents 0.2 percentage points of the Canadian METR.

Source: Department of Finance.

Reproduced from Canada (2008) with permission granted under the Department of Finance License Agreement.³⁷

³⁷ © Her Majesty the Queen in Right of Canada (2008). As of the time of writing, the license agreement may be viewed at [http://www.fin.gc.ca/pub/licence-eng.asp](http://www.fin.gc.ca/pub/licence-eng.asp).
On the heels of extensive tax reform at the federal level in Canada, Finance Canada (2005) estimates projected 2010 METRs for Canada, the United States and Canada’s provinces, as well as national METRs for particular industries. But most relevant to the present study is the inter-provincial METR analysis, which incorporates CIT, RST and CCT.38 Estimated METRs vary widely among provinces, and are particularly lower in the Atlantic provinces due to the federal Atlantic Investment Tax Credit. Based on the methodology outlined in Finance Canada (2005), Chart 3.10 (reproduced herein as Figure 2.2-2) from the 2008 Federal Budget displays the most recent Finance Canada METRs that were stratified by individual tax contribution.

Finance Canada (2005) is the first study to my knowledge to stratify individual tax contributions to the METR at the subnational level, however absent from all Finance Canada analyses thus far is the BPT. Finance Canada (2005) defends this omission by stating that part of the BPT corresponds directly to the local benefits conferred onto investing businesses by municipal services and that data limitations preclude estimation of the net portion of the municipal BPT. While this defence is acceptable to some extent for municipal BPTs, it is clearly not so for provincial BPTs, however no distinction was made by the study between municipal and provincial BPTs. The most recent provincial METR estimates appear in the 2012 federal budget, but unfortunately without tax stratification and again with BPTs excluded.

Summarizing the improvements made to Canada’s tax competitiveness during 1997-2006, Chen & Mintz (2006) use inter-provincial METR analysis to evaluate recent federal and provincial tax reforms and update METRs accordingly. The authors estimate that Canada’s METR on capital investment was 44.3% in 1997 and that by 2010 it would be down to 33.5% if all federal and provincial post-2006 tax reforms were implemented as planned. While inter-provincial analysis is done, METR estimates are not stratified by individual tax contribution. Aside from briefly crediting Saskatchewan for introducing a property tax credit for machinery investments in the forestry industry, the study is silent on property taxes and so invariably excludes them from the analysis. In a very similar but earlier study, Chen & Mintz (2003) omit property taxes on the grounds of insufficient data, so this may again have been the reason the authors omitted property taxes in their 2006 study, however this reason is not articulated explicitly.

38 I do not review the three federal territories in Canada.
With a focus on Ontario’s monumental business tax-cutting 2009 budget, Mintz (2009) performs inter-provincial METR analysis, updating tax regime parameters for Canada’s ten provinces. Again, the METRs are not stratified by individual tax contribution, but the results show a noticeable trend toward improvement of tax competitiveness among the provinces and for Canada, incorporating planned tax regime changes as of 2009. He omits BPTs because:

“Property taxes help pay for municipal services that reduce business costs. In principle, only property tax net of benefits should be included in estimates. Although net property taxes ideally should also be included, the variation across municipalities, industries, and special concessions make it impossible to do so even for individual provinces, let alone other countries.” (Mintz, 2009)

This rationale echoes that of Finance Canada (2005). Again, while it applies to municipal BPTs, it does not apply to provincial BPTs because, like other provincial general revenue taxes, they are wholly net taxes from the perspective of investing businesses. Also, municipal BPT contributions to the METR can be approximated, albeit with some assumptions and quite a bit of work in many cases, at least for individual municipalities. Certainly, my general view is that a BPT-inclusive METR is better than a BPT-exclusive METR so long as the appropriate qualifications, to the extent required, are noted.

2.2.3 Studies Including the BPT

The first study to include the BPT in METR estimation is Feldstein et al. (1983), which estimates the METR for the United States. The authors clearly reject the notion that the local BPT is a benefit tax, stating “… taxes paid by business to state and local governments do not represent charges for benefits received.” (Feldstein, et al., 1983), but do not offer any supporting argumentation or data for this position.

Based on data from the Economic Report of the President and the Balance Sheet of the U.S. Economy, the authors use various calculations to estimate that 30% ($1,711B) of the 1979 total taxable capital stock corresponds to corporations. It is not indicated by the authors whether the primary data used in the calculations represents acquisition value, book value, replacement cost or market value.
Feldstein et al. (1983) then obtain total annual state and local property tax revenue from all sources (residential, commercial, etc.) for 1948-1979 from the National Income and Product Accounts, but it is not indicated whether this data includes or excludes property tax credits. Since the property tax revenue data is aggregated for all property classes, the authors explore three different scenarios relating the corporate effective property tax rate and that levied on the non-corporate sector: (i) the rates are equal, (ii) the corporate rate is three times that of the non-corporate rate and (iii) the corporate rate is one-third of the non-corporate rate. For the remainder of the Feldstein et al. (1983) review, I shall focus on the results obtained under scenario (ii), the assumption that is likely most accurate of the three.

Since the study does not disaggregate capital into land, buildings and machinery categories, it does not calculate effective BPT rates. Based on BPT scenario (ii), the 1979 national METR is calculated as 69.4%, of which the BPT contributes 10.5 percentage points. While these results are of interest, they should be taken with caution largely because they are derived under the assumption that total property tax revenue can be apportioned across property classes according to shares of total property value. Only for states and municipalities in which all classes of property are actually taxed at the same effective property tax rate is this assumption valid.

The next study to include BPT in the METR is King & Fullerton (1984), which lays the theoretical foundation of the METR and performs international METR analysis across four countries: the United Kingdom, Sweden, West Germany and the United States. The authors clearly understand that in principle there is no theoretical distinction to be made among the various incarnations of the corporate wealth tax (CWT) in terms of how the effective CWT rate is incorporated into the METR. That is, taking the CCT and BPT as examples of a CWT, their effective rates exert METR impacts that are, from the perspective of business taxpayers, indistinguishable from one another. In particular, the authors explicitly view local BPTs as a form of CWT, however they also openly view municipal BPTs as purely net taxes and hence make no offsetting adjustment to account for the local benefit of municipal services potentially derived by businesses.

King & Fullerton (1984) show that effective CWT rates are incorporated additively into the gross-of-tax rate of return, raising the METR accordingly. While the CWT has a rather straightforward impact on the METR, the challenge, as recognized by the authors, is empirically
determining the effective CWT rate to insert into the model. This problem is especially apparent when it comes to the BPT, largely due to a lack of reliable tax regime data. Analysis of how the authors determined effective BPT rates for each of the four countries, except Sweden as it has no BPT, demonstrates this point.

Considering first the United Kingdom, the effective BPT rate of 2.46% was calculated simply by dividing total municipal BPT revenue raised in the nation by the estimated replacement cost of the national business capital stock. As is well known, replacement cost is not equivalent to market value, and so the accuracy of the resulting 2.46% average effective municipal BPT rate is questionable. Moreover, it was not clear whether the revenue data was net of BPT credits.

Municipalities in West Germany levy a local BPT and the federal government levies a national BPT, however property reassessment occurs on an irregular and infrequent basis such that assessed values and market values differ substantially. For instance, the 1981 assessment roll had a valuation date of 1964. In an effort to correct for this disparity, the authors simply cite that West Germany’s Ministry of Finance estimates that assessed values are roughly 25% of replacement costs. However, with no data or other evidence given to support this estimate, its reliability is certainly questionable, and moreover replacement cost is not equivalent to market value. Combining an average statutory municipal BPT rate of 0.96% with the average statutory federal BPT rate of 0.70%, the authors apply the estimated 25% assessed-to-market value ratio to arrive at an average national effective BPT of 0.42%.

The determination of effective BPT rates in the United States is at least as problematic as it was for the United Kingdom. King & Fullerton (1984) extract total property tax paid to local and state governments for the year 1977 in the United States from the Bureau of Economic Analysis (BEA) at the Department of Commerce. For 1972, they take the business proportion of local and state property tax revenue from the Advisory Commission on Intergovernmental Relations (ACIR). The authors also take the total 1977 value of business real estate in the United States from the unpublished capital stock dataset in Jorgenson and Sullivan (1981). They then apply the ACIR proportion (28.6%) to the BEA total tax figure ($17.885B) and divide by Jorgenson’s capital stock value for business real estate ($1,588.516B) to arrive at an average national effective BPT rate of 1.126%.
A number of issues arise from the approach taken for the United States unfortunately. First, there is no assurance that a consistent definition for “business” has been applied for all three independent datasets. Second, there is no indication of whether the BEA revenue data is net or gross of BPT credits, and it certainly cannot account for the favourable tax arrangements (e.g. tax holidays) for new business investment in many American municipalities. Third, it cannot be verified whether the Jorgenson and Sullivan (1981) capital stock values are acquisition value, book value, replacement cost, market value or are even consistent across industries. For these reasons, like with the United Kingdom and West Germany, the reliability of the data used to calculate the American effective BPT rate is questionable.

To my knowledge, after King & Fullerton (1984) only three subsequent METR studies include the BPT, all of which follow the King & Fullerton (1984) methodology: Daly et al. (1985a), Daly et al. (1985b) and Daly & Jung (1987). The first adds Canada to the countries studied by King & Fullerton (1984) and reruns the METR analysis, while the second focuses the METR analysis on Canada’s manufacturing sector. With regard to including the BPT in the METR, the contribution of these studies is identical to that of the third study, Daly & Jung (1987), so for the purposes of the present paper it is sufficient to review only the third study.

Adopting the theoretical approach of King & Fullerton (1984) but adapting it to include sales taxes on capital inputs, Daly & Jung (1987) calculate 1985 METRs for Canada by both industry and asset category. The authors obtain from unpublished Statistics Canada data BPT rates for each of the eight industries studied, but unfortunately do not give any details about the data. For instance, it is not indicated whether provincial or education taxes are included, the extent to which the BPT rates are indeed effective rates or the extent to which the data accounts for BPT credits. Working under the small open economy assumption, the Canadian corporate METR is calculated as 21.0%, of which 6.7 percentage points are attributable to BPTs. The methodology used to calculate/obtain the effective BPT rates for this study seems questionable.

Based on the review of the studies including BPT in the METR, issues with regard to the following have emerged:

39 For instance, the data suggests that land value is only 10.7% of business property value, which appears to be quite lower than expected.
1. **Calculation of Effective BPT Rates**: The data and methodologies used to calculate/estimate effective BPT rates have been of limited accuracy and reliability. For instance, data has been lacking in terms of ideal disaggregation across capital categories, consistency across datasets, linkage between assessed and market property values, and clarity regarding assessment lags and property tax credits.

2. **Local vs. Subnational BPT**: Also, no distinction is made between subnational and municipal/local BPTs, and the inclusion of municipal BPTs without incorporation of an offsetting factor to account for possible local benefits tied to the municipal BPT has not been adequately defended.

3. **Calculation of Subnational METRs**: METRs for federal nations have been calculated for the national level only, leaving unrevealed the variability in BPT burdens across subnational jurisdictions. Moreover, to my knowledge a BPT-inclusive METR for Canada or any jurisdiction has not been calculated since Daly & Jung (1987), more than 25 years ago.

The present study addresses these issues by (i) improving considerably upon the data, methodology and transparency of the calculation of effective BPT rates, (ii) incorporating the provincial and municipal BPTs subject to an offset made to the latter to reflect possible benefit taxation and (iii) extending the analysis to the subnational and municipal levels. Finance Canada could adopt the empirical framework developed herein and hence begin incorporating the BPT into its official national and provincial METR estimates. As will be evident, estimating METRs on this revised basis underscores the BPT’s impact on domestic and international competitiveness, revealing the striking differences in BPT burdens across Canada’s provinces and municipalities.

### 2.3 The Business Property Tax Belongs in the METR

It has occurred to me that reluctance to include BPTs in the METR is likely to be sourced from at least one of the following concepts: benefit taxation, capitalization of the property tax into land values and incomplete inclusion of the property tax across levels of government. I address each in turn and argue that none of these issues is a valid reason for excluding BPTs from the METR.
2.3.1 Benefit Taxation

A potential misconception is that the property tax is necessarily a benefit tax, perhaps even by virtue of being a property tax. While the property tax is not necessarily a benefit tax, it is a benefit tax to the extent that taxpayers rationally perceive benefits from efficiently provided local services as being directly linked to, and dependent on, the property tax in full and lock step. Clearly, a pure benefit tax cannot distort investment because it is equivalent to a user fee in exchange for public services rendered. However, there is very often a portion of the property tax that does not satisfy this tax-benefit relation referred to as the “net” tax as it exists net of linkable local benefits received by taxpayers. It is this portion of the property tax that belongs in the METR.

Provincial BPTs are often historically the result of the provincial takeover of education property taxes from school boards or even local property taxes from municipalities (Kitchen & Slack, 2012). In other cases, the provincial BPT has always or long time been a general revenue property tax layered on top of local property taxes. In all provinces, education has largely or entirely been provincialized. Like with any provincial service, rational budgeting would mean that education expenditure now has no more a lock-step link with provincial BPT revenue than it does with provincial CIT revenue. Under rational budgeting, a marginal dollar of provincial general revenue will be applied to the optimal expenditure line, regardless of its specific revenue source.

There is therefore no question that the provincial BPT is entirely a net tax on business investment in property and that it is as much a general revenue tax for provincial coffers as is the CIT or RST. This is true notwithstanding the fact that the provincial BPT is often collected (but not levied) by municipalities and remitted to either the province or school boards. Among the provinces that continue to use the euphemistic labels “Education Tax” or “School Tax” for what is obviously a general revenue provincial property tax, probably none have demonstrated more publicly than Ontario that this constitutes a mislabelling of a capital tax that is not at all a benefit tax. A revealing statement to this effect, though likely inadvertently so, is found in the part of the Ontario 2007 Budget announcing the 2007-2014 provincial BPT reduction program:

“This initiative is a key element in the government’s overall strategy to enhance Ontario’s investment climate and builds on the proposal in this Budget to accelerate the elimination of the
capital tax to July 1, 2010. The BET reductions will improve the competitive position of Ontario businesses, create new jobs and strengthen the provincial economy.

Business education property taxes currently contribute $3.5 billion in funding to support elementary and secondary education in Ontario. The Province’s direct transfers to school boards are being increased to ensure that BET cuts will not affect planned increases in overall education funding.” (Ontario, 2007)

It is clear Ontario equates its provincial BPT to a capital tax and recognizes that education funding levels are not linked to this tax any more than they are to any other general revenue provincial tax. The bottom line here is that Ontario provincial BPT revenue is now no more connected to education expenditure, or for that matter any provincial expenditure line, than is Ontario CIT revenue. Indeed, this is true for all other provinces with formerly local education property taxes because like Ontario they have provincialized the education property tax, as is specifically recognized by the Province of Saskatchewan: “Operating funding payable to boards of education will be reduced by an estimate of education property tax revenue.” (Saskatchewan, 2013)

Like Saskatchewan and Ontario, all other provinces with formerly local education property tax systems have taken over those systems and thus broken any potential lock-step dependency of local education quality on local education property tax revenue.40 So if the CIT and other general revenue taxes levied on capital are to be included in the METR, then necessarily so should the provincial BPT.

In contrast, since the property tax is typically the only tax available to municipalities providing local services, it is often argued that it is a benefit tax; that municipal service levels depend on taxation levels in lock step for each and every taxpayer. To the extent that this is the case, the municipal property tax is equivalent to a general user fee for municipal services and thus

40 Manitoba and Nova Scotia are to some extent exceptions as in the former province local school boards are still permitted to levy a property tax and in the latter province municipalities are permitted to levy a supplemental property tax to help fund their local school boards. However, both provinces levy a provincial property tax, which is ostensibly linked to education spending but is in reality just another general revenue provincial tax. Also, as of 2013 Alberta has started setting provincial property tax rates as required to finance 32% of school spending. In this case, education expenditure determines property tax revenue rather than vice versa, as would be required for the provincial property tax to function as a benefit tax.
generates zero deadweight loss. However, the consensus among municipal finance experts is that the municipal BPT is largely a net tax because its revenue is estimated to substantially exceed the value of municipal services benefitting businesses (Kitchen & Slack, 1993); (Haughwout, Inman, Craig, & Luce, 2004); (Mintz & Roberts, 2006); (Wheaton & Lee, 2010); (Dahlby, 2012); (Bird, et al., 2012); (Kitchen & Slack, 2012). This is especially the case in classified property tax systems where commercial and industrial properties are typically taxed at rates several times that levied on residential properties.

To the extent that the municipal BPT is, if at all, a benefit tax from the perspective of investing businesses, municipal BPT rates would need to be discounted accordingly prior to being included in the METR. The rationale behind the discounting is to remove the portion of the municipal BPT deemed to represent a benefit tax. In terms of the preceding Figure 2.2-1, levying a capital tax that is partially a benefit tax would shift up $MC$ due to the cost thereby imposed but also $MRP$ to the extent to which there is an identifiable, direct and dependent benefit. This shift of $MRP$ reflects an increase in the return to any given capital investment caused by the benefit of lowering operating costs and/or increasing revenue for businesses.

In order to approximate the net portion of the municipal BPT, I invoke the suggested methodology of Bird et al. (2012) in that a conservative estimate of the net municipal BPT rate would be the difference between business and residential municipal property tax rates. This approach is supported by the recent work of Mintz & Roberts (2006) where the degree to which municipal BPTs exceed the corresponding benefits is estimated:

“Just like federal and provincial capital taxes that have been reduced in recent years, non-residential property taxes that are in excess of municipal service benefits especially hurt businesses in cyclical industries. They must pay the tax regardless of their profitability.” (Mintz & Roberts, 2006)

2.3.2 Capitalization of the Property Tax into Land Values

Some hold the position that the BPT contribution to the METR should be discounted to the extent that the BPT is capitalized into land values (i.e. lower land prices result from BPT). While capitalization is relevant only to the net property tax since a benefit tax is neutral by definition, this line of argument is based on one or more of the following assumptions:
i. The supply of land is inelastic.

ii. The substitution elasticity between land and structure capital is low.

iii. Zoning ordinances severely restrict or prevent the flow of structure capital.

While as previously discussed at length, a number of authors have included BPTs in METR estimates – without indicating a need to discount estimates for capitalization into land value – I address each assumption in turn.

The standard assumption that analysts make regarding capital supply curves in METR analysis is that the jurisdictions they are examining are small relative to the world market for capital. They assume that capital supply curves are perfectly elastic and that capital flows out of markets in response to capital taxes. This assumption is consistent with provincial and municipal land markets because demand is composed of competing uses for land and because of the ubiquitous availability of vacant and underutilized land (for example, industrial parks). So assumption (i) is invalid.

It is also clear that structure capital and land are highly substitutable inputs as evidenced by large variation in observed land use intensity within and across municipalities and in local development applications. So assumption (ii) is invalid.

The type of zoning required to prevent structure capital flows would have to be unrealistically strict. In fact, such zoning would have to be “perfect” as implied in Fischel (2000), where each site is locked in its current state forever where even depreciation and demolition by way of neglect would be outlawed. Any cursory observation would reveal that such extreme zoning is not in effect. So assumption (iii) is invalid.

If for some reason any of the above three assumptions did hold, it would be relevant for the CIT as well as the BPT. If the BPT ought to be discounted to reflect its capitalization into land prices, then by necessary implication so should other taxes traditionally in the METR, especially since structures account for over 35 percent of national corporate investment according to Statistics Canada. Since the literature continues to refrain from discounting the METR contribution of non-BPTs to reflect any potential impact they may have on factor market prices
including land value, analytical consistency lends comfort and confidence in adding the net BPT to the METR in its entirety.

On a broader level, what is of interest to economists and policymakers are the following with respect to capital taxation: (1) the size of the capital tax wedge and (2) the extent to which capital will flow in response to a change in the size of this wedge. The proper venue for (1) is METR analysis and the proper venue for (2) is tax elasticity analysis. If capital taxes discourage capital investment as opposed to capitalizing into land values, tax elasticity analysis should bear this out with findings of capital flow responsiveness to capital taxes.

At any rate, even if evidence reveals that land values correlate negatively with capital taxes, it would be uninformative because capitalization is consistent with both responsive and unresponsive capital stocks (Zodrow, 2007). The rationale is that such capitalization is expected to occur to some extent even in a responsive capital market as a result of capital-land factor substitution responses to capital taxes.

2.3.3 Incomplete Inclusion of the Property Tax across Levels of Government

With the conceptional issues of benefit taxation and capitalization dismissed as valid reasons for continuing to exclude BPT from the METR, or otherwise discount its impact thereon, a potential empirical challenge is that the BPT should not appear in the METR unless BPTs levied by all levels of government are included. With respect to a jurisdictional (e.g. provincial) basis for METR analysis, the basis of this potential issue is that one level of government may rely heavily on the BPT while another overlapping level of government may hardly rely on the BPT. For inter-provincial METR analysis, this potential issue arises because incorporation of provincial BPTs into the METR is, by an order of magnitude, relatively straightforward compared to incorporation of municipal BPTs for reasons already noted. To perform inter-jurisdictional METR analysis where only the provincial BPT is included may lead to difficulty in comparing tax competitiveness across provinces.

For instance, suppose in Province A the provincial BPT is large and the municipal BPT is small and that in Province B the opposite is true, where the total BPT burden in each province is the same. Including only the provincial BPT in METR analysis may make Province A appear less competitive than Province B. Such a situation is certainly plausible depending on the
demarcation of public services and grant structure between the provincial and municipal levels of government. However, it is just as plausible for Province A, which has the relatively high BPT, to rely much less heavily on the CIT compared to Province B, which has the relatively low BPT, with revenue being equal across the provinces. If the conventional approach in the literature, which would be to include in the METR the CIT only, were followed, then Province A would seem more competitive than Province B. By including at least the provincial BPT, the apparent disparity between the two provinces would in all likelihood be mitigated.

Hence, if admitting only part of the total BPT into the METR unacceptably undermines inter-jurisdictional comparability, then by necessary implication the same must also hold if the BPT were omitted entirely from the METR because the various incarnations of capital taxation are mutual substitutes. What the literature reveals, however, is a broad practice of omitting the BPT in its entirety. In fact, the literature shows that the prevailing view is that BPTs ought to be in the METR in principle but data limitations and institutional complexities often preclude their incorporation. It is one thing to omit a capital tax from the METR because of data limitations, but it is quite another to do so because admitting some other capital tax into the METR is not currently viable for whatever reason. I find myself unable to subscribe to the latter rationale – the more capital taxes included in the METR the better.

Since all capital taxes are mutual substitutes, capital tax room can be occupied by any type of capital tax, so there is no reason to require or assume that capital tax room opened up by a low provincial BPT can only be filled by a high municipal BPT; that tax room could just as likely or easily be filled by a higher than otherwise provincial CIT or RST. Moreover, inter-jurisdictional comparison is not the only objective of METR analysis; an equally important objective is to estimate as completely as possible the tax burden that any given jurisdiction imposes on capital investment.

For the above reasons, there is no empirical obligation to include municipal BPTs in addition to provincial BPTs for inter-provincial METR analysis if incorporation of municipal BPTs at the provincial level is not a viable option. Nonetheless, I have elected to compute METRs at the municipal level for two reasons. First, since the provincial METR forms the base onto which the METR contribution of any of a province’s municipalities adds, incumbent and potential investing businesses are much more likely to find municipal METRs more relevant than
provincial METRs. Second, data limitations currently preclude the aggregation of effective municipal BPT rates to the provincial level on an assessment-weighted basis for all provinces. Under these limitations, METRs inclusive of municipal BPT must be computed at the municipal rather than provincial level.

Accounting for institutional features as much as possible, I assemble the data required to perform METR analysis for the largest municipality in each province. A focus on the largest municipality is especially of interest because it gives a general sense of the impact of municipal business taxation in the home province and should thus improve inter-provincial comparability compared to when METR analysis excludes municipal BPT (whether or not provincial BPT is included). METR analysis for these municipalities is a first step toward broader analysis including additional major municipalities and also inclusion of all municipalities at the provincial level, which are tasks I leave for future research pending data availability. At any rate, the present study is the first to compute METRs at the municipal level and the first to compute provincial BPT-inclusive METRs at the provincial level.

2.4 METR Model Framework

This section largely draws on King & Fullerton (1984), but also to some extent on Boadway et al. (1984) and Daly & Jung (1987), to construct the theoretical framework behind the METR. Letting $M_k$ denote the METR and $P_{g,k}$ denote the real gross-of-tax rate of return for investing in capital assets of type $k \in K$, we have

$$M_k = \frac{P_{g,k} - R}{R}$$

where $R$ is the real rate of return on savings and $K$ is the set of capital categories. Governments may, and often do, apply differential tax treatment across the various capital categories $k$, hence the distinction made across capital categories.

2.4.1 Theoretical Assumptions

To derive expressions for $P_{g,k}$ and $R$, a few assumptions are required to make the theoretical treatment tractable:
T1. The financial capital market is frictionless, certain\textsuperscript{41} and composed of investors (the capital suppliers) and investing businesses (the capital demanders).

T2. Since provincial capital markets are small relative the global capital market, the King \& Fullerton (1984) fixed-r framework (i.e. small open economy assumption) is adopted.

T3. Investors’ environment is such that:

(a) Investors domestically earn the world rate of return $R$ as investment income subject to both provincial and federal personal income tax (PIT) at the highest marginal rates regardless of where in the world $R$ originates.

(b) $R$ is such that it yields investors the required net-of-PIT rate of return $R_n$ on investment income.

(c) Investors provide capital in the form of credit and/or equity and in equilibrium are indifferent between the two types of financing.

T4. Equity income exists in the form of either capital gains or dividends.

T5. Equity providers are divided into two groups: capital gain investors and dividend investors such that:

(a) Capital gain investors purchase shares at the beginning of a year, after which they realize a capital gain at the end of the year by selling their shares on the market.

(b) Dividend investors purchase shares at the beginning of a year and realize a dividend at the end of the year. After receiving their dividend, but just before the year closes, dividend investors sell their shares on the market and realize an inflationary capital gain because share prices have risen with inflation over the year.

\textsuperscript{41} With uncertainty and/or investment-irreversibility, capital taxes have an even greater impact on the METR (McKenzie, 1994).
T6. The relative issuance/financing of debt and equity among investing businesses and investors is fixed such that $\beta$ is the proportion of total investment issued/financed as debt.

T7. Capital is divisible and subject to decreasing returns.

T8. Investing businesses:

(a) Invest until the marginal revenue product of capital is equal to the marginal cost of capital.

(b) Allocate earnings such that $\theta$ is the fixed proportion of total earnings retained.

(c) Are sufficiently profitable each year such that applicable tax credits and deductions are realized in the year in which they are accumulated.

T9. The taxation system is static.

With this framework in hand, expressions can be built for $R$ and $P_{g,k}$, and the METR thus constructed.

2.4.2 Rate of Return on Savings

This subsection draws on Boadway et al. (1984), simplifying as permissible to reflect the fixed monetary exchange rate across subnational jurisdictions. Let $\rho$ be the nominal gross-of-tax rate of return on equity (that is, the nominal appreciation rate of shares), $c$ be the PIT rate on capital gains, $d$ be the PIT rate on dividends and $\pi$ be the inflation rate. A capital gain investor earns a nominal gross-of-tax return on equity of $\rho$, which translates into a real net-of-tax return of $(1 - c)\rho - \pi$.

For a dividend investor, the nominal appreciation of his shares is $\rho$ over the course of the year. However, unlike a capital gain investor, a dividend investor receives part of $\rho$ as a dividend and the remainder as a capital gain. Since over the course of a year the profit of a share issuer has risen by a rate of $\rho$ less inflation, the dividend component of $\rho$ earned is $\rho - \pi$. Once dividend investors realize their dividend, they immediately sell their shares and further realize a capital gain of $\pi$ since share prices have inflated over the course of the year. So $\pi$ is the capital gain
component of $\rho$ earned. Therefore, dividend investors receive a real net-of-tax return of $(1 - d)(\rho - \pi) + (1 - c)\pi - \pi$.

Letting $m$ be the PIT rate on interest income and $i$ be the gross-of-tax nominal interest rate for debt, the real net-of-tax return on debt is $(1 - m)i - \pi$. Noting that the real net-of-tax rates of return on different modes of investing must be equal in equilibrium, so that the investor is indifferent between financing debt and equity, we have:

$$\theta (1 - c)\rho + (1 - \theta)[(1 - d)(\rho - \pi) + (1 - c)\pi] - \pi = (1 - m)i - \pi$$

$$\rho = \frac{(1 - m)i - \pi (1 - \theta)(d - c)}{\theta(1 - c) + (1 - \theta)(1 - d)}$$

where $\theta$ is the proportion of earnings investing businesses retain as opposed to divest as dividends. This expression gives the nominal rate of return on equity as a function of the model’s exogenous parameters. It is easily verified that indeed $\rho = i$ when personal income is not taxed, that is when $m = d = c = 0$. In equilibrium, and with $\beta$ proportion of total investment issued and financed as debt, the real opportunity cost of investment $R$ must yield the required net-of-PIT rate of return:

$$R_n = \beta i(1 - m) + (1 - \beta)[\theta (1 - c)\rho + (1 - \theta)[(1 - d)(\rho - \pi) + (1 - c)\pi]] - \pi$$

By setting all PIT rates equal to zero in this expression, we derive the equation for the real rate of return on savings (i.e. the real opportunity cost of investment):

$$R = \beta i + (1 - \beta)\rho - \pi$$

Substituting the foregoing expression for $\rho$ yields the following expression of $R$ in terms of the model’s exogenous parameters:

$$R = \beta i + (1 - \beta)\left[\frac{(1 - m)i - \pi (1 - \theta)(d - c)}{\theta (1 - c) + (1 - \theta)(1 - d)}\right] - \pi$$

This is the hurdle investors must clear gross-of-PIT to realize at least the required net-of-PIT rate of return $R_n$ in the province; otherwise they will invest elsewhere to earn $R$ gross-of-PIT. Incidentally, it is clear that $R = i - \pi$ in the absence of PITs.
2.4.3 Rate of Return on Investment

The remainder of this section draws primarily from King & Fullerton (1984). For capital category $k$, the last unit of investment yields a marginal revenue product $MRP_k$ to investing businesses, a decreasing function expressed as a gross-of-depreciation rate of return. Letting the net-of-depreciation rate of return on the marginal investment be $P_k$, then $P_k = MRP_k - \delta_k$ in a world without capital taxes.

The real rate of economic depreciation $\delta_k$ is the combination of two distinct effects: physical wear and real appreciation (i.e. the capital gain net of inflation) of physically remaining capital stock which could be either positive or negative depending on changes in relative purchase prices of capital assets as driven by factors such as obsolescence (Boadway, et al., 1984). These effects are represented by $\delta_k^p$ and $a_k$, respectively, hence $\delta_k = \delta_k^p - a_k$. However, due to the difficulty of projecting relative values over an infinite time period for the myriad of capital assets purchased by investing businesses, METR studies typically assume $a_k = 0$ for all $k$; that is, assets yield zero capital gain over their useful lives.

Letting $R^f$ denote the nominal cost of financing a unit of capital, and therefore the rate at which funds are discounted by investing businesses, the real net present value of the marginal unit investment is

$$V_k = MRP_k \int_0^\infty e^{-(R^f + \delta_k - \pi)n} \, dn - C_k$$

$$V_k = \frac{MRP_k}{R^f + \delta_k - \pi} - C_k$$

where depreciation occurs at rate $\delta_k$ in real terms and $C_k$ is the real present value of the cost of acquiring and holding the unit of investment. Designating capital as the numeraire, we may set $C_k = 1$ without loss of generality. Since the capital market is competitive, then $V_k = 0$ is an equilibrium condition, implying that $MRP_k = R^f + \delta_k - \pi$. So the real net-of-depreciation rate of return on investment is

$$P_k = R^f - \pi$$
in the absence of capital taxes, using the relation \( P_k = MRP_k - \delta_k \), where \( R^f \) is endogenously determined. In equilibrium, this rate of return must be equal to that earned by savers, \( R \). Setting \( P_k = R \) yields

\[
R^f = \beta i + (1 - \beta) \rho
\]

using the expression for \( R \) previously derived, where it is plain that \( R^f = i \) in the absence of PITs.

Introducing capital taxes will however raise the required rate of return for an investment to proceed (assuming taxation outweighs subsidization). The following subsections build into the foregoing no-tax framework the various taxes levied on corporate investment, as well as the associated tax allowances and investment tax credits that may be available. I do this first for land, building (i.e. structural) and machinery capital, and then modify the results for inventory capital as required.

### 2.4.4 Corporate Income Tax

I first incorporate the effects of the combined provincial-federal corporate income tax (CIT), which is levied at a rate of \( u \) on corporate profits. Let \( V_{g,k} \) and \( C_{g,k} \) denote the gross-of-tax counterparts to \( V_k \) and \( C_k \), respectively. Under CIT, incremental revenue generated by the unit investment is now taxed at a rate of \( u \), leaving \( (1 - u) MRP_k \) left for firms each period. But firms are able to deduct from CIT nominal interest paid on borrowed funds as an operating cost, reducing \( R^f \) to \( R^f_g = (1 - u) \beta i + (1 - \beta) \rho \) where \( R^f_g \) denotes the gross-of-tax nominal cost of finance. Hence,

\[
V_{g,k} = (1 - u) MRP_k \int_0^\infty e^{-(R^f_g + \delta_k - \pi)n} \, dn - C_{g,k}
\]

\[
V_{g,k} = \frac{(1 - u) MRP_k}{R^f_g + \delta_k - \pi} - C_{g,k}
\]

In Canada, corporations are also permitted to deduct from CIT annual depreciation based on Capital Cost Allowance (CCA) depreciation rates, and they can take advantage of certain investment tax credits (ITCs) to reduce the acquisition cost of capital. The effect of these
measures is clearly to lower the present value of the cost of capital. Letting $A_k$ represent the present value of eligible CCA deductions, we have

$$A_k = u \alpha_k \int_0^\infty e^{-(r_g + \alpha_k)n} \, dn$$

$$A_k = \frac{u \alpha_k}{r_g + \alpha_k}$$

where $\alpha_k$ is the applicable CCA deprecation rate. With CCAs, a unit of capital that originally cost unity to acquire in an untaxed world now costs only $C_{g,k} = 1 - A_k$ to acquire. Recognizing ITCs reduce the initial depreciable purchase price, a unit of capital now costs only

$$C_{g,k} = 1 - \phi_k - (1 - \phi_k)A_k$$

$$C_{g,k} = (1 - \phi_k)(1 - A_k)$$

to acquire where $\phi_k$ is the combined federal-provincial effective ITC rate. Setting $V_{g,k} = 0$ yields

$$MRP_k = \frac{(R_g + \delta_k - \pi)(1 - \phi_k)(1 - A_k)}{1 - u}$$

which, after subtracting real depreciation, gives

$$P_{g,k} = \frac{(R_g + \delta_k - \pi)(1 - \phi_k)(1 - A_k)}{1 - u} - \delta_k$$

as the real gross-of-tax rate of return with all aspects of the CIT incorporated.

### 2.4.5 Retail Sales Tax

A value-added sales tax, such as Canada’s Goods and Services Tax (GST), does not impact the METR because investing businesses are able to deduct the amount of it paid on capital inputs from that collected with revenue (Finance Canada, 2005). However, a multi-stage retail sales

---

42 This deductibility essentially renders the RST akin to a strictly retail-stage sales tax.
tax (RST) does drive up the marginal cost of capital to the extent its incidence falls onto investing businesses because this deductibility is generally not available for such an RST. Currently, all non-harmonized provincial RSTs levied in Canada are multi-stage, so herein the term “RST” means “multi-stage RST”.

The provincial RST, which is not CIT deductible in Canada, is clearly akin to a negative ITC, however it also raises the initial depreciable purchase price of capital for CCA purposes (Daly & Jung, 1987). The first effect is the market incidence effect and the second is the CCA effect. Incorporating these effects along the lines of Daly & Jung (1987), the present value of the cost of a unit of capital is now

\[
C_{g,k} = 1 - \phi_k - (1 - \phi_k)(1 + t^e_{s,k})A_k + (1 - \phi_k)t^e_{s,k}
\]

\[
= (1 - \phi_k)(1 + t^e_{s,k})(1 - A_k)
\]

where \( t^e_{s,k} \) is the effective RST rate. Therefore, the real gross-of-tax rate of return is now raised to:

\[
P_{g,k} = \left( R^f_g + \delta_k - \pi \right)(1 - \phi_k)(1 + t^e_{s,k})(1 - A_k) \left( 1 - \frac{\pi}{1 - u} \right) - \delta_k
\]

### 2.4.6 Corporate Wealth Tax

Other taxes, such as the corporate capital tax (CCT) and the business property tax (BPT), are directly levied on the capital asset itself over its useful life, rather than on the income it generates or on the transaction in which it is acquired. Such a tax is often referred to as a corporate wealth tax (CWT) (King & Fullerton, 1984). King & Fullerton (1984) incorporate the CWT simply by subtracting its effective tax rate from marginal revenue product in the calculation of \( V_{g,k} \). While it is true this approach arrives at the correct result, that being the effective CWT rate is simply added to \( P_{g,k} \), my view is that a more intuitive approach would be to incorporate the CWT into \( C_{g,k} \). I therefore recast the theory to adopt this preferred yet equivalent approach. I also extend the King & Fullerton (1984) framework to accommodate the idiosyncratic nature of CCTs and BPTs.
Letting $t_{w,k}^e$ denote the effective CWT rate and noting that it is levied annually on the market value of capital (which depreciates at a nominal rate of $\delta_k - \pi$), the CWT increases the cost of a unit of capital by

$$T_{w,k} = (1 - u)t_{w,k}^e \int_{0}^{\infty} e^{-(R_g^{f} + \delta_k - \pi)n} dn$$

$$T_{w,k} = \frac{(1 - u)t_{w,k}^e}{R_g^{f} + \delta_k - \pi}$$

in present value, assuming the CWT is CIT-deductible (one would just set $u = 0$ in this expression if the CWT were not CIT-deductible). This cost is akin to a negative CCA deduction, raising the gross-of-tax rate of return to

$$P_{g,k} = \frac{R_g^{f} + \delta_k - \pi}{1 - u} \left[ (1 - \phi_k) \left( 1 + t_{w,k}^e \right) (1 - A_k) + T_{w,k} \right] - \delta_k$$

$$P_{g,k} = \frac{R_g^{f} + \delta_k - \pi}{1 - u} \left( 1 - \phi_k \right) \left( 1 + t_{w,k}^e \right) (1 - A_k) + t_{w,k}^e - \delta_k$$

after substituting for $T_{w,k}$. With CIT-deductibility, the CWT’s effect on $P_{g,k}$ is additive such that $P_{g,k}$ increases by exactly $t_{w,k}^e$ in absolute terms. Unlike the capital taxes seen prior, the impact of effective CWT rates on $P_{g,k}$, and therefore on the METR as will be seen, is independent of all other parameters of the model – there is no interaction between effective CWT rates and any other term in $P_{g,k}$. This means that even a modest CWT rate can generate a substantial impact on the marginal cost of capital. This general CWT framework can be tailored to specific CWTs.

Turing first to the CCT, it is levied on capital assets, including land, buildings, machinery and inventories at an ad-valorem rate applied to CCA-depreciated book value. Noting that provincial CCTs in Canada are CIT-deductible, a CCT levied at a statutory rate of $t_{c,k}^{s}$ on the CCA depreciated capital base imposes a cost of

\[43\] This result holds only if the CWT is CIT-deductible.
\[ T_{c,k} = (1 - u)(1 - \phi_k)(1 + t_{s,k}^s)T_{c,k}^s \int_0^\infty e^{-(R_g^f + \alpha_k)n} \, dn \]

\[ T_{c,k} = \frac{(1 - u)(1 - \phi_k)(1 + t_{s,k}^s)T_{c,k}^s}{R_g^f + \alpha_k} \]

on a unit capital investment in present value, where \((1 - \phi_k)(1 + t_{s,k}^s)\) is the initial depreciable amount corresponding to a unit of capital invested.

As we know, the effective CCT rate, denoted by \(t_{c,k}^e\), must satisfy

\[ T_{c,k} = \frac{(1 - u)t_{c,k}^e}{R_g^f + \delta_k - \pi} \]

implying the CCT raises the gross-of-tax rate of return to

\[ P_{g,k} = \frac{(R_g^f + \delta_k - \pi)[(1 - \phi_k)(1 + t_{c,k}^e)(1 - A_k) + T_{c,k}]}{1 - u} - \delta_k \]

\[ P_{g,k} = \frac{(R_g^f + \delta_k - \pi)(1 - \phi_k)(1 + t_{c,k}^e)(1 - A_k)}{1 - u} + t_{c,k}^e - \delta_k \]

where

\[ t_{c,k}^e = \frac{(R_g^f + \delta_k - \pi)(1 - \phi_k)(1 + t_{s,k}^s)t_{c,k}^s}{R_g^f + \alpha_k} \]

after substituting for \(T_{c,k}\). It is worth noting that if the CCT were levied on the market value rather than CCA-depreciated book value of capital, the effective CCT rate would equal its statutory counterpart as the RST and ITC would no longer effect the tax base, which in this case would depreciate at a nominal rate of \(\delta_k - \pi\) instead of \(\alpha_k\). Under these conditions, the CCT is in fact equivalent to a conventional property tax, as will be seen.

Turning now to the BPT, its omission from almost all METR estimates is surprising considering the resemblance between CCTs and BPTs. In fact, the structural differences in the manner in which the two taxes work are not all that appreciable, with perhaps the largest difference being
that property taxes are levied on land and buildings only, and not on machinery or inventories. While the CCT is levied on the CCA-depreciated book value of property, the property tax is levied on the assessed value of property which is usually based on some estimate of market value. Since provincial data often permits, albeit with a degree of work, the conversion of statutory BPT rates into effective counterparts, the derivation below treats the property tax as a pure corporate wealth tax on the market value of land and buildings. In this sense, the BPT is a more direct CWT than is its CCT cousin. Furthermore, the derivation below can be easily modified to account for time-varying future BPT rates announced in advance, such as has been done by the Province of New Brunswick.

Recognizing that property taxes are CIT-deductible in Canada, the present value of BPT paid on a unit of property invested is

\[ T_{p,k} = (1 - u)t_{p,k}^s \int_0^\infty \sigma(n)e^{-\left(r_f^f + \delta_k - \pi\right)n} dn \]

where \( t_{p,k}^s \) is the statutory BPT rate net of assessment discounts and BPT credits and \( \sigma(n) \) is the assessed-to-market property value ratio in period \( n \). For most assessment regimes, assessed value deviates from market value due to a deliberate lag wedged between valuation and taxation dates. A reasonable assumption is therefore that assessments trail market values by a fixed lag of \( y \) years where property appreciates at a constant long run average annual rate of \( r \).\(^{44}\) Incidentally, this assumption renders the property tax system static, in line with the theoretical assumptions, where the assessed-to-market value ratio is now given by \( \sigma(n) = (1 + r)^{-y} \) and therefore independent of \( n \). Accordingly, the BPT raises the cost of a unit of capital by

\[ T_{p,k} = \frac{(1 - u)t_{p,k}^s(1 + r)^{-y}}{R_f + \delta_k - \pi} \]

The gross-of-tax rate of return is thus now

\(^{44}\) As will be seen, an additional modification is required to account for the multi-year phase-in of assessed values for the provinces of Ontario and Quebec.
\[ P_{g,k} = \frac{(R_g^f + \delta_k - \pi)(1 - \phi_k)(1 + t_{s,k}^e)(1 - A_k) + T_{p,k}}{1 - u} + t_{c,k}^e - \delta_k \]

\[ P_{g,k} = \frac{(R_g^f + \delta_k - \pi)(1 - \phi_k)(1 + t_{s,k}^e)(1 - A_k)}{1 - u} + t_{c,k}^e + t_{p,k}^e - \delta_k \]

where \( t_{p,k}^e = t_{p,k}^s(1 + r)^{-y} \) is the effective BPT rate. The terms \( t_{p,k}^s, r \) and \( y \) are often directly observable or estimable from suitable property tax and assessment regime data.

### 2.4.7 Rate of Return on Inventory Investment

Inventory capital must be treated somewhat differently than other capital in Canada because it faces an inflation tax caused by a CIT deduction based on the first-in-first-out (FIFO) method of inventory accounting, as is mandatory for CIT purposes in Canada (McKenzie, et al., 1998). The permitted deduction is equal to the cost of producing the inventory at the time it was produced. At the time inventory is disposed, there is no provision to allow the corresponding CIT deduction to equal the cost that would have been incurred had the inventory been produced at disposal time, and thereby account for the inflation of corporate income since the inventory was created (McKenzie, et al., 1998). In other words, there is no provision, such as last-in-first-out (LIFO) accounting, to allow the CIT deduction to account for the inflationary increase in the cost of purchasing or producing inventory.

The inflation tax engendered by the CIT framework is thus equal to \( u \pi \) for each unit of inventory held, akin to a negative write-off of nominal interest. For inventory capital, which is deemed non-depreciable, the net present value of the marginal investment is

\[ V_{g,j} = [(1 - u)MRP_1 - u\pi] \int_0^\infty e^{-(R_g^f - \pi)n} dn - C_{g,j} \]

\[ V_{g,j} = \frac{(1 - u)MRP_1 - u\pi}{R_g^f - \pi} - C_{g,j} \]
assuming for simplicity, as in King & Fullerton (1984) and McKenzie et al. (1998), the relative nominal price of inventories increases by inflation and inventory is held indefinitely.\textsuperscript{45} Also, inventory capital is not subject to RST, ITCs, BPT or CCAs, but it is however subject to CCT, which raises the cost of a unit of inventory capital from unity to

\[ C_{g,I} = 1 + T_{c,I} \]

\[ C_{g,I} = 1 + \frac{(1-u)t_{c,I}^e}{R_g - \pi} \]

in present value. Setting \( V_{g,k} = 0 \) gives

\[ MRPI_I = \frac{R_g^f}{1-u} - \pi + t_{c,I}^e \]

\[ P_{g,I} = \frac{R_g^f}{1-u} - \pi + t_{c,I}^e \]

since \( \delta_I = 0 \). It is clear that when there is no inflation the inflation tax is zero.

### 2.4.8 Marginal Effective Tax Rate

Recall that the METR for capital asset of type \( k \in K \) is

\[ M_k = \frac{P_{g,k} - R}{R} \]

where \( R \) is the no-tax rate of return (i.e. the rate of return on savings) and \( K \) is the set of capital categories. It is easily verified that indeed \( P_{g,k} = R \) and thus \( M_k = 0 \) when there are no taxes on capital and no ITCs. With \( M_k \) varying across capital categories \( k \) due to underlying structural and parametric differences in tax treatment, capital stock weights \( w_k \) for a jurisdiction can be used to calculate the weighted average METR for capital using the expression

\[ M^w = \sum_K w_k M_k \]

\textsuperscript{45} For an excellent treatment of the cost of holding inventory capital in Canada, see Boadway et al. (1982a)
where $\sum_k w_k = 1$.

### 2.5 Empirical Assumptions and Data

Simplifying empirical assumptions are required for tractable and standardized inter-jurisdictional METR analysis, framing a context in which the METR on capital investment should be interpreted. Also, because property tax payable equals a tax rate multiplied by assessed value and may be subject to systems that cause effective tax rates to deviate from statutory tax rates, BPTs typically require a measure of preparation greater than other capital taxes prior to being incorporated into a METR model. This is especially the case for the municipal BPT if it is to be offset somewhat to recognize a level of benefit taxation for the business sector. The material on BPT regimes is sourced from provincial and municipal websites as well as correspondence with provincial and municipal civil service and assessment agency staff.

#### 2.5.1 Empirical Assumptions

Unfortunately, the real world of capital taxation is not quite as simple as suggested in the previous section. In reality, capital tax systems are not static and are generally rife with special, and often non-transparent, provisions geared toward altering the tax burdens that would otherwise be realized if statutory tax rates were the whole story.

For instance, certain industries, such as oil and gas, mining, forestry and manufacturing, are targeted with industry-specific tax treatment such as royalties, excise taxes and ITCs. In other cases, CIT rates levied on “small” firms are lower than the general rate levied on other firms, while research and development (R&D) investments are often given favourable CIT treatment to address knowledge externalities. Also, a jurisdiction’s economic development programs may offer tax incentives, such as CIT “holidays”, ITCs or property tax abatements to businesses making new investments within its boundaries or within a particular area thereof (e.g. Canada’s federal Atlantic Investment Tax Credit).

There is also generally no guarantee that jurisdictions will keep general statutory tax rates and other policy parameters constant over time, but at the same time there is no readily apparent manner for investors, investing businesses and, for that matter, economists to project these values. Like special tax regime provisions, dynamic tax systems can significantly diminish empirical tractability of METR analysis.
Additionally, in order to facilitate comparability among jurisdictions, it is ideal to standardize non-tax input parameters across jurisdictions leaving inter-jurisdictional variation to be driven by tax parameters only (Chen, 2000). For inter-provincial METR analysis, this is accomplished by standardizing all subnational non-tax parameters to the corresponding national averages, weighted by investment shares where applicable. This standardization implies that the individual subnational METRs then reflect the impact of a jurisdiction’s tax regime on the average investment made in the nation.

Therefore, in order to make inter-provincial and inter-municipal METR analysis viable for Canada, some simplifying empirical assumptions are necessary for empirical tractability and standardization. These assumptions are detailed in Appendix 2.1. For inter-municipal METR analysis, I extend the provincial standardizations to their respective municipalities.

2.5.2 British Columbia and Vancouver BPT

In British Columbia, the provincial assessment agency, B.C. Assessment, performs reassessments annually using July 1 as a valuation date with implementation on the following January 1 for five different business classes as shown in Table 2.5-1.

<table>
<thead>
<tr>
<th>Property Class</th>
<th>Share of Assessment Base</th>
<th>Statutory BPT Rate</th>
<th>BPT Credit Rate</th>
<th>Effective BPT Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilities</td>
<td>1.44%</td>
<td>1.400%</td>
<td>0.0%</td>
<td>1.400%</td>
</tr>
<tr>
<td>Major Industry</td>
<td>3.33%</td>
<td>0.620%</td>
<td>60.0%</td>
<td>0.248%</td>
</tr>
<tr>
<td>Light Industry</td>
<td>10.10%</td>
<td>1.080%</td>
<td>0.0%</td>
<td>1.080%</td>
</tr>
<tr>
<td>Commercial</td>
<td>85.13%</td>
<td>0.620%</td>
<td>0.0%</td>
<td>0.620%</td>
</tr>
<tr>
<td>All Business</td>
<td>100.00%</td>
<td>0.678%</td>
<td>N/A</td>
<td>0.665%</td>
</tr>
</tbody>
</table>

In 2013, British Columbia increased BPT rates for the Utilities Class and Light Industry Class, and announced the elimination of the 60% BPT credit for the latter.\textsuperscript{46} Property tax data for the province and the City of Vancouver have been obtained from the website of the Ministry of Community, Sport and Cultural Development for 2013. The 2013 assessment-weighted statutory

\textsuperscript{46} The credit for the Light Industry Class has been reduced to 30% for 2013 and it will be 0% in 2014. The credit is however to remain intact for the Major Industry Class.
provincial BPT rate is 0.678%, which translates into an effective rate of 0.665% once the 60% BPT credit for the Major Industry Class is taken into account. This BPT credit applies to provincial BPT only, not municipal BPT.

The City of Vancouver’s net effective BPT rate is 0.800% as calculated in Table 2.5-2 following a method similar to that in Table 2.5-1. The municipal RPT rate does not require adjustment for the British Columbia Homeowner Grant as it applies to provincial RPT only.

Table 2.5-2  Vancouver RPT and BPT Rates - 2013

<table>
<thead>
<tr>
<th>Property Class</th>
<th>Share of Business Assessment Base</th>
<th>Effective Tax Rate</th>
<th>Net Effective Tax Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>0.00%</td>
<td>0.234%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Utilities</td>
<td>0.54%</td>
<td>3.982%</td>
<td>3.748%</td>
</tr>
<tr>
<td>Major Industry</td>
<td>0.56%</td>
<td>3.597%</td>
<td>3.363%</td>
</tr>
<tr>
<td>Light Industry</td>
<td>2.11%</td>
<td>1.041%</td>
<td>0.807%</td>
</tr>
<tr>
<td>Commercial</td>
<td>96.79%</td>
<td>1.003%</td>
<td>0.769%</td>
</tr>
<tr>
<td>All Business</td>
<td>100.00%</td>
<td>1.034%</td>
<td>0.800%</td>
</tr>
</tbody>
</table>

2.5.3 Alberta and Calgary BPT

Municipalities in Alberta, as well as the Ministry of Municipal Affairs, must reassess properties on an annual basis using July 1 as a valuation date with implementation on the following January 1. Only properties of the farmland, linear, machinery and railway type are assessed by the Ministry of Municipal Affairs; otherwise, property is assessed locally by municipalities. The only class levied with the provincial BPT is the Non-Residential Class; the other classes are the Residential Class, Farmland Class and Machinery and Equipment Class, the latter of which may be subject to a municipal capital tax levy at the option of the local municipality, but is exempt from the provincial BPT.

The province assigns annual BPT requisitions to each municipality. According to the website of the Ministry of Municipal Affairs, in the interest of equity the province uses municipality-specific market-to-assessed value equalization ratios to correct for local assessment biases (i.e. systemic deviations from market value) when assigning provincial BPT requisitions to municipalities. As the Ministry requires time to audit reported municipal assessments and
calculate appropriate equalization ratios, equalized assessment lags market value by approximately one year. With municipal assessment largely a service provided at the municipal level, currently available provincial data alone is insufficient to estimate province-wide appreciation for any property class.

Since the Ministry was unable to provide all data required to account for the lag built into equalized assessment, I appeal to the Ministry’s 1999-2013 Equalized Assessment Reports and assessment data provided for Ontario in a later subsection. The Alberta data indicates that total business assessment increased by 9.11% per year on average during 1998-2012, where this figure combines both new construction and appreciation of existing stock. The Ontario data indicates that business assessment increased by a total of 6.89% per year on average during 2008-2012. As per Table 2.5-9, 3.99 percentage points of the 6.89% total are attributable to appreciation, implying that the residual 1.90 percentage points reflect new construction. Taking the 3.99% as a proportion of the total assessment increase of 6.89% and applying the result to the 9.11% total assessment growth rate for Alberta, I arrive at an estimated average annual business property appreciation rate of 5.28% for Alberta.

Using this appreciation rate to account for equalized assessment lagging market value by about one year and noting that the Ministry of Education’s website indicates that the 2013 province-wide BPT rate on equalized assessment is 0.390%, Alberta’s effective provincial BPT rate is calculated as 0.370%.

According to the City of Calgary’s website, the 2013 statutory RPT and BPT rates are 0.380% and 1.099%, respectively. Comparing Calgary’s 2012 assessments to the province’s corresponding equalized assessments indicates that those of Calgary exactly match market value as determined by the province. Hence, Calgary’s statutory RPT and BPT rates are effective rates.

Calgary has also elected to levy a business occupancy tax (BOT) on lessees of business premises, which is clearly akin to a BPT (Kitchen & Slack, 2012). The BOT base is annual rental value of business premises as derived from assessed purchase values, and the BOT assessment system operates as part of the overall market value-based assessment system for property taxation. According to the City’s website, the 2013 statutory BOT rate is 7.58%. However, the City of Calgary will be rolling this tax into the BPT on a phased basis during 2014-2019. According to
the city’s website, this transition will raise current BPT revenue by 28% once completed. Applying this factor to the existing effective BPT rate gives a total equivalent effective BPT rate of 1.407%. Subtracting from this the effective RPT rate, Calgary’s total net effective municipal BPT rate is 1.027%.

2.5.4 Saskatchewan and Saskatoon BPT

With the exception of a number of municipalities that are responsible for their own local assessment, the Saskatchewan Assessment Management Agency (SAMA) is responsible for assessment in the province. Reassessment province-wide takes place every four years with the most recent having taken effect January 1, 2013 and remaining in effect until the end of 2016. Since the valuation date for the 2013-2016 assessment cycle is January 1, 2011, the current reassessment lag is two years and it should be taken into account when calculating effective BPT rates. Starting with the current assessment cycle, the base date has been shifted forward from June 30, which is 2.5 years behind the implementation date, to January 1 which is two years behind the implementation date. Since the base date of the last assessment cycle is June 30, 2006, then 2013 assessments reflect 4.5 years’ worth of appreciation since the previous reassessment.

Table 2.5-3 Saskatchewan BPT Rates - 2013

<table>
<thead>
<tr>
<th>Property Class</th>
<th>Share of Assessment Base</th>
<th>Statutory BPT Rate</th>
<th>2006-2011 Average Annual Appreciation</th>
<th>Effective BPT Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial/Industrial</td>
<td>58.50%</td>
<td>0.828%</td>
<td>13.28%</td>
<td>0.645%</td>
</tr>
<tr>
<td>Resource</td>
<td>41.50%</td>
<td>1.104%</td>
<td>4.29%</td>
<td>1.015%</td>
</tr>
<tr>
<td>All Business</td>
<td>100.00%</td>
<td>0.943%</td>
<td>9.04%</td>
<td>0.793%</td>
</tr>
</tbody>
</table>

As of January 1, 2013, the number of business classes for provincial BPT purposes has been reduced to two, however differential BPT rates continue to apply as per Table 2.5-3, which is based on province-wide assessment data provided by SAMA. Special thanks to SAMA, particularly to Steve Suchin, Managing Director, Technical Standards and Policy Division for invaluable assistance.

---

47 Special thanks to SAMA, particularly to Steve Suchin, Managing Director, Technical Standards and Policy Division for invaluable assistance.
weighted statutory provincial BPT rate is 0.943% and the corresponding effective rate is 0.793% due to the 2-year reassessment lag for 2013, assuming the 2006-2011 appreciation trend has continued into 2013.

The City of Saskatoon’s statutory property tax rate for 2013 is 0.751% on all taxable property, however different tax rate multipliers are applied to residential and business property so as to overtax businesses relative to residents. I use 2012 year-end and 2013 year-beginning assessment data provided by the city to calculate 2006-2011 average annual appreciation rates for the residential and business property classes and use these figures to account for the 2-year assessment lag.

**Table 2.5-4  Saskatoon RPT and BPT Rates - 2013**

<table>
<thead>
<tr>
<th>Property Class</th>
<th>Assessment Discount Rate</th>
<th>Statutory Tax Rate</th>
<th>Tax Rate Multiplier</th>
<th>2006-2011 Average Annual Appreciation</th>
<th>Effective Tax Rate</th>
<th>Net Effective Tax Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>30.00%</td>
<td>0.751%</td>
<td>0.9411</td>
<td>14.48%</td>
<td>0.377%</td>
<td>0.000%</td>
</tr>
<tr>
<td>Commercial/Industrial</td>
<td>0.00%</td>
<td>0.751%</td>
<td>1.1765</td>
<td>15.58%</td>
<td>0.661%</td>
<td>0.284%</td>
</tr>
</tbody>
</table>

As indicated in Table 2.5-4, Saskatoon’s net effective BPT rate is calculated as 0.284%. For both provincial and municipal property taxation, Saskatchewan requires residential assessment to be discounted by a factor of 30% prior to property taxation, while business property receives no

---

48 I ignore Saskatoon’s special tax treatment of private recreational aircraft hangers. I also do not attempt to account for Saskatoon’s phase-in of reassessment-related tax bill changes on the basis that phased increases and decreases offset one another in terms of the overall impact on the business sector. Separate school boards in Saskatchewan maintain a constitutional authority to levy a property tax. According to the Ministry of Government Relations, most separate school boards have however elected to align their property tax regimes with that instituted by the province for public school boards. This is not surprising given the structure of Saskatchewan’s funding/taxation system, which reduces provincial grants to a separate school board should it elect to levy property tax rates higher than those set by the province for public school boards:

“Minority faith boards of education have the constitutional right to levy different mill rates from members of the minority faith. The rates must be in the same proportion by property class as government mill rates. If a board levies mill rates that are higher than those set by government, their funding allocation will be adjusted to ensure that their total budget remains as approved by the minister. If a board levies mill rates that are lower than those set by government, their funding allocation will be adjusted to the level that would have been determined if the board had adopted the provincial mill rates.” (Saskatchewan, 2013).

The provincial funding/taxation system incents separate school boards to hold local property tax rates at the provincial levels set for public school boards. At any rate, the separate school boards within the City of Saskatoon have adopted the provincial property tax rates, so they may be treated as though they are indistinguishable from the public school boards for taxation purposes.
such discount. Despite this favourable treatment of residential property, due to a combination of a relatively low business-to-residential tax ratio (currently at 1.75 on an effective basis as per Saskatoon’s tax ratio policy) and low levels of property taxation generally, Saskatoon has by far the most competitive net effective municipal BPT rate among the municipalities herein studied.

### 2.5.5 Manitoba and Winnipeg BPT

While the City of Winnipeg maintains its own assessment system, the remainder of the province is assessed by the Ministry of Local Government. Both Winnipeg and the residual Province of Manitoba are on a 2-year assessment cycle with a valuation date of April 1 of even years and an implementation date of January 1 of the following even year. For 2013, the induced lag between market and assessed values of about 3 years should be taken into account when calculating effective BPT rates.

Table 2.5-5 illustrates Manitoba’s classification and differential treatment of business property based on data obtained from the Ministry of Local Government and the City of Winnipeg. Although a uniform statutory provincial BPT rate is levied across all business property classes, effective rates differ by class due to corresponding differences in assessment discount rates and appreciation over the assessment lag. According to various Manitoba municipal websites, the 2013 statutory provincial BPT rate is 1.183%. The corresponding effective rate is 0.605% once assessment discounting and the current 3-year assessment lag for 2013 are taken into account.

<table>
<thead>
<tr>
<th>Property Class</th>
<th>Share of Assessment Base</th>
<th>Assessment Discount Rate</th>
<th>Statutory BPT Rate</th>
<th>2010-2012 Average Annual Appreciation</th>
<th>Effective BPT Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline</td>
<td>18.87%</td>
<td>50.00%</td>
<td>1.183%</td>
<td>0.01%</td>
<td>0.591%</td>
</tr>
<tr>
<td>Railway</td>
<td>19.46%</td>
<td>75.00%</td>
<td>1.183%</td>
<td>0.32%</td>
<td>0.293%</td>
</tr>
<tr>
<td>Other Business</td>
<td>61.67%</td>
<td>35.00%</td>
<td>1.183%</td>
<td>2.81%</td>
<td>0.708%</td>
</tr>
<tr>
<td>All Business</td>
<td>100.00%</td>
<td>N/A</td>
<td>1.183%</td>
<td>1.80%</td>
<td>0.605%</td>
</tr>
</tbody>
</table>

As for the City of Winnipeg, it is the arguably the most complicated of the municipalities herein studied because it has a BOT and a supplementary property tax levied by eight local school boards on top of a conventional municipal BPT. The city’s website indicates that it levies a uniform statutory tax rate of 1.460% on all property, however effective rates differ across
property classes for the same reasons they do province-wide. Using the assessment data provided by the City of Winnipeg, the net effective BPT rate is calculated as 0.275% as indicated in Table 2.5-6.\textsuperscript{49}

Table 2.5-6 Winnipeg RPT and BPT Rates - 2013

<table>
<thead>
<tr>
<th>Property Class</th>
<th>Share of Business Assessment Base</th>
<th>Assesment Discount Rate</th>
<th>2010-2012 Average Annual Appreciation</th>
<th>Statutory Tax Rate</th>
<th>Effective Tax Rate</th>
<th>Net Effective Tax Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>0.00%</td>
<td>55.00%</td>
<td>5.78%</td>
<td>1.460%</td>
<td>0.555%</td>
<td>0.000%</td>
</tr>
<tr>
<td>Pipeline</td>
<td>0.20%</td>
<td>50.00%</td>
<td>3.44%</td>
<td>1.460%</td>
<td>0.660%</td>
<td>0.105%</td>
</tr>
<tr>
<td>Railway</td>
<td>1.55%</td>
<td>75.00%</td>
<td>10.79%</td>
<td>1.460%</td>
<td>0.268%</td>
<td>-0.287%</td>
</tr>
<tr>
<td>Other Business</td>
<td>98.25%</td>
<td>35.00%</td>
<td>4.18%</td>
<td>1.460%</td>
<td>0.839%</td>
<td>0.284%</td>
</tr>
<tr>
<td>All Business</td>
<td>100.00%</td>
<td>N/A</td>
<td>4.28%</td>
<td>1.460%</td>
<td>0.830%</td>
<td>0.275%</td>
</tr>
</tbody>
</table>

Like Calgary, Winnipeg levies a BOT on the annual rental value of business premises. According to Winnipeg’s website and 2013 Budget, the 2013 BOT rate of 5.90% will raise $58.4M in revenue but will be offset by a $4.7M tax expenditure dedicated to funding the Small Business Tax Credit, leaving net revenue at $53.7M. Dividing this revenue into total (undiscounted) business assessment yields a notional statutory BPT rate of 0.315%. Since this rate applies to all business premises, I account for the 3-year assessment lag by deflating it by the overall business appreciation rate of 4.28% calculated in Table 2.5-6 to arrive at a notional effective rate of 0.278%. Rolling this rate into Winnipeg’s conventional net effective BPT rate as calculated in Table 2.5-6 yields a total net effective municipal BPT rate of 0.553%.

Unlike other cities under analysis, Winnipeg’s school boards levy a local property tax on top of the provincial property tax. Although each school board is required to levy a uniform statutory tax rate across property classes, effective rates differ accordingly for the same reasons they do for the province and the City of Winnipeg. An additional wrinkle related to this local tax is the provincial Education Property Tax Credit (EPTC) which is only available to residential taxpayers. The basic EPTC is $700 for 2013.

\textsuperscript{49} This table excludes the impact of Winnipeg’s BOT.
Statutory 2013 education tax rates for Winnipeg’s school boards have been obtained from the city’s website. Table 2.5-7 uses these rates along with school board level assessment data obtained from the 2012-2013 Financial Reporting and Accounting in Manitoba Education (FRAME) Report to estimate the 2013 assessment-weighted statutory RPT and BPT rates for local education as 1.464% and 1.512%, respectively.

Table 2.5-7  Winnipeg Local Statutory Education RPT and BPT Rates - 2013

<table>
<thead>
<tr>
<th>City School Board</th>
<th>Share of City Residential Assessment Base</th>
<th>Share of City Business Assessment Base</th>
<th>Statutory RPT Rate</th>
<th>Statutory BPT Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winnipeg</td>
<td>21.63%</td>
<td>44.25%</td>
<td>1.672%</td>
<td>1.672%</td>
</tr>
<tr>
<td>St. James-Assiniboia</td>
<td>9.43%</td>
<td>15.23%</td>
<td>1.335%</td>
<td>1.335%</td>
</tr>
<tr>
<td>Pembina Trails</td>
<td>18.54%</td>
<td>12.04%</td>
<td>1.311%</td>
<td>1.311%</td>
</tr>
<tr>
<td>Seven Oaks</td>
<td>8.68%</td>
<td>3.60%</td>
<td>1.672%</td>
<td>1.672%</td>
</tr>
<tr>
<td>Seine River</td>
<td>3.78%</td>
<td>1.75%</td>
<td>1.537%</td>
<td>1.537%</td>
</tr>
<tr>
<td>Interlake</td>
<td>2.28%</td>
<td>2.29%</td>
<td>1.516%</td>
<td>1.516%</td>
</tr>
<tr>
<td>Louis Riel</td>
<td>19.16%</td>
<td>11.67%</td>
<td>1.330%</td>
<td>1.330%</td>
</tr>
<tr>
<td>River East Trascona</td>
<td>16.51%</td>
<td>9.17%</td>
<td>1.459%</td>
<td>1.459%</td>
</tr>
<tr>
<td>All School Boards</td>
<td>100.00%</td>
<td>100.00%</td>
<td>1.464%</td>
<td>1.512%</td>
</tr>
</tbody>
</table>

Table 2.5-8  Winnipeg Local Effective Education RPT and BPT Rates - 2013

<table>
<thead>
<tr>
<th>Property Class</th>
<th>Assessment Discount Rate</th>
<th>Education Property Tax Credit Rate</th>
<th>2010-2012 Average Annual Appreciation</th>
<th>Statutory Tax Rate</th>
<th>Effective Tax Rate</th>
<th>Net Effective Tax Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>55.00%</td>
<td>33.52%</td>
<td>5.78%</td>
<td>1.464%</td>
<td>0.370%</td>
<td>0.000%</td>
</tr>
<tr>
<td>Business</td>
<td>35.00%</td>
<td>0.00%</td>
<td>4.28%</td>
<td>1.512%</td>
<td>0.867%</td>
<td>0.497%</td>
</tr>
</tbody>
</table>

Using these assessment-weighted local statutory education RPT and BPT rates, Table 2.5-8 is the analogue to Table 2.5-6 for the purpose of estimating the local net effective BPT rate for education on an assessment-weighted basis. City-wide EPTC revenue data from the FRAME Report is divided into Winnipeg’s 2012 residential assessment base to estimate the implicit EPTC rate for residential property. This rate is likely accurate for 2013 since the 2013 basic EPTC amount of $700 also applied in 2012.
Since the FRAME Report does not disaggregate the business assessment base, I treat the entire base as if it were classified as Other Business since that class represents over 98% of the total business assessment base in Winnipeg as per Table 2.5-6. The appreciation rates used to account for the 3-year assessment lag as well as the assessment discount rates are taken from Table 2.5-6. Table 2.5-8 indicates that the estimated local net effective education BPT rate is 0.497%. Adding this to the total net effective municipal BPT rate of 0.553% previously computed yields a total net effective BPT rate of 1.050% for the City of Winnipeg.

2.5.6 Ontario and Toronto BPT

Responsibility for maintaining Ontario’s assessment system is vested in the Municipal Property Assessment Corporation (MPAC). Reassessment is performed every four years with January 1 of years divisible by four as the valuation date. Reassessments are implemented one year after the valuation date with increases in property value being phased in with equal installments over the 4-year period for which the reassessment applies.

The province sets provincial BPT rates individually for each business class (commercial, industrial and pipeline) in each single-tier and upper-tier municipality, but a uniform rate, known as the “new construction” rate, applies to all new business investment in most municipalities. For historical reasons, in a number of municipalities the province levies BPT rates lower than the new construction rate and these rates vary by municipality and even business class within a single municipality. These lower rates need to be combined with the new construction rate across municipalities and business classes to arrive at an assessment-weighted average statutory provincial BPT for Ontario as a whole.

Under a special academic research agreement, MPAC has generously provided phased assessment data for all property classes by municipality for 2012 and 2013. I have also obtained 2013 municipality-specific provincial BPT rates prescribed by regulation under the Education Act, which establishes the 2013 new construction rate as 1.260%. Using this information, Table 2.5-9 shows the calculation of Ontario’s effective BPT rate.50

50 Although vacant land and excess land property classes receive tax rate discounts, I treat these classes as though they face the full applicable tax rate with the rationale that vacant/excess status is lost once land is developed with an investment.
Table 2.5-9  Ontario BPT Rates - 2013

<table>
<thead>
<tr>
<th>Property Class</th>
<th>Share of Assessment Base</th>
<th>Assessment-Weighted Statutory BPT Rate</th>
<th>2008-2012 Average Annual Appreciation</th>
<th>Assessment-Weighted Effective BPT Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>83.68%</td>
<td>1.206%</td>
<td>4.12%</td>
<td>1.029%</td>
</tr>
<tr>
<td>Industrial</td>
<td>14.14%</td>
<td>1.259%</td>
<td>3.53%</td>
<td>1.098%</td>
</tr>
<tr>
<td>Pipeline</td>
<td>2.18%</td>
<td>1.119%</td>
<td>1.90%</td>
<td>1.038%</td>
</tr>
<tr>
<td>All Business</td>
<td>100.00%</td>
<td>1.212%</td>
<td>3.99%</td>
<td>1.039%</td>
</tr>
</tbody>
</table>

In order to calculate effective BPT rates for Ontario I have developed a formula to account for a multi-year equalized phase-in of property value increases. Let $t^e_{y,c}$ denote the statutory BPT rate for year $y \in \{1,2, \ldots, x\}$ of assessment cycle $c \in \{1,2,3, \ldots\}$, $t^s_{y,c}$ denote the corresponding effective rate, $x$ denote the length of the assessment cycle in years and $r_c > 0$ denote the (geometric) average nominal appreciation rate for business property province-wide during assessment cycle $c$. It can be shown that the effective BPT rate is a weighted version of its statutory counterpart:

$$t^e_{y,c} = \left( \frac{1}{1 + r_c} \right)^y \left[ \left( 1 - \frac{y}{x} \right) \left( \frac{1}{1 + r_{c-1}} \right)^x + \frac{y}{x} \right] t^s_{y,c}$$

Table 2.5-9 also shows 2008-2012 average annual appreciation by business property class. Since the next valuation date is not until January 1, 2016, I assume appreciation rates for the previous assessment cycle have continued into the current assessment cycle. Applying this assumption to each property class, the relevant values for the year 2013 are therefore $y = 1$, $x = 4$, $c = 2$, $r_1 = r_2 \in \{4.12\%, 3.53\%, 1.90\%\}$ and $t^s_{1,2} \in \{1.206\%, 1.259\%, 1.119\%\}$. Using the above formula for $t^e_{y,c}$ and weighting the results by property class assessment shares, the 2013 assessment-weighted average effective Ontario BPT rate is calculated as $t^e_{1,2} = 1.039\%$.

For the City of Toronto, using the Ontario assessment dataset and 2013 tax rate information from the city’s website, I calculate a net effective BPT rate of 0.896%. This calculation is summarized in Table 2.5-10 and accounts for the 4-year assessment cycle as well as Toronto’s decision to apply a lower BPT rate to the first $1,000,000$ of assessed value for properties classified as Residual Commercial. I use assessment share data derived from Toronto’s 2012
Financial Information

Return to apportion commercial’s 91.50% share of the business assessment base among the three subclasses of commercial property.

Table 2.5-10  Toronto RPT and BPT Rates - 2013

<table>
<thead>
<tr>
<th>Property Class</th>
<th>Share of Business Assessment Base</th>
<th>Statutory Tax Rate</th>
<th>2008-2012 Average Annual Appreciation</th>
<th>Effective Tax Rate</th>
<th>Net Effective Tax Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>0.00%</td>
<td>0.534%</td>
<td>5.08%</td>
<td>0.440%</td>
<td>0.000%</td>
</tr>
<tr>
<td>General Commercial</td>
<td>47.75%</td>
<td>1.672%</td>
<td>5.17%</td>
<td>1.372%</td>
<td>0.932%</td>
</tr>
<tr>
<td>Residual Commercial - Tax Band 1</td>
<td>24.46%</td>
<td>1.478%</td>
<td>5.17%</td>
<td>1.213%</td>
<td>0.773%</td>
</tr>
<tr>
<td>Residual Commercial - Tax Band 2</td>
<td>19.29%</td>
<td>1.672%</td>
<td>5.17%</td>
<td>1.372%</td>
<td>0.932%</td>
</tr>
<tr>
<td>Industrial</td>
<td>8.21%</td>
<td>1.666%</td>
<td>4.19%</td>
<td>1.417%</td>
<td>0.977%</td>
</tr>
<tr>
<td>Pipeline</td>
<td>0.29%</td>
<td>1.027%</td>
<td>1.81%</td>
<td>0.956%</td>
<td>0.516%</td>
</tr>
<tr>
<td>All Business</td>
<td>100.00%</td>
<td>1.622%</td>
<td>5.08%</td>
<td>1.336%</td>
<td>0.896%</td>
</tr>
</tbody>
</table>

2.5.7 Quebec and Montreal BPT

The Government of Quebec has indicated via correspondence that its assessment-weighted statutory BPT rate for 2013 is 0.221%. Each year, assessors revalue properties in one third of the municipalities in Quebec, generating a 3-year assessment cycle. Like Ontario, Quebec requires assessment increases to be phased in by equal annual instalments, which can be taken into account with a formula similar to the Ontario formula noted above.

Quebec divides business property assessment into commercial and industrial classes. I use province-wide assessment data obtained from the provincial government to calculate a business assessment growth rate of 3.06% for 2012. Since this figure includes both new construction and appreciation, it should be reduced by a factor approximating the contribution of new construction to the total assessment base. The data obtained indicates that the change in the number of business properties was 0.66% in 2012. Assuming that new business properties are of average value relative to the existing business property stock, I reduce the overall growth rate of 3.06% by 0.66 percentage points to arrive at an estimated business appreciation rate of 2.40%.

Given the staggered structure of the reassessment system across municipalities, there is no apparent way to differentiate between assessment cycles, so I assume the average property is in the second year of its respective assessment cycle and that \( r_{c-1} = r_c \) for all \( c \). The relevant
values for the year 2013 are therefore $y = 2$, $x = 3$, $r_{c-1} = r_c = 2.40\%$, and $t_{2,c}^c = 0.221\%$.

Using the above formula for $t_{y,c}^c$, the 2013 average effective BPT rate in Quebec is calculated as $t_{2,c}^c = 0.206\%$.

Turning now to the City of Montreal, to simplify matters I focus on the Borough of Ville Marie as the borough representative of the city as it has several boroughs. The rationale is that borough-level assessment data required to weight all borough taxes within Montreal is not available. At any rate, borough taxes represent a very small part of the overall property tax burden in Montreal. The Montreal website indicates that within the Borough of Ville Marie a total statutory RPT rate of 0.919\% is levied along with a total statutory BPT rate of 3.839\%.

Using the Montreal portion of the assessment data obtained from the province and applying the method used above to estimate business property appreciation for Quebec, I calculate a residential appreciation rate of 5.27\% and a business appreciation rate of 4.22\% for Montreal.

Using the same formula as above to account for the 3-year assessment cycle, the effective 2013 RPT and BPT rates for Montreal are 0.790\% and 3.397\%, respectively. Taking the difference yields a net effective BPT rate of 2.607\%.

### 2.5.8 New Brunswick and Saint John BPT

Service New Brunswick, a provincial agency, performs reassessments annually using January 1 as the valuation date and, retroactively, the implementation date. The property tax system is divided into residential and non-residential classes, and the province has legislated a business-residential ratio of 1.5 for all municipal property tax rates.

New Brunswick is the only province aside from Prince Edward Island that uses appropriate nomenclature for its property tax, officially calling it the “Provincial Property Tax”, rather than the “School Tax” or “Education Tax”. What is more, New Brunswick and Prince Edward Island are the only provinces to establish provincial property tax rates for future years. In particular, the *Real Property Tax Act* establishes New Brunswick’s statutory provincial BPT rates for 2013 onward as per Table 2.5-11, where successive tax rates represent an approximately 4\% reduction from the previous year’s. It is worth noting that, with a 2012 BPT rate of 2.186\%, New Brunswick’s legislated BPT reduction plan will have shaved 5.5 percentage points off of the provincial METR by 2016.
Table 2.5-11  New Brunswick BPT Rates - 2013

<table>
<thead>
<tr>
<th>Year</th>
<th>Statutory BPT Rate</th>
<th>Effective BPT Rate - Land</th>
<th>Effective BPT Rate - Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>2.104%</td>
<td>1.866%</td>
<td>1.885%</td>
</tr>
<tr>
<td>2014</td>
<td>2.021%</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2015</td>
<td>1.939%</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2016 Onward</td>
<td>1.856%</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Recall that with a fixed effective BPT rate of $t_{p,k}^e$ the present value of BPT paid on a unit of capital invested is

$$T_{p,k} = (1 - u) t_{p,k}^e \int_0^\infty e^{-\left(R_g^f + \delta_k - \pi\right)n} dn = \frac{(1 - u)t_{p,k}^e}{R_g^f + \delta_k - \pi}$$

However, when the BPT rate is scheduled to change over time in a discrete (e.g. annual) manner, I instead use the expression

$$T_{p,k} = (1 - u) \sum_{n=0}^\infty t_{p,k,n}^e \frac{(1 - \delta_k + \pi)^n}{(1 + R_g^f)^{n+1}}$$

without loss of generality, where $t_{p,k,n}^e$ is the effective BPT rate in year $n$ and BPT payment is assumed to take place at year end. This sum is empirically relevant only when future statutory provincial BPT rates have been definitively established, something the New Brunswick government has clearly done for 2013 onward. It is also equivalent to the integral version of $T_{p,k}$ when $t_{p,k,n}^e$ is constant over time.

Setting these two expressions for $T_{p,k}$ equal and rearranging for $t_{p,k}^e$ gives an expression for the equivalent level effective tax rate (ELETR) representing the series of BPT rates $t_{p,k,n}^e$:

$$t_{p,k}^{ELETR} = \left(R_g^f + \delta_k - \pi\right) \sum_{n=0}^\infty \frac{t_{p,k,n}^e (1 - \delta_k + \pi)^n}{(1 + R_g^f)^{n+1}}$$

It is the ELETR that enters the METR model, and since it depends on the real rate of economic depreciation, land and building capital face different ELETRs because land does not depreciate
and buildings do. Based on the announced statutory BPT rates, New Brunswick’s 2013 ELETRs for land and buildings are $t_{p,L}^{ELETR} = 1.866\%$ and $t_{p,B}^{ELETR} = 1.885\%$, respectively, as shown in Table 2.5-11.

The City of Saint John levies an RPT rate of 1.785\%. With New Brunswick’s required municipal property tax ratio of 1.5, Saint John’s BPT rate is therefore 2.678\%. These are effective rates given the structure of New Brunswick’s assessment system, thus the net effective rate for Saint John is 0.893\%.

2.5.9 Nova Scotia and Halifax BPT

In Nova Scotia, the Property Valuation Services Corporation (PVSC) maintains the assessment rolls of the province’s municipalities. Although reassessment takes place annually, the valuation date is always two years behind the implementation date. Specifically, the implementation date of January 1, 2013 corresponds to a valuation date of January 1, 2011. The province classifies property by residential, resource (farming, fishing etc.) and commercial (which includes industrial property).

Several attempts to acquire appropriate assessment data from PVSC were unsuccessful, so I assume all property province-wide appreciates annually at the residential rate of appreciation (2.80\%) noted in the Halifax Regional Municipality’s 2013-2014 Budget since this municipality represents well over 50\% of the provincial property tax base. If anything, this approach should make estimated effective BPT rates conservative since property in Halifax likely appreciates faster compared to the rest of Nova Scotia.

Table 2.5-12 Nova Scotia BPT Rates - 2013

<table>
<thead>
<tr>
<th>Nova Scotia BPT Rates - 2013</th>
<th>Statutory BPT Rates</th>
<th>Deemed Annual Appreciation</th>
<th>Effective BPT Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property Class</td>
<td>Education</td>
<td>PVSC</td>
<td>Correctional Services</td>
</tr>
<tr>
<td>Commercial</td>
<td>0.305%</td>
<td>0.010%</td>
<td>0.009%</td>
</tr>
</tbody>
</table>

I aggregate all of Nova Scotia’s 2013-2014 provincial BPT rates levied on the commercial class to arrive at an effective provincial BPT rate of 0.313\%, as calculated in Table 2.5-12. The education BPT rate is that prescribed by current regulation under the Education Act with the
remaining provincial BPT rates as indicated in the Halifax Regional Municipality’s 2013-2014 Budget.

The Halifax Regional Municipality levies general property tax rates, numerous area rates mostly based on geographic variation in deemed service levels and a supplemental education tax rate for the local school board. Since data is not available to weight area rates by geographic area of Halifax Regional Municipality, and since they are largely insignificant relative to general rates and are equal for residential and business classes where one exists for business, I largely ignore them. The exceptions are fire and transit area rates as they differ substantially by class and are relatively non-negligible in magnitude. Applying the aforementioned 2.80% appreciation rate to both residential and commercial classes, Table 2.5-13 calculates Halifax Regional Municipality’s 2013 total net effective BPT rate as 2.223%.

Table 2.5-13 Halifax Regional Municipality RPT and BPT Rates - 2013

<table>
<thead>
<tr>
<th>Property Class</th>
<th>Statutory Tax Rates</th>
<th>Deemed Annual Appreciation</th>
<th>Effective Tax Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Urban General</td>
<td>Fire</td>
<td>Transit</td>
</tr>
<tr>
<td>Residential</td>
<td>0.651%</td>
<td>0.025%</td>
<td>0.156%</td>
</tr>
<tr>
<td>Commercial</td>
<td>3.037%</td>
<td>0.075%</td>
<td>0.000%</td>
</tr>
</tbody>
</table>

2.5.10 Prince Edward Island and Charlottetown BPT

Like New Brunswick, Prince Edward Island uses the proper nomenclature with respect to its property tax, officially calling it the “Real Provincial Property Tax” and has established future provincial BPT rates. In fact, the provincial BPT rate is fixed by legislation at 1.5% for all business property. The Real Property Assessment Act requires the provincial government to reassess properties each year with a January 1 valuation date and implementation on the following January 1. In line with the empirical assumptions, the effective provincial BPT rate is thus simply 1.5%.

As for the City of Charlottetown, its 2013 Budget indicates that its 2013 statutory RPT and BPT rates are 0.670% and 2.360%, respectively. Given Prince Edward Island’s assessment system, these are effective rates, so taking the difference yields a net effective BPT rate of 1.690%.
2.5.11 Newfoundland and Labrador and St. John’s BPT

The Assessment Act requires property reassessment to be carried out by the Municipal Assessment Agency (MAA) and the City of St. John’s every three years between January 1 and September 30 with implementation the following year for taxation. The City of St. John’s manages its own assessment system while MAA manages the rest of the province. The base date is defined as the more recent of January 1, 2005 or January 1 every third year after 2005. With the current base date being January 1, 2011, assessed values in 2013 are two years behind market values, a lag for which should be accounted. The Province of Newfoundland and Labrador does not levy a provincial property tax.

According to the website of the City of St. John’s, as of January 1, 2013 it has rolled its BOT into the BPT. The city’s 2013 statutory RPT and BPT rates for properties with water and sewer services are 0.810% and 2.620%, respectively. Using assessment and tax information provided by city staff, I estimate that residential and commercial property appreciated by average annual rates of 8.85% and 3.32%, respectively, during 2008-2011. Assuming this trend has continued into 2013, effective RPT and BPT rates are 0.684% and 2.454%, respectively. Taking the difference yields a net effective BPT rate of 1.770%.

2.5.12 Parameter Values

The parameter values required for the METR analysis are summarized in Appendix 2.2. The information presented there is sufficient to permit replication of the results presented in the next section.

2.6 METR Estimates

Before heading into the results, it is helpful to first consider Finance Canada’s latest provincial METR estimates. In the 2012 federal budget, Finance Canada updated its METR data to reflect federal and provincial tax regime changes executed or announced as of January 1, 2012, shown in Chart A2.3 (reproduced herein as Figure 2.6-1). The chart shows projected 2014 METRs and documents the progress made toward METR reduction throughout Canada since 2006.

Unfortunately, unlike with past METR publications, Finance Canada did not stratify the METR estimates by individual tax contribution. Also, Chart A2.3 does not reflect the most recent changes in business tax policy, such as Prince Edward Island’s 2013 decision to harmonize its
RST with the federal GST and New Brunswick’s 2013 decision to raise its CIT rate. Nonetheless, qualifying where necessary Chart A2.3 provides a reasonable benchmark for the present study’s METR results, even though it reflects Finance Canada’s adoption of the convention of using the gross-of-tax rate of return on investment as the METR’s base.

**Figure 2.6-1 Reproduction of Chart A2.3 from Canada (2012)**

<table>
<thead>
<tr>
<th>Province</th>
<th>Marginal Effective Tax Rates¹ by Province, 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>per cent</td>
</tr>
<tr>
<td>B.C.</td>
<td>34.0</td>
</tr>
<tr>
<td>Alta.</td>
<td>39.3</td>
</tr>
<tr>
<td>Sask.</td>
<td>30.0</td>
</tr>
<tr>
<td>Man.</td>
<td>27.1</td>
</tr>
<tr>
<td>Ont.</td>
<td>24.2</td>
</tr>
<tr>
<td>Que.</td>
<td>26.3</td>
</tr>
<tr>
<td>N.B.</td>
<td>37.8</td>
</tr>
<tr>
<td>N.S.</td>
<td>30.3</td>
</tr>
<tr>
<td>P.E.I.</td>
<td>16.2</td>
</tr>
<tr>
<td>N.L.</td>
<td>13.8</td>
</tr>
<tr>
<td></td>
<td>14.7</td>
</tr>
<tr>
<td></td>
<td>21.3</td>
</tr>
<tr>
<td></td>
<td>35.1</td>
</tr>
<tr>
<td></td>
<td>17.6</td>
</tr>
</tbody>
</table>

¹The marginal effective tax rate reflects actions taken since 2006 by federal and provincial governments, and includes measures announced as of January 1, 2012. It excludes resource and financial sectors and tax provisions related to research and development.

Reproduced from Canada (2012) with permission granted under the Department of Finance License Agreement.⁵¹

Figures 2.6-2 and 2.6-3 illustrate the present study’s results, stratifying individual tax contributions to the METR. The results underscore the need for such stratification and they indicate the substantial impact of the BPT. Since the only CCTs remaining in effect are those levied strictly on the banking sector, a sector excluded from the analysis, provincial CCTs are not relevant to the METR analysis herein and so $t_{c,k}^S = 0$ for all $k$.

---

⁵¹ © Her Majesty the Queen in Right of Canada (2012). As of the time of writing, the license agreement may be viewed at [http://www.fin.gc.ca/pub/licence-eng.asp](http://www.fin.gc.ca/pub/licence-eng.asp). The estimates in this chart reflect British Columbia’s reversal of its PST’s harmonization with the GST but not Prince Edward Island’s decision to harmonize its PST with the GST in 2013 or a number of other decisions (e.g. CIT rate increases) made by provinces as reflected in their 2012 and 2013 budgets.
There are two overall findings worth noting for Figure 2.6-2. First, while provincial BPTs are levied on land and buildings only, they contribute considerably to the METR on capital investment in absolute and relative terms. For instance, the provincial BPT increases the METR for Ontario, New Brunswick and Canada by 17.1, 31.0 and 9.7 percentage points, respectively. Clearly, the impact of provincial BPT is comparable to that of the federal CIT, which is the single largest contributor to the Canadian METR of all the taxes analyzed in Figure 2.6-2. Especially notable is the impact of New Brunswick’s provincial BPT. Second, as indicated in Figure 2.6-2, provincial competitiveness depends crucially on whether provincial BPTs are included in the METR. For instance, Prince Edward Island’s ranking drops from 2 to 9 while Quebec rises from 4 to 2. Again, New Brunswick is of special note, where its ranking falls from first to last place.
As for Figure 2.6-3, the results indicate that the municipal BPT is by far the largest single contributor to the METR among all individual taxes considered, where it translates into 19.5 percentage points of the 47.8% Canadian METR. The City of Montreal faces the greatest municipal impediment to investment among the municipalities considered, and Halifax, St. John’s and Charlottetown are materially worse than the group average. On the other side of the spectrum, the City of Saskatoon’s municipal BPT regime is the most competitive among the municipalities considered and is so by a substantial margin.

If the METRs in Figure 2.6-3 are taken to be representative of the corresponding provinces generally, these results also indicate that provincial rankings are dependent on inclusion of BPT in the METR. Adopting this interpretation, Saskatchewan’s ranking, for instance, jumps from 6 to 2 once provincial and municipal BPTs are included in the METR. However, the largest
municipality in a province may not be entirely representative of a province’s municipal landscape.\textsuperscript{52}

On average for any jurisdiction, each percentage point of effective BPT (net effective BPT municipally) contributes about 16.5 percentage points to the METR. All in all, the BPT in total represents 29.2 percentage points (or about 61\%) of Canada’s total METR of 47.8\%. The BPT thus imposes over 1.5 times the barrier of all other capital taxes combined and is by far the largest single barrier to investment in Canada among the types of capital taxes analyzed.

\section*{2.7 Concluding Remarks}

This paper set out to address the severe lack of attention paid to BPT over 30 years of METR analysis. While most studies have omitted the BPT, the few that have included it have used unreliable and often opaque data and methodologies with regard to calculating the effective BPT rate and have been restricted to national or international METR analysis. Unfortunately, contemporary METR studies, as well as the latest international and official Canadian METR estimates, do not include the BPT. Nor do they stratify METR estimates by individual tax contribution, rendering the results essentially useless for governments wishing to optimize targeted tax reform. In particular, official national and provincial METRs estimated by Finance Canada and appearing in federal budgets have not been stratified by individual tax contribution since 2008, nor have they ever included the BPT.

In updating METRs for Canada’s ten provinces to 2013, the present study has considerably improved upon the empirical manner in which the BPT was previously incorporated into the METR over 25 years ago, stratifying the results by individual tax contribution. I also recast the theoretical manner in which the BPT is incorporated into the METR to make it more intuitive. The present study is the first to compute municipal METRs. While I computed METRs for the largest municipality of each province, I leave for future research the estimation of METRs for other major Canadian municipalities and the incorporation of municipal BPTs on a provincial level pending data availability. Such work is the next logical step in this literature and it is

\textsuperscript{52} For example, replicating Saskatoon’s analysis for the City of Regina, which is Saskatchewan’s capitol and barely smaller than Saskatoon, reveals that Regina’s net effective municipal BPT rate is 0.535\%, generating a METR contribution of 8.8 percentage points whereas the corresponding figure for Saskatoon is 4.7 percentage points.
needed to further solidify the METR as a comprehensive and reliable measure of tax competitiveness.

The findings clearly underscore the need to ensure METR analyses begin accounting for the property tax; the impact of this tax on investing businesses is far too substantial to justify ignoring when assessing a jurisdiction’s investment climate. Indeed, the results indicate that BPTs represent over 60% of the Canadian METR, providing all the more motivation for Finance Canada to adopt the empirical framework developed herein and hence begin incorporating the BPT into its official national and provincial METR estimates.

In terms of the provincial BPT, among the provinces that should be most concerned are Ontario, New Brunswick and Prince Edward Island, all of which will continue to be put at a considerable competitive disadvantage if they do not begin addressing their relatively high provincial BPT burdens. While provincial BPT burdens in British Columbia, Saskatchewan and Manitoba are not overly above the Canadian average, these provinces have relatively high overall METR levels and hence should at least consider transforming their RSTs from a multi-stage to a value-added structure, perhaps via harmonization with the federal GST. This move would substantially reduce the METRs for these provinces and shave about 2 percentage points off of the national METR. While Alberta, Quebec, Nova Scotia and Newfoundland and Labrador stand out as relatively competitive provinces with respect to the provincial BPT, like all provinces this tax should appear in official METR estimates where applicable.

As for municipal BPT, Saskatoon has set a virtuous example for the rest of the nation, whereas Montreal, Halifax, Charlottetown and St. John’s have erected high barriers to investment with their relatively high net municipal BPT rates. While Vancouver, Calgary, Winnipeg, Toronto and Saint John have municipal BPT contributions to the METR below that of the national average, they too should be concerned about the magnitude of these contributions and the associated adverse impact they have on decisions to invest locally.

Overall, governments need to seriously consider all capital taxes, including BPTs, before proceeding with tax reform. Admittedly, working the BPT into METRs often requires considerably more effort than that needed to incorporate other capital taxes into METRs, especially at the municipal level, but that is hardly a valid reason for leaving it out of the METR entirely. Instead of leaving the BPT buried in obscurity from public policy deliberations,
governments and METR analysts should begin giving it the attention and consideration it deserves commensurate with its METR impact.

While the provincial BPT has been relatively absent from headlines and effectively so for METR analyses, the results strongly suggest its effect on municipal, provincial and international competitiveness is far from benign. The results further suggest that the municipal BPT is about twice as damaging as its provincial counterpart at current taxation levels in the major provincial municipalities, and this is reason enough for the literature to move toward including these taxes in METR estimates and toward computing and comparing municipal METRs for major cities. By including the BPT in the METR, governments, business advocates and policy analysts will be much better positioned to assess the relative and aggregate impact of various capital taxes on investment climates and therefore improve upon efficiency-enhancing tax reform going forward.
References


2.8 Appendix 2.1 - List of Empirical Assumptions

E1. Excluded from the analysis is tax treatment in respect of:

(a) The natural resource sector (including exploration and development), except for data required to estimate effective ITC rates for the Atlantic Investment Tax Credit (AITC).

(b) The banking sector.

(c) Intangible investment, such as R&D and goodwill.

(d) Extremely specialized business tax regime features, such as Ontario’s Brownfields Financial Tax Incentive Program.

(e) Corporate investment in the residential structure sector in respect of BPT.

E2. Where possible and appropriate, a jurisdiction’s statutory tax regime parameters are treated as follows:

(a) If a jurisdiction has not announced a sequence of future tax rates, the current tax rate applies from the current year onward.

(b) If a jurisdiction has announced a sequence of future tax rates, the sequence is taken into account such that the final value in the sequence applies from its corresponding year onward.

(c) Announced temporary changes to non-tax rate parameter values, such as temporary accelerated CCA rates, are ignored.

(d) Announced permanent changes to non-tax rate parameter values that are currently being phased in are treated as though they have been fully implemented.

E3. RSTs and ITCs do not apply to land or inventories.

E4. Finance Canada advised it will not share its RST data due to an agreement with Statistics Canada over the data, but suggested using its past RST METR contributions to back out the effective RST rates likely used. Following this method to standardize the
varying complexities and tax bases of provincial RSTs, I therefore appeal to the 2008 Federal Budget (the most recent of Finance Canada’s METR publications that stratifies provincial METRs by individual tax contribution), which reflects tax polices announced as of January 1, 2007. As a result, the 2013 statutory RST rates of British Columbia, Saskatchewan and Manitoba are multiplied by 69.5%, 57.5% and 68.5%, respectively, to arrive at corresponding effective RST rates. Since provincial tax changes have taken place since 2007, the estimated 2013 RST contributions to the METR will not necessarily match those estimated in the 2008 Federal Budget.

E5. The national inflation rate is set to 2 percent per year for all provinces, as that is the Bank of Canada’s target.

E6. The following parameters apply to all provinces, the values of which are based on 2012 Statistics Canada data unless otherwise indicated:

(a) Nominal interest rate on debt, obtained from Finance Canada in August, 2013.

(b) Proportion of investment financed/issued as debt.

(c) Proportion of equity held as retained earnings.

(d) Corporate investment shares across capital categories, to some extent based on McKenzie et al. (1998).

(e) Real economic depreciation rates across capital categories.

E7. The combined provincial-federal PIT rates used to represent the average domestic investor in Canada are weighted averages of the corresponding 2013 statutory rates using provincial shares of national investment as weights sourced from 2012 Statistics Canada data.

E8. The capital stock is divided into the following categories:

(a) Land

(b) Buildings
(c) Machinery

(d) Inventories

E9. CCA rates across capital categories are assigned as follows:

(a) Land: 0% since it is outside of CCA classification.

(b) Buildings: a weighted average of the two general rates for Class 1, the class most representative of structures. These rates are 10% for manufacturing and 6% for all other structures. Statistics Canada’s 2012 manufacturing share of national building investment is used to calculate the weighted average CCA rate.

(c) Machinery: 30% since this is the general rate for Class 43, the class most representative of machinery and equipment.

(d) Inventories: 0% since they are outside of CCA classification.

E10. With respect to the BPT:

(a) Assessed values are deemed market values only if reassessment takes place with a frequency such that the valuation date (i.e. the date on which the reassessment is based) is no more than one year before the implementation date (i.e. the date on which the reassessment takes effect for taxation).

(b) To the extent possible using available current and historical data, effective tax rates account for:

   i. Property classification when there is differential tax treatment across business classes.

   ii. Assessment discounts and property tax credits.

   iii. Reassessment lags (rounded to the nearest year) when assessed values are not deemed market values as per (a).
(c) Where possible, effective BPT rates are calculated by property class and then weighted by corresponding assessment shares to arrive at a province-wide effective BPT rate.

(d) A Business Occupancy Tax (BOT) is a type of BPT and as such is converted into a conventional BPT equivalent where required.

E11. Once an investment is made, the depreciation it experiences reflects physical wear only; that is, the investment’s real capital gain in present value is zero over its useful life. Thus, \( a_k = 0 \) for all \( k \).

E12. Provincial ITCs apply to all manufacturing buildings and machinery and the federal AITC applies to all buildings and machinery engaged in manufacturing, agriculture, forestry, fishing or hunting in the four Atlantic provinces.\(^{53}\) Using 2012 Statistics Canada data, provincial ITC-eligible and AITC-eligible shares of provincial investment are estimated for the buildings and machinery categories. These shares are applied to statutory ITC rates to obtain effective ITC rates.

E13. Since CIT impacts the METR non-linearly and since ITCs are part of the CIT regime, the METR contribution of the CIT is apportioned between federal and provincial levels on a pro-rata basis for each province according to the following procedure:

(a) Including only federal ITCs and CIT, calculate the notional METR.

(b) Including only provincial ITCs and CIT, calculate the notional METR.

(c) Sum (a) and (b).

(d) Including only federal and provincial ITCs and CIT, calculate the METR. This is the combined federal-provincial CIT contribution to the METR.

(e) The federal CIT contribution to the METR is (d) multiplied by (a) divided by (c).

\(^{53}\) As of 2013 the AITC no longer applies to the oil and gas industry (Canada, 2012).
(f) The provincial CIT contribution to the METR is (d) minus (e).

E14. For each province, once the CIT contribution to the METR is calculated, the contributions of the RST and BPT are calculated by incorporating them into the METR in that order, respectively.\(^{54}\)

E15. With respect to local BPTs and where possible:

(a) The foregoing empirical assumptions are adapted and applied to municipalities where appropriate. Otherwise, parameters and data for a province are assumed to apply to its municipalities.

(b) When a local authority (e.g. a school board) other than a municipality levies differential effective property tax rates across residential and business classes, the tax rates are treated as though they are levied by the municipality itself.

E16. The Canadian national METR is calculated as a weighted average of the provincial or municipal METRs, as the case may be, using 2012 provincial shares of national corporate investment as weights.

2.9 Appendix 2.1 - Parameter Values and Selected Endogenous Values

Table 2.9-1 National Parameter Values Common to All Capital Categories

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Interest Rate on Debt</td>
<td>5.80%</td>
<td>Finance Canada</td>
</tr>
<tr>
<td>Proportion of Investment Financed/Issued as Debt</td>
<td>34.77%</td>
<td>Statistics Canada</td>
</tr>
<tr>
<td>Proportion of Equity Held as Retained Earnings</td>
<td>35.73%</td>
<td></td>
</tr>
<tr>
<td>Inflation Rate</td>
<td>2.00%</td>
<td>Assumed by Author</td>
</tr>
</tbody>
</table>

Table 2.9-2 National Parameter Values Varying by Capital Category

As it turns out, the results are not appreciably sensitive to the order of incorporation of the various taxes.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Land</th>
<th>Buildings</th>
<th>Machinery</th>
<th>Inventories</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of Corporate Investment</td>
<td>10.56%</td>
<td>35.19%</td>
<td>23.22%</td>
<td>31.03%</td>
<td>Statistics Canada; McKenzie et al. (1998)²⁵⁵</td>
</tr>
<tr>
<td>Real Economic Depreciation Rate</td>
<td>0.00%</td>
<td>4.04%</td>
<td>10.77%</td>
<td>0.00%</td>
<td>Canada Revenue Agency</td>
</tr>
<tr>
<td>CCA Depreciation Rate</td>
<td>0.00%</td>
<td>6.15%</td>
<td>30.00%</td>
<td>0.00%</td>
<td></td>
</tr>
</tbody>
</table>

Table 2.9-3  Corporate Investment Shares

<table>
<thead>
<tr>
<th>Corporate Investment Shares</th>
<th>BC</th>
<th>AB</th>
<th>SK</th>
<th>MB</th>
<th>ON</th>
<th>QC</th>
<th>NB</th>
<th>NS</th>
<th>PE</th>
<th>NL</th>
<th>Canada</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Corporate Investment</td>
<td>12.62%</td>
<td>34.42%</td>
<td>6.60%</td>
<td>3.13%</td>
<td>23.28%</td>
<td>14.08%</td>
<td>1.38%</td>
<td>1.68%</td>
<td>0.23%</td>
<td>2.58%</td>
<td>100.00%</td>
<td>Statistics Canada</td>
</tr>
<tr>
<td>Federal Atlantic ITC-</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>16.33%</td>
<td>13.34%</td>
<td>22.81%</td>
<td>9.25%</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eligible - Buildings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federal Atlantic ITC-</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>32.44%</td>
<td>27.68%</td>
<td>33.60%</td>
<td>21.37%</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eligible - Machinery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provincial Manufacturing</td>
<td>N/A</td>
<td>N/A</td>
<td>6.51%</td>
<td>3.55%</td>
<td>N/A</td>
<td>7.02%</td>
<td>N/A</td>
<td>N/A</td>
<td>7.89%</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITC-Eligible - Buildings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provincial Manufacturing</td>
<td>N/A</td>
<td>N/A</td>
<td>8.76%</td>
<td>16.69%</td>
<td>N/A</td>
<td>24.36%</td>
<td>N/A</td>
<td>N/A</td>
<td>20.46%</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>ITC-Eligible - Machinery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2.9-4  Combined Federal-Provincial PIT Rates

<table>
<thead>
<tr>
<th>Combined Federal-Provincial PIT Rates</th>
<th>BC</th>
<th>AB</th>
<th>SK</th>
<th>MB</th>
<th>ON</th>
<th>QC</th>
<th>NB</th>
<th>NS</th>
<th>PE</th>
<th>NL</th>
<th>Canada</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIT Rate on Interest</td>
<td>43.70%</td>
<td>39.00%</td>
<td>44.00%</td>
<td>46.40%</td>
<td>49.53%</td>
<td>49.97%</td>
<td>45.07%</td>
<td>50.00%</td>
<td>47.37%</td>
<td>42.30%</td>
<td>44.52%</td>
<td>Canada Revenue Agency; Provincial Websites</td>
</tr>
<tr>
<td>PIT Rate on Capital Gains</td>
<td>21.85%</td>
<td>19.50%</td>
<td>22.00%</td>
<td>23.20%</td>
<td>24.77%</td>
<td>24.99%</td>
<td>22.54%</td>
<td>25.00%</td>
<td>23.69%</td>
<td>21.15%</td>
<td>22.26%</td>
<td></td>
</tr>
<tr>
<td>PIT Rate on Dividends</td>
<td>25.78%</td>
<td>19.29%</td>
<td>24.81%</td>
<td>32.46%</td>
<td>33.85%</td>
<td>35.22%</td>
<td>24.91%</td>
<td>36.06%</td>
<td>28.70%</td>
<td>22.47%</td>
<td>26.98%</td>
<td></td>
</tr>
</tbody>
</table>

²⁵⁵ Since the land data is not disaggregated by Statistics Canada along residential/corporate lines, in line with McKenzie et al. (1998) the investment share for land is deemed to be 30% of that for buildings, implying about 23% of corporate property value is attributable to land. Since inventory investment is not included in the corporate investment flow dataset, the share of inventory investment is deemed to be 45% of land, building and machinery investment combined, again in line with McKenzie et al. (1998).
### Table 2.9-5  Statutory Business Tax and ITC Rates

<table>
<thead>
<tr>
<th>Parameter</th>
<th>BC</th>
<th>AB</th>
<th>SK</th>
<th>MB</th>
<th>ON</th>
<th>QC</th>
<th>NB</th>
<th>NS</th>
<th>PE</th>
<th>NL</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal General CIT Rate</td>
<td>15.00%</td>
<td>15.00%</td>
<td>15.00%</td>
<td>15.00%</td>
<td>15.00%</td>
<td>15.00%</td>
<td>15.00%</td>
<td>15.00%</td>
<td>15.00%</td>
<td>15.00%</td>
<td>Canada Revenue Agency; Provincial Websites</td>
</tr>
<tr>
<td>Provincial General CIT Rate</td>
<td>11.00%</td>
<td>10.00%</td>
<td>12.00%</td>
<td>12.00%</td>
<td>11.50%</td>
<td>11.90%</td>
<td>12.00%</td>
<td>16.00%</td>
<td>16.00%</td>
<td>14.00%</td>
<td>Province websites; Author’s Calculations</td>
</tr>
<tr>
<td>Federal ITC Rate - Manufacturing</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>10.00%</td>
<td>10.00%</td>
<td>10.00%</td>
<td>10.00%</td>
<td>Province websites; Author’s Calculations</td>
</tr>
<tr>
<td>Provincial ITC Rate - Manufacturing</td>
<td>0.00%</td>
<td>0.00%</td>
<td>5.00%</td>
<td>10.00%</td>
<td>0.00%</td>
<td>5.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>10.00%</td>
<td>0.00%</td>
<td>Province websites; Author’s Calculations</td>
</tr>
<tr>
<td>Provincial General RST Rate</td>
<td>7.00%</td>
<td>0.00%</td>
<td>5.00%</td>
<td>8.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>Province websites; Author’s Calculations</td>
</tr>
<tr>
<td>Assessment-Weighted Provincial BPT Rate</td>
<td>0.678%</td>
<td>0.390%</td>
<td>0.943%</td>
<td>1.183%</td>
<td>1.212%</td>
<td>0.221%</td>
<td>2.104%</td>
<td>0.331%</td>
<td>1.500%</td>
<td>0.000%</td>
<td>Author’s Calculations</td>
</tr>
</tbody>
</table>

### Table 2.9-6  Effective RST, BPT and ITC Rates

<table>
<thead>
<tr>
<th>Parameter</th>
<th>BC</th>
<th>AB</th>
<th>SK</th>
<th>MB</th>
<th>ON</th>
<th>QC</th>
<th>NB</th>
<th>NS</th>
<th>PE</th>
<th>NL</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provincial General RST Rate - Buildings and Machinery</td>
<td>4.865%</td>
<td>0.000%</td>
<td>2.875%</td>
<td>5.480%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>Author’s Calculations</td>
</tr>
<tr>
<td>Assessment-Weighted Provincial BPT Rate - Land</td>
<td>0.665%</td>
<td>0.370%</td>
<td>0.793%</td>
<td>0.605%</td>
<td>1.039%</td>
<td>0.206%</td>
<td>1.866%</td>
<td>0.318%</td>
<td>1.500%</td>
<td>0.000%</td>
<td>Author’s Calculations</td>
</tr>
<tr>
<td>Assessment-Weighted Provincial BPT Rate - Buildings</td>
<td>0.665%</td>
<td>0.370%</td>
<td>0.793%</td>
<td>0.605%</td>
<td>1.039%</td>
<td>0.206%</td>
<td>1.885%</td>
<td>0.318%</td>
<td>1.500%</td>
<td>0.000%</td>
<td>Author’s Calculations</td>
</tr>
<tr>
<td>Federal ITC Rate - Buildings</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>1.633%</td>
<td>1.334%</td>
<td>2.281%</td>
<td>0.925%</td>
<td>Author’s Calculations</td>
</tr>
<tr>
<td>Federal ITC Rate - Machinery</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>3.244%</td>
<td>2.768%</td>
<td>3.360%</td>
<td>2.137%</td>
<td>Author’s Calculations</td>
</tr>
<tr>
<td>Provincial ITC Rate - Buildings</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.326%</td>
<td>0.355%</td>
<td>0.000%</td>
<td>0.789%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>Author’s Calculations</td>
</tr>
<tr>
<td>Provincial ITC Rate - Machinery</td>
<td>0.000%</td>
<td>0.000%</td>
<td>0.438%</td>
<td>1.669%</td>
<td>0.000%</td>
<td>1.218%</td>
<td>0.000%</td>
<td>0.000%</td>
<td>2.046%</td>
<td>0.000%</td>
<td>Author’s Calculations</td>
</tr>
</tbody>
</table>

### Table 2.9-7  Net Effective Local BPT Rate for Largest Municipality in a Province

<table>
<thead>
<tr>
<th>Parameter/Attribute</th>
<th>Vancouver</th>
<th>Calgary</th>
<th>Saskatoon</th>
<th>Winnipeg</th>
<th>Toronto</th>
<th>Montreal</th>
<th>St. John</th>
<th>Halifax</th>
<th>Charlottetown</th>
<th>St. John’s</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Province</td>
<td>BC</td>
<td>AB</td>
<td>SK</td>
<td>MB</td>
<td>ON</td>
<td>QC</td>
<td>NB</td>
<td>NS</td>
<td>PE</td>
<td>NL</td>
<td>Statistics Canada</td>
</tr>
<tr>
<td>2011 Population</td>
<td>603,502</td>
<td>1,096,833</td>
<td>222,189</td>
<td>663,617</td>
<td>2,615,060</td>
<td>1,649,519</td>
<td>68,043</td>
<td>390,096</td>
<td>32,174</td>
<td>100,646</td>
<td>Municipal and Provincial Websites; Author’s Calculations</td>
</tr>
<tr>
<td>Statutory RPT Rate</td>
<td>0.234%</td>
<td>0.380%</td>
<td>0.751%</td>
<td>2.924%</td>
<td>0.534%</td>
<td>0.919%</td>
<td>1.785%</td>
<td>0.867%</td>
<td>0.670%</td>
<td>0.810%</td>
<td>Municipal and Provincial Websites; Author’s Calculations</td>
</tr>
<tr>
<td>Statutory BPT Rate</td>
<td>1.034%</td>
<td>1.407%</td>
<td>0.751%</td>
<td>3.287%</td>
<td>1.622%</td>
<td>3.839%</td>
<td>2.678%</td>
<td>3.216%</td>
<td>2.360%</td>
<td>2.620%</td>
<td>Municipal and Provincial Websites; Author’s Calculations</td>
</tr>
<tr>
<td>Effective RPT Rate</td>
<td>0.234%</td>
<td>0.380%</td>
<td>0.377%</td>
<td>0.925%</td>
<td>0.440%</td>
<td>0.790%</td>
<td>1.785%</td>
<td>0.820%</td>
<td>0.670%</td>
<td>0.684%</td>
<td>Municipal and Provincial Websites; Author’s Calculations</td>
</tr>
<tr>
<td>Effective BPT Rate</td>
<td>1.034%</td>
<td>1.407%</td>
<td>0.661%</td>
<td>1.975%</td>
<td>1.336%</td>
<td>3.397%</td>
<td>2.678%</td>
<td>3.043%</td>
<td>2.360%</td>
<td>2.454%</td>
<td>Municipal and Provincial Websites; Author’s Calculations</td>
</tr>
<tr>
<td>Net Effective BPT Rate</td>
<td>0.800%</td>
<td>1.027%</td>
<td>0.284%</td>
<td>1.050%</td>
<td>0.896%</td>
<td>2.607%</td>
<td>0.893%</td>
<td>2.223%</td>
<td>1.690%</td>
<td>1.770%</td>
<td>Municipal and Provincial Websites; Author’s Calculations</td>
</tr>
</tbody>
</table>
Table 2.9-8  Selected Endogenous Values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>BC</th>
<th>AB</th>
<th>SK</th>
<th>MB</th>
<th>ON</th>
<th>QC</th>
<th>NB</th>
<th>NS</th>
<th>PE</th>
<th>NL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Rate of Return on Equity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.23%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real Rate of Return on Savings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.77%</td>
<td></td>
</tr>
<tr>
<td>Nominal Cost of Financing</td>
<td>4.25%</td>
<td>4.27%</td>
<td>4.23%</td>
<td>4.23%</td>
<td>4.24%</td>
<td>4.23%</td>
<td>4.23%</td>
<td>4.15%</td>
<td>4.15%</td>
<td>4.19%</td>
</tr>
</tbody>
</table>
Chapter 3
The Effect of Commercial Property Taxes on Structure Investment and the Tax Base

3.1 Introduction

In an effort to improve the investment climate of the Province of Ontario, the provincial government in recent years has eliminated its corporate capital tax (CCT), reduced its corporate income tax (CIT), transformed its multi-stage retail sales tax into a value-added sales tax and reduced its provincial business property tax (BPT) (Ontario, 2013). In recent Ontario budgets, the government has derided capital taxes, including the provincial BPT, as barriers to investment and has reiterated the need to reduce or eliminate such taxes to attract much needed investment to the province (Ontario, 2007).

While economists have applauded Ontario for these efforts to reduce destructive taxes on capital investment (Mintz, 2009), there is an ongoing debate in the literature over the incidence of the property tax that may put into question the economic benefits of reducing BPTs. Two schools of thought have emerged from this long-standing debate to define the following dichotomy: either the property tax is ultimately shifted onto landowners or is ultimately paid by businesses investing in structure capital (i.e. buildings) (Smart, 2012). These opposing views are known as the “benefit view” and “capital tax view”, respectively, and specifically relate to the portion of the property tax in excess or shortage of the benefits received by taxpayers from local public services thereby directly funded. This portion of the property tax is the “net” tax as it exists net of linkable local benefits received by taxpayers. Unless otherwise contextually indicated, throughout the paper this is the tax referred to by the term “property tax”.

If the benefit view is correct, then the property tax is equivalent to a pure land tax because perfect zoning or otherwise extreme land-structure substitution inelasticity causes it to become fully capitalized into land values, rendering it economically efficient and not a barrier to investment. In this case, the property tax is fully shifted onto an immobile and non-producible factor of production, land, generating little concern regarding the magnitude and uniformity of tax rates across property classes and the subnational jurisdiction, except perhaps on the grounds
of taxpayer equity. What is more, the benefit view’s implications reach much farther than the efficiency of the property tax. Under the benefit view, any tax with a legal incidence on structure capital is necessarily fully capitalized into land values, such as a CIT or CCT, and is therefore an efficient tax on structure capital.\textsuperscript{56}

If however the capital tax view is correct, then the structure portion of the property tax is equivalent to an excise tax on capital, raising barriers to investment and causing economically damaging distortions in the capital market by raising the user cost of capital faced by investing businesses. In this case, there is a public policy case supporting the reduction of BPTs and the adjustment of BPT rates to levels below those for residential property since businesses typically consume less local services than residents (Kitchen & Slack, 2012). Moreover, under the capital tax view, converting the property tax into a uniform land tax on a revenue-neutral basis would entail large economic benefits, subject to conversion costs and land value capitalization (i.e. Laffer) effects related to land taxation.

In the 2008 Ontario budget, the provincial government made it clear that its BPT reduction program, announced just one year prior, was motivated by its subscription to the capital tax view of the BPT:

\textit{“The BPT reductions are key elements in the government’s overall strategy to enhance Ontario’s investment climate. This initiative (the BPT reduction program) will also reduce the wide variation in BPT rates across the province. The variation in rates distorts efficient business location decisions, placing many regions of the province at a disadvantage and harming the provincial economy.”} (Ontario, 2008)\textsuperscript{57}

Given this official policy stance of the Province of Ontario and with structures representing over 35\% of Canada’s national corporate investment according to 2012 Statistics Canada data, there is a public policy interest in determining which of the two views more accurately captures the

\textsuperscript{56} Since the CIT taxes income generated by structure capital, it is therefore equivalent to a tax on the value of the stock of structure capital, like a CCT or BPT.

\textsuperscript{57} In this quotation I have replaced the acronym BET (Business Education Tax) with BPT for consistency and clarity with respect to the general-revenue nature of the Business Education Tax despite its now obsolete and obviously misleading name.
incidence of the BPT. In particular, there is a public policy interest in determining the extent to which BPT’s contribution to the marginal effective tax rate (METR) on capital translates into a tangible impact on investment.58

One way of resolving the benefit view vs. capital tax view debate empirically is to analyze changes in BPT rates at the municipal level and measure subsequent changes in structure investment, all else equal. If the benefit view is correct, then variation in property tax rates should have virtually no impact on variation in structure investment across municipalities. If however the capital tax view is correct, then this impact would evidently be economically significant and negative, where I would consider any tax elasticity below -0.10 to be economically significant.

To implement such a test, the present study exploits an unanticipated 2007 reduction in the provincial portion of the BPT in Ontario for new investment. Due to certain historical and institutional features of Ontario’s property tax system, this reduction resulted in variation in the change in the total effective BPT rate across municipalities. I take advantage of this exogenous variation to identify the BPT’s impact on structure investment and the tax base over the past number of years and thus estimate generalized tax elasticity and revenue hill functions.

While the growing consensus within the literature linking property taxes to capital investment in buildings points toward the capital tax view (Bartik, 1992), econometric studies have routinely been challenged by issues related to possible tax-benefit linkage, calculation of effective tax rates and measurement of structure capital. In addition to addressing these issues, I build onto the literature by integrating tax elasticity and revenue hill estimation and by enabling the decomposition of tax base depression due to the property tax into its capitalization and investment components.

The present study builds naturally onto Found (2013a) in which inter-provincial and inter-municipal METR analysis is conducted for Canada with BPTs included. Simply put, while the METR represents the extent to which capital taxes drive up the marginal cost of capital, the tax

58 This contribution is estimated to be about 17 percentage points for Ontario’s provincial BPT and about 15 percentage points for the City of Toronto’s BPT (Found, 2013a).
elasticity represents the extent to which investing businesses are sensitive to this increase in marginal cost. That is, the METR measures the upward shift of the elastic capital supply curve due to capital taxes in a small open economy, while the tax elasticity measures the response as measured by the profile and movement of the capital demand curve (i.e. the responsiveness to capital taxes). Full capitalization of a BPT into land values would be represented by an upward shift of the structure capital demand curve exactly offsetting the increase in the marginal cost of structure capital induced by the BPT.

In brief, I find that Ontario’s average tax elasticity (and tax-base elasticity) lies in the range -0.80 to -0.90 at current taxation levels, and thus conclude that capital investment in commercial structures and the commercial tax base are highly sensitive to the property tax.

3.2 Literature Review

Consider the following articulations of the two opposing views of the property tax:

“Zoning changes the property tax from a tax on real-estate capital to a tax on land.”...“The local property tax is a benefit tax.” (Fischel, 2000)

“Property taxes on commercial and industrial property increase the marginal effective tax rate on capital, discouraging investment in structures, and reducing the competitiveness of the business sector.” (Dahlby, 2012)

Quite succinctly, these two prominent public finance economists frame the ongoing debate in the literature. While the debate has played out almost entirely within the context of the residential property tax, a BPT analogue does exist, as pointedly suggested by Dahlby (2012).

Important to note is the fact that both the benefit and capital tax views agree in respect of the portion of the property tax that corresponds directly to local benefits received by the taxpayer. To the extent that taxpayers perceive benefits from efficiently provided local services as being directly linked to, and dependent on, the property tax, this tax is a benefit tax and hence does not distort investment in structures. In such an environment, the property tax is converted into a general user fee for local services and thus generates zero deadweight loss. This “benefit” portion of the property tax is not the subject of the debate at hand, a fact that would be made much more apparent had the literature not assigned the term “benefit view” to the notion that
property taxes in excess or shortage of benefits received are capitalized into land values. In my view, a much less ambiguous term would have been “land tax view”, but it would appear the established terminology has become too entrenched for there to be much hope of changing it now.

Where the two views strongly disagree, however, is on the portion of the property tax that does not satisfy the foregoing tax-benefit relation. As previously mentioned, this portion of the property tax is the net tax as it exists net of linkable local benefits received by taxpayers, which could be either positive or negative in principle. The benefit view holds that the net property tax is fully capitalized into land values through either extreme (i.e. perfect) site-by-site zoning ordinances fixing the capital-to-land ratio to current use (Zodrow, 2007) or extremely low land-structure substitutability. In contrast, the capital tax view holds that, while some of the property tax is eventually capitalized into land values as a product of capital-land substitution effects, it is equivalent to an excise tax on structure capital and thus discourages investment in structures and depresses both land and structure values. This view is echoed by three eminent public finance economists in their recent account of property tax reform in Ontario:

“One problem with imposing a relatively heavy tax on business property is that it is, in effect, a tax on a form of investment, and like all such taxes, it is likely to discourage investment to some extent. Moreover, by taxing one particular form of investment, real property, the nonresidential property tax penalizes more heavily those activities and production techniques that are more real-property intensive.” (Bird, et al., 2012)

Due to certain factors, such as the residential control of municipal councils and the use of classified property tax systems, the net portion of the property tax faced by businesses is large relative to the benefit portion (Kitchen & Slack, 1993); (Haughwout, Inman, Craig, & Luce, 2004); (Mintz & Roberts, 2006); (Wheaton & Lee, 2010); (Dahlby, 2012); (Bird, et al., 2012); (Kitchen & Slack, 2012), so the benefit view vs. capital tax view debate is especially relevant to the BPT. Despite this heightened relevance however, the tax elasticity, tax-base elasticity and revenue hill estimation literature is surprisingly sparse when it comes to the BPT.

While many studies have estimated the impact of local and state taxes on “business activity” generally (Bartik, 1992), I tend to exclude them from review on the grounds that they largely study taxes other than the property tax or otherwise use tax base metrics such as number of
business establishments, firm location, employment etc. that do not relate directly to property tax elasticity and revenue hill estimation. In my view, the metrics of structure capital stock and market value assessment base (i.e. the bases that are actually taxed) are the only ideal tax base metrics for property tax elasticity and revenue hill estimation. While other metrics may be useful for answering economic questions such as those related to firm location or job creation, they are not ideal for drawing inferences specifically regarding tax base and structure investment sensitivity to the property tax.

Among the studies estimating property tax elasticities or revenue hills, the vast majority analyze the residential property tax, while only a few analyze the BPT. In terms of the BPT studies herein reviewed, my intent is to strike a balance between currency, breadth and relevance to Ontario. In order to achieve this balance, I find it useful to review a small number of studies using tax base metrics other than the ideal ones noted above. I first review studies on structure elasticity to the BPT (i.e. tax elasticity), and then review those on tax-base elasticity to the BPT (i.e. revenue hills).

A distinction to bear in mind is that the tax elasticity is defined as \( \frac{\partial \ln K}{\partial \ln \tau} \) while the tax-base elasticity is defined as \( \frac{\partial \ln V(K)}{\partial \ln \tau} \), where \( K \) is structure capital stock, \( V(K) \) is the market value of the tax base (land value plus structure value) and \( \tau \) is the effective property tax rate.\(^{59}\) These elasticities correspond to the investment effect and combined investment and capitalization effect, respectively, of the property tax. In their analysis of property taxes in the province of New Brunswick, Brett & Tardif (2008) highlight the difference between the investment and capitalization effects:

“*The ability to raise property taxes is subject to economic constraints. The value of the local tax base is likely to be sensitive to the tax rate. There are two explanations for this elasticity of the tax base. First, any value-enhancing improvement to a property increases its tax assessment, thereby increasing the taxes payable on the property. The additional taxes add to the real cost of improvements, thereby deterring some enhancements to properties. The higher the tax rate, the...*”

\(^{59}\) As established later on, the tax and tax-base elasticities are of identical value when production of buildings uses Cobb-Douglas technology.
greater is the incentive to economize on improvements. Second, increases in the property tax can directly depress property values. People buy property along with the obligation to pay the taxes on that property. These future tax burdens decrease a buyer’s willingness to pay for the property, thereby lowering its purchase price and its assessed value.” (Brett & Tardif, 2008)

As noted in Bird et al. (2012), the investment and capitalization effects of the property tax are combined and embedded in the property tax’s revenue hill (i.e. Laffer curve). In fact, none of the previous studies on property tax revenue hills have disentangled these two quite distinct components of tax base depression. Under the benefit view where the investment effect is zero, the property tax’s revenue hill would reflect the capitalization effect only, so even under the benefit view the property tax would be subject to revenue generation limitations.

### 3.2.1 Studies on Tax Elasticity

Of the papers on tax elasticity estimation, probably most akin to the present study is that of Pollock & Shoup (1977) in which a structure investment model is developed and used to estimate the tax elasticity as a function of the property tax rate. Using data for a 1973 sample of hotels in the State of Hawaii, the authors find that the tax elasticity equation is given by $\varepsilon(\tau) = -3.74\tau$, where $\tau$ is the property tax rate and $i$ is the discount/interest rate. The magnitude of the coefficient estimate for the numerator (-3.74) indicates substantial sensitivity to the property tax. This function is remarkably similar to that derived and estimated in the present study, however it does not account for the dynamic nature of effective tax rates.

Wheaton (1984) develops a structure investment model to study the effect of the commercial property tax. Property-level data for commercial leases in the Boston Standard Metropolitan Statistical Area (SMSA) is used, where property tax paid per square foot of floor area is the metric for the effective tax rate. The author concludes that (i) inter-jurisdictional property tax differentials are not shifted onto tenants by property owners, (ii) the spatial demand for commercial capital is highly price elastic and (iii) the incidence of the commercial property tax must therefore largely lie with the owners of structure and land. The author further concludes these results moreover suggest that the level of a municipality’s commercial structure capital stock is highly sensitive to inter-municipal differentials in the commercial property tax rate.
Bartik (1992) performs a meta-analysis of studies estimating the effect of state and local taxes on various forms of business activity. Using the most sophisticated of the studies considered, he concludes that the mean elasticity of “business activity” with respect to state and local taxes generally is -0.51 with a 95% confidence interval of -0.17 to -0.85. Although this represents quite a broad range of elasticities in respect of a bundle of state and local taxes, it is consistent with the foregoing studies that found sensitivity to the BPT. As Bartik (1992) notes, even a tax elasticity of -0.15 should be considered economically significant because it can easily mean the difference between investing in one municipality or another or even discourage investment altogether.

Although Smart (2012) does not measure property tax elasticity as conventionally defined, his Ontario-centric work is particularly relevant to the present study and should be reviewed nonetheless because of the empirical methodologies used. Smart (2012) explicitly notes his intention to contribute to the benefit view vs. capital tax view debate notwithstanding the fact that he does not use the property tax base but instead number of business establishments as the dependent variable. He uses 2000-2006 Ontario municipal data to estimate how the number of business establishments is affected by the property tax. With proper assessment data unavailable for his analysis, Smart (2012) proxied effective property tax rates by dividing total employment into total property tax levies at the business property class level.60

After estimating a reduced form first-difference model, Smart (2012) finds that the elasticity of business establishments with respect to the property tax rate, unconventionally referred to as the “tax elasticity”, is -0.25 and concludes his finding is economically insignificant and therefore evidence for the benefit view. In principle, I take issue with interpreting a tax elasticity of -0.25 as evidence of the benefit view because if the benefit view were in fact true then this elasticity would be zero. In line with Bartik (1992), I view a tax elasticity of -0.25 to be significantly different than zero economically speaking, and in fact evidence of the capital tax view.

60 Using postal code areas, Smart (2012) aggregated employment using SIC codes roughly corresponding to the commercial, office building and industrial property classes within municipal boundaries. The levies corresponding to these classes were divided by the aggregated employment figures to arrive at his version of effective tax rates.
The results and conclusion of Smart (2012) also need to be taken in context as he did not measure the property tax elasticity as conventionally defined, which is the percent change in structure investment for a 1% increase in the effective property tax rate. He instead measured the elasticity of number of business establishments with respect to a rather blunt substitute for the effective property tax rate. Moreover, number of business establishments cannot confidently be used as a measure of structural investment as a new Toyota automotive plant, like that in Cambridge, Ontario, would then count the same as a new Starbucks coffee shop. Therefore, the results of Smart (2012) likely do not reflect those one would obtain had structure capital investment and effective tax rates been measured using the ideal metrics for tax elasticity analysis.

### 3.2.2 Studies on Tax-Base Elasticity and Revenue Hills

A study by Bradbury & Ladd (1988) provides an excellent example of tax-base elasticity estimation. The authors consider 86 large cities in the United States over time and find that the elasticity of the aggregate tax base (residential and business) to the municipal property tax to be -0.15. Clearly, this result is a combination of capitalization and reduced investment in response to an increase in the effective property tax rate. However, the estimate of -0.15 is likely biased toward zero due to the aggregation of residential and business property and the benefit tax component of the municipal property tax.

A structure investment model is developed by McDonald (1993) to investigate the impact of inter-jurisdictional differentials in commercial property tax rates on business tax base. The author uses 1979-1988 data for 24 counties within the Chicago SMSA to estimate that the market value of business structures in a county with a rate of effective tax rate growth 1% higher than that in other counties will grow at a rate that is 46.53% slower than it would have otherwise. It is also found that the market value of business structures in a county with an effective tax rate level 1% higher than that in other counties will grow at a rate that is 36.54% slower than it would have otherwise. The author concludes that the BPT base is indeed sensitive to the property tax.

Haughwout et al. (2004) set out to estimate property tax revenue hills (among revenue hills for other local taxes) for four major cities in the United States: Minneapolis, Houston, Philadelphia, and New York. Using about 30 years’ worth of data starting in the late 1960s, the authors use market-to-assessed value equalization ratios to estimate market values of property tax bases,
where the tax base metric used for analysis is market value tax base per capita. In Haughwout et al. (2004), the property tax revenue hills are unfortunately not separated by property type. However, in Ladd (1998), the property tax revenue hills estimated by Haughwout et al. (2004) do appear separately for residential and business classes, but not for New York as at that time analysis had not been completed for that city. The revenue-maximizing tax rates for the BPT are 7.50% for Minneapolis, 2.47% for Houston, and 3.25% for Philadelphia.

In analyzing municipalities in the Province of New Brunswick over 1983-2003 using reduced form simultaneous equation modelling, Brett & Tardif (2008) set out to determine the extent to which tax competition exists among municipalities, especially neighbouring municipalities. Like many provinces in Canada, property in New Brunswick is reassessed annually to keep assessed values in line with market values. The authors define the average tax rate for a municipality as total property tax collected from all property classes combined divided by the corresponding total assessment base.

While Brett & Tardif (2008) find weak tax competition effects, they find a strong negative relationship between a municipality’s tax rate and the value of its tax base. It is estimated that the median tax rate among the municipalities generated a tax-base elasticity of -0.42 while the highest tax rate generated a tax-base elasticity of -0.91. While New Brunswick municipalities appear to have the capacity to raise additional revenue using property tax rate increases, the authors warn that this strategy may not be the most efficient way for municipalities to offset declining unconditional grants from the province.

In Bird et al. (2012), tax base elasticities are estimated for the residential and business classes of municipalities located within the Greater Toronto Area (GTA) of Ontario, where the business class is formed by merging the commercial and industrial classes. Tax rate, tax levy and assessment data for 1977-2005 are gathered along with market-to-assessed value equalization ratios needed to calculate effective tax rates. Municipal and education/provincial property taxes are aggregated and the two-tier structure of regional municipalities is accounted for in the analysis.

The authors find business tax base elasticities in the range of -0.46 to -0.92 depending on the municipality examined, results consistent with those of the present study. Using 2013 municipal assessment acquired for the present study to weight these estimated elasticities for each of the
five regions in the GTA (where the City of Toronto counts as a region), I find that the weighted average business tax base elasticity for the GTA is -0.84 according to the results of Bird et al. (2012). Echoing Brett & Tardif (2008), the authors are aware that embedded in their estimated tax-base elasticities are two effects of the tax rate on the tax base, namely capitalization and investment, but note however that their model does not permit disentanglement of these two effects.

3.2.3 Contributions to the Literature

A review of the literature makes apparent a number of, often reoccurring, issues connected with estimating tax elasticities and revenue hills for the BPT. Probably most notable are the issues of possible tax-benefit relation in respect of the municipal property tax, definition and measurement of effective tax rates, definition and measurement of structure capital investment and decomposition of tax-base elasticities into capitalization and investment effects.

I address the effective tax rate and structure investment issues by focusing the analysis on the actual base being taxed, namely market value of commercial real estate, as opposed to popular substitutes such as number of business establishments or business employment. I address the tax-base elasticity decomposition issue by using a structural model that generates equations for total tax base depression and the capitalization effect, the difference of which is the investment effect by definition.

Relative to these approaches, the way in which I address the potential tax-benefit issue requires a somewhat deeper contextual premise. While a case can be made for labeling the residential portion of the municipal property tax a benefit tax, the same cannot be said for the municipal BPT in its entirety. Indeed, I subscribe to the general view echoed by Haughwout et al. (2004), Dahlby (2012), Bird et al. (2012) and Kitchen & Slack (2012) that the municipal BPT is a substantially weaker benefit tax than its residential counterpart, especially in classified property tax systems like that of Ontario. Since, as noted earlier, businesses tend to consume far less

---

61 Since residents, and not businesses, control municipal councils and since municipalities provide an array of services funded by a combination of property taxes, development charges, provincial grants, federal grants and user fees, it cannot be assumed that there is necessarily a lock-step relationship between total BPT rates and the municipal service benefits received by businesses. This is especially the case when a classified property tax system is used, which tends to disproportionately burden business property in favour of residential property.
municipal resources than residents and yet tend to be taxed at several times the residential tax rate in classified property tax systems, the size of the net component of the municipal BPT is likely large compared to the benefit component.\textsuperscript{62} Also, as noted by three experts on municipal finance in Ontario

“At least half of the property tax collected by local municipal governments reflects decisions made at higher levels of government, decisions that are often not related in visible or accountable ways to corresponding benefits to the community.” (Bird, et al., 2012).

While all of this suggests the municipal BPT is largely, and perhaps almost entirely, a net tax on business investment in structures, I am able to sidestep the potential tax-benefit issue with regard to the municipal BPT by focusing my analysis on BPT rate reduction variation induced in the provincial BPT, an entirely net tax.

The list below summarizes the present study’s contributions to the literature:

1. Municipal Taxes and Service Levels: My analysis exploits a substantial and unanticipated 2007 cut in the provincial BPT, a tax which cannot possibly be a benefit tax any more than any other general revenue provincial tax.\textsuperscript{63} Since the municipal BPT is composed of benefit and net components, I address each component separately:

   a. Given the nature of a benefit tax, any change in the benefit portion of the municipal BPT during 2007-2012 would have no effect on investment or the tax base.

\textsuperscript{62} This view is consistent with the finding of Haughwout et al. (2004) that marginal balanced-budget increases in the municipal tax-expenditure bundle do not confer net benefits to property taxpayers. One can think of the municipal BPT as a small benefit tax on top of which a large net tax is added, where changes in the effective municipal BPT rate reflect variation in the net portion rather than the benefit portion. Under this view, a cut in the effective municipal BPT rate would arguably negatively impact municipal services benefitting businesses only if it were substantial enough to eliminate the net portion of the tax.

\textsuperscript{63} The provincial BPT cuts were announced in the 2007 Ontario budget on March 22, 2007. Like anything else in the budget, this policy change was subject to government secrecy prior to budget day. Implementation of an immediate tax cut for new investment was totally unforeseen by businesses – that feature had never been proposed by businesses lobbying the government. After budget day, there was no opposition in the legislature to the BPT cuts. No legislative amendments were proposed in regard to them, nor was there any deliberation regarding them in the Ontario Legislature. The introduction of the new construction BPT rate on March 22, 2007 was therefore about as exogenous as a tax cut could possibly be.
b. I make an identifying assumption that the net portion of the municipal BPT is a fixed effect during 2007-2012; that changes in it over the time period of analysis were anticipated by the business sector based on historical trends. This assumption is supported by the data for the average municipality in that a large effective BPT rate decrease of 13.38% occurs in 2007 compared to corresponding decreases of around 3% in 2005-2006 and 2008-2011. The data strongly indicate that these smaller, consistent decreases are simply the result of tax levies growing slower than property values as opposed to unanticipated tax cuts.

2. **Effective Property Tax Rates**: In previous studies, effective tax rates are calculated using potentially unreliable market-to-assessed value “equalization ratios” or are proxied with crude substitutes such as taxes per square foot of floor area or taxes per employee. By using property class level market value assessment data and statutory BPT rates, I am able to calculate accurate effective BPT rates. Additionally, to my knowledge the present study is the first of its class to structurally model the effective tax rate as a dynamic variable.

3. **Measurement of Structure Capital**: It is clear that past studies have struggled with measuring structure capital, where crude substitutes such as number of business establishments and employment have been used as proxies. The structural model I employ avoids the need to measure structure capital directly provided that appropriate time series market value assessment data is available. Since I do have such data, I am able to sidestep the problem of having to measure structure capital directly.

4. **Tax Elasticity and Revenue Hill Integration**: To my knowledge, the present study is the first to integrate tax elasticity and revenue hill analyses and results. Previous studies have been restricted to estimating either tax elasticities or revenue hills in isolation, largely due to the use of reduced form econometric models and/or lack of data. The present study on the other hand employs a structural model in which the tax elasticity and tax-base elasticity are equal. Hence my data enable the simultaneous estimation of tax elasticities and revenue hills, permitting the graphical integration of them as functions of the effective tax rate.
5. **Decomposition of Tax Base Depression**: While a number of past studies have estimated revenue hills or tax-base elasticities, to my knowledge none have been able to decompose the depression of the tax base due to the property tax into its two constituent parts: capitalization and investment. The structural model I employ enables this decomposition.

To a substantial degree, these contributions set the present study apart from previous studies in the literature.

### 3.3 Theoretical Model

To motivate and structure the empirical strategy, I adapt a theoretical model of property development from Arnott (2005), introducing a dynamic property tax and solving it to develop a structural econometric model.\(^\text{64}\)

#### 3.3.1 Model Setup and No-Tax Solution

Consider a developer contemplating an investment in the present period in order to indefinitely earn a growing stream of future rental income.\(^\text{65}\) Development entails combining structure capital (i.e. physical building material) and land to produce floor space in a jurisdiction under constant returns to scale technology. With constant returns production, the model can be fully characterized without loss of generality by analyzing both floor space and capital on a per-unit-land basis.

The following variables characterize the model:

- **\(t\)** time (e.g. years, where \(t = 0\) represents the present year)
- **\(Q(K)\)** production function for floor space per unit land (density) where \(Q_K > 0\) and \(Q_{KK} < 0\)
- **\(K\)** structure capital per unit land (capital/land ratio)

---

\(^{64}\) Arnott (2005) analyzes timing and level of property investment. In order to focus on the latter feature I abstract from the former, which does not change the qualitative results of interest but substantially increases modelling tractability when the complexity of dynamic property taxation is introduced.

\(^{65}\) The model abstracts from demolition and brownfield costs in the case that an existing structure and/or pollution occupies the acquired land.
- \( p(t) \) rent net of operating costs per unit floor area at time \( t \) where \( \frac{dp(t)}{dt} \geq 0 \)

- \( R(t) \) present value of \( p(u) \) for all \( u \geq t \)

- \( r \) discount rate (required gross rate of return on investment)

- \( P_K \) purchase price per unit of structure capital

- \( P_L \) purchase price per unit of land

The price of capital construction \( P_K \) and the rent function \( p(t) \) enter exogenously to reflect the perfect mobility of capital and tenants across municipal boundaries, and the model is assumed deterministic for simplicity. Without loss of generality, the discount rate is gross of depreciation and inflation; all other growth rates are in nominal terms. As a simplification, the price of land is assumed to adjust to ensure developers earn zero economic profit (ZEP). Given the definition of \( R(t) \), we have
\[
R(t) \equiv \int_t^\infty p(u)e^{-r(u-t)}du.
\]

When \( K \) units of capital are invested (and therefore sunk into a building) today, let the function \( V(K, t) \) denote the present value of the property’s income (i.e. market property value) at time \( t \). In the absence of a property tax we have:
\[
V(K, t) = Q(K)R(t)
\]

Letting \( D(K) \) denote today’s value of development profit per unit land, we have
\[
D(K) = V(K, 0) - P_K K - P_L.
\]

The developer thus chooses the amount of \( K \) to purchase today to solve:
\[
\max_K D(K) = Q(K)R(0) - P_K K - P_L
\]

The optimization problem has the following first-order condition and ZEP condition, respectively:
\[
K: \quad Q_K R(0) = P_K
\]
\[
p_L: \quad Q(K)R(0) - P_K K = P_L
\]
These are the usual conditions characterizing this sort of problem: the marginal revenue product of capital is equal to the price of capital and all revenue net of non-land costs goes to land to ensure ZEP.\textsuperscript{66}

\subsection*{3.3.2 Introduction of a Dynamic Property Tax}

Now consider the introduction of a property tax levied at an ad-valorem effective rate of $\tau(t)$ on property value at time $t$, generalizing the time-invariant tax rate typically assumed in the theoretical literature, including Arnott (2005).\textsuperscript{67} This generalization permits analysis of alternative dynamic property tax regimes and their effects on capital investment choices and tax base growth. I now extend Arnott (2005) by introducing a dynamic property tax and analyzing its impact on the level of investment made in, and the value of, the subject property.

Let the tax bill at time $t$ be given by $\tau(t)V(K, t) = \tau_0 V(K, 0)e^{\theta t}$ where $\tau_0$ is today’s tax rate and $\theta$ is the constant growth rate of the total levy for the property class net of that accruing from physical assessment growth (i.e. construction) where the subject property is a representative (i.e. average) property. The remainder of the paper imposes the reasonable and realistic requirement that the severity of the tax is insufficient to cause property value to become negative at any point in time. As will be seen, a necessary condition for this requirement to hold is $\theta < r$ so that the rate of tax bill growth is restrained to be less than the discount rate. This formulation of the effective tax rate is not only intuitive, it also captures at least two important features of property taxation in practice. First, it permits the effective tax rate to vary over time. Second, it gives the levying authority two different policy tools: $\theta$ in addition to the usual $\tau_0$.

This second feature resembles taxation policy as practiced where any given year’s tax rate is a function of the levying authority’s requisition from the assessment base. It is very typical for a levying authority to increase its requisition by a relatively constant or average percentage $\theta$ annually, net of that generated by physical assessment growth. For a property appreciating at the assessment base’s average, its tax bill will grow at the same rate as that for the property class as whole, namely $\theta$. The levying authority can even set $\theta$ equal to the average rate of property

---

\textsuperscript{66} It is clear that the second-order sufficiency condition is always met since $Q_{kk} < 0$.

\textsuperscript{67} Other taxes on business are assumed uniform throughout the subnational jurisdiction and are hence not modelled.
appreciation so as to keep the effective tax rate for the property class constant over time, which is the special case typically assumed in the literature, at least implicitly. Clearly, the converse is also true: holding the effective tax rate constant implies the tax levy grows at the appreciation rate of the assessment base.

Today’s tax rate $\tau_0$ is the policy tool used to implement an immediate one-time tax cut, shifting the time-variant revenue function $\tau(t)V(K, t)$ down but maintaining its growth rate at $\theta$. This tool is particularly useful for analyzing an asymmetric tax cut where for instance $\tau_0$ is lowered for new investment but is maintained at the previous level for existing buildings, holding levy growth constant.

For any given $r$ and $n$, in this model a tax regime is fully characterized by the vector $\{\tau_0, \theta\}$. Like in other tax models, I abstract from considering how public services financed by the property tax may enhance production or obtainable rents. The rationale for this abstraction is that a benefit tax cannot affect investment or the value of the tax base. Under the property tax regime $\{\tau_0, \theta\}$, following the method of Arnott (2005) the present value of the property at time $t$ is now given by the following recursive expression:

$$V(K, t) = Q(K)R(t) - \int_t^\infty \tau(u)V(K, u)e^{-r(u-t)} \, du$$

Substituting $\tau(u)V(K, u) = \tau_0V(K, 0)e^{\theta u}$ and rearranging removes the recursion and yields:

$$V(K, t) = Q(K)R(t) - \tau_0V(K, 0)\int_t^\infty e^{-r(u-t)+\theta u} \, du$$

$$V(K, t) = Q(K)R(t) - \tau_0V(K, 0)\frac{e^{\theta t}}{r-\theta}$$

As before, setting $t = 0$ brings the value of the income stream back to the present period:

$$V(K, 0) = Q(K)R(0) - \tau_0V(K, 0)\frac{1}{r-\theta}$$

$$V(K, 0) = \left(1 + \frac{\tau_0}{r-\theta}\right)^{-1} Q(K)R(0)$$
As expected, the property tax lowers the value of development but leaves it positive since 
\[ 0 < \left( 1 + \frac{\tau_0}{r - \theta} \right)^{-1} < 1. \] Upon revising the first order condition for \( K \), it is clear that this depression of property value is equivalent to raising the user cost of capital by \( \frac{\tau_0}{r - \theta} \) percent:

\[
K: \quad Q_K R(0) = \left( 1 + \frac{\tau_0}{r - \theta} \right) P_K
\]

Since \( P_K \) is exogenous to reflect fluid capital mobility across jurisdictional boundaries, the property tax raises the (marginal) user cost of capital for the developer while the suppliers of capital continue to receive \( P_K \) as they bear no burden of the tax. The property tax therefore, in addition to depressing property value via capitalization, deters developers from investing as much as they would have in absence of the tax, further depressing property value. For instance, the plausible values \( r = 8.0\% \), \( \theta = 2.0\% \) and \( \tau_0 = 2.1\% \) mean the property tax increases the user cost of capital by 35\% – clearly a substantial increase. It can also be shown that the property tax causes the land price to fall, leading the developer to substitute land for capital and thus build at lower density.

Since the econometric analysis herein takes advantage of an exogenous one-time unanticipated reduction in \( \tau_0 \) holding \( \theta \) fixed, the independent variable of direct interest is \( \tau_0 \). Once the production and rent functions are specified, a structural econometric model can be developed to analyze the impact of \( \tau_0 \) on structure investment and the tax base.

### 3.3.3 Preliminary Structural Equations for Tax and Tax-Base Elasticities

The latest empirical research indicates that production of commercial buildings is subject to constant returns to scale (CRS) and constant elasticity of substitution (CES) technology, where the elasticity of substitution between structure capital and land is somewhat above unity (Epple, et al., 2010).\(^{68}\) Therefore, since Cobb-Douglas technology is of the CES type with a constant substitution elasticity of unity, I assume production of buildings is Cobb-Douglas where 
\[ Q(K) = K^\alpha \] where \( 0 < \alpha < 1. \)

\(^{68}\) Epple et al. (2010) estimate this elasticity to be 1.39.

\(^{69}\) Arnott (2005) also uses Cobb-Douglas technology.
in all likelihood it is somewhat greater than unity as indicated in Epple et al. (2010), in which case the Cobb-Douglas assumption renders resulting estimated tax elasticities conservative (i.e. biased toward zero) because a smaller capital-land substitution elasticity means capital demand is less sensitive to changes in the cost of capital.

Since the exogenous structure of \( p(t) \) does not impact the main results of interest, for simplicity I align with Arnott (2005) by assuming that the growth rate of rent for floor space is time-invariant where \( p(t) = p_0 e^{nt} \) where \( p_0 > 0 \) is today’s (i.e. the initial) rent and \( n > 0 \) is the applicable growth rate.\(^7\) Hence, \( R(0) = \frac{p_0}{r-n} \), and with the production and rent functions now defined, equilibrium capital investment under the property tax regime \( \{\tau_0, \theta\} \) is

\[
K^* = \left( \frac{\alpha p_0}{(r-n)P_k} \right)^{\frac{1}{1-\alpha}} \left( 1 + \frac{\tau_0}{r-\theta} \right)^{\frac{-1}{1-\alpha}}
\]

where it is easy to verify that \( K^* \) reverts to the no-tax level of investment when \( \tau_0 = 0 \). Taking the natural log of both sides of this equation gives

\[
\ln K^* = z + \rho \ln \left( 1 + \frac{\tau_0}{r-\theta} \right)
\]

where \( z \equiv \frac{1}{1-\alpha} \ln \left( \frac{\alpha p_0}{(r-n)P_k} \right) \) is a constant term and \( \rho \equiv \frac{-1}{1-\alpha} \) is the price elasticity of capital factor demand since \( \frac{\partial \ln K^*}{\partial \ln P_K} = \frac{-1}{1-\alpha} \). With data on \( K^* \), the above equation for \( \ln K^* \) can be used to statistically estimate the price elasticity \( \rho \).

The tax elasticity is defined as \( \varepsilon(\tau_0, \theta) \equiv \frac{\partial \ln K^*}{\partial \ln \tau_0} \), which represents the percentage change in structure capital invested for a one percent increase in the tax rate. Using the Inverse Function Theorem on the equation for \( \ln K^* \), it can be shown that the tax elasticity is a weighted version of the price elasticity:

\[
\varepsilon(\tau_0, \theta) = \frac{\rho \tau_0}{r-\theta + \tau_0}
\]

\(^7\) It is assumed that \( n < r \) so that property value is finite.
While it is rare for the analyst to actually observe $K^*$ directly, my dataset allows one to observe $V(K^*, t)$ (i.e. market property value) at time (i.e. year) $t$. As it turns out, another path to the tax elasticity can be formulated that takes advantage of this data. At $K^*$, making the substitution $R(0) = \frac{p_0}{r-n}$ and taking the natural log of property value yields

$$V(K^*, 0) = \left(1 + \frac{\tau_0}{r-\theta}\right)^{-1} (K^*)^\alpha \frac{p_0}{r-n}$$

$$\ln V(K^*, 0) = \ln \left[\frac{p_0}{r-n}\right] - \ln \left(1 + \frac{\tau_0}{r-\theta}\right) + \alpha \left[z + \rho \ln \left(1 + \frac{\tau_0}{r-\theta}\right)\right]$$

$$\ln V(K^*, 0) = c + \rho \ln \left(1 + \frac{\tau_0}{r-\theta}\right)$$

where $c \equiv \alpha z + \ln \left[\frac{p_0}{r-n}\right]$ is a constant term. Once data for the parameters $r, \theta$ and $\tau_0$ are ascertained, market-based property assessments can in principle be used to structurally estimate $\rho$ and therefore $\varepsilon(\tau_0, \theta)$.

However, adapting this approach so as to identify the effect of a change in a parameter on property value requires an accounting for the fact that physical development takes time. Years are often required for developers to acquire land, navigate legal processes, and plan and construct buildings. Assessment authorities also require time to incorporate new construction into municipal assessment rolls. Based on results in this section, I derive a structural model in the next section that accounts for the lag in development.

### 3.3.4 Revenue Hills and Tax Base Retention Functions

Since structure capital investment is not equivalent to property value, it has been conventional in the literature to estimate either tax elasticity or tax-base elasticity, but not both simultaneously, depending on data availability. Under Cobb-Douglas production for buildings in the presence of constant returns scale however, these elasticities are in fact identical so that $\varepsilon(\tau_0, \theta) = \varepsilon_b(\tau_0, \theta)$, removing the distinction between tax elasticity and revenue hill estimation. To derive this result, take the natural log of the property value equation and differentiate the result with respect to $\ln \tau_0$ to yield the tax-base elasticity.
\[
\varepsilon_b(\tau_0, \theta) \equiv \frac{\partial \ln V(K, 0)}{\partial \ln \tau_0} = \frac{-\tau_0}{r - \theta + \tau_0} + \varepsilon(\tau_0, \theta) \frac{\partial \ln Q(K)}{\partial \ln K}
\]

Hence, \( \varepsilon_b(\tau_0, \theta) = \varepsilon(\tau_0, \theta) \) if and only if

\[
\frac{\partial \ln Q(K)}{\partial \ln K} = 1 + \frac{\tau_0}{(r - \theta + \tau_0)\varepsilon(\tau_0, \theta)}
\]

It can be verified that this condition is satisfied if production is Cobb-Douglas and subject to constant returns to scale.

Letting \( M(\tau_0, \theta) \) denote the property tax revenue function in the present period, revenue from the representative property is given by \( M(\tau_0, \theta) = \tau_0 V(K^*, 0) \) where \( V(K^*, 0) = e^c \left[ 1 + \frac{\tau_0}{r - \theta} \right]^{\rho} \).

Hence,

\[
\frac{\partial M(\tau_0, \theta)}{\partial \tau_0} = [1 + \varepsilon_b(\tau_0, \theta)]V(K^*, 0)
\]

with the second derivative confirming that \( M(\tau_0, \theta) \) is a hill-shaped function in respect of \( \tau_0 \) that is maximized if and only if \( \varepsilon_b(\tau_0, \theta) = -1 \). Since \( \varepsilon(\tau_0, \theta) = \varepsilon_b(\tau_0, \theta) \), once the tax elasticity is known the revenue hill function will be known, thus integrating the typically separated tax elasticity and revenue hill analyses.

Letting \( \tau_0^{max} \) denote the revenue-maximizing tax rate, it is given by:

\[
\tau_0^{max} = \frac{r - \theta}{1 + \rho}
\]

In order to graph the revenue hill without monetary or any other units, it will prove worthwhile to consider the proportion of maximum revenue generated by \( \tau_0 \), defined as \( \frac{M(\tau_0, \theta)}{M(\tau_0^{max}, \theta)} \) as a function of \( \tau_0 \) and \( \theta \). This representation of the revenue hill function is given by

\[
\frac{M(\tau_0, \theta)}{M(\tau_0^{max}, \theta)} = \frac{\tau_0^{max}}{\tau_0} \left( \frac{r - \theta + \tau_0}{r - \theta + \tau_0^{max}} \right)^{\rho}
\]
where $\tau_0^{\text{max}} = -\frac{r-\theta}{1+\rho}$ and $0 \leq \frac{M(\tau_0, \theta)}{M(\tau_0^{\text{max}}, \theta)} \leq 1$ for all $\tau_0 \geq 0$. Since this function and the original revenue hill function peak at the same tax rate $\tau_0$, and since this location is of particular interest as it is where revenue is maximized and represents an upper bound for the optimal tax rate (Bird, et al., 2012), the former function is of value because it can be plotted in the same graph as the tax elasticity since both of these functions are unit-free.

Letting $K^*(\tau_0, \theta)$ denote the equilibrium level of investment prevailing under tax regime $\{\tau_0, \theta\}$, it will also be interesting to graph with these functions the proportion of property tax base retained, which is given by

$$\frac{V(K^*(\tau_0, \theta), 0)}{V(K^*(0, \theta), 0)} = \left[1 + \frac{\tau_0}{r - \theta}\right]^\rho$$

as a function of $\tau_0$ and $\theta$, where $0 < \left[1 + \frac{\tau_0}{r - \theta}\right]^\rho \leq 1$ for all $\tau_0 \geq 0$. This is what I refer to as the tax base retention function, and it is of interest because it directly indicates the sensitivity of the tax base’s value to the property tax as a function of the initial property tax rate $\tau_0$ and the rate of levy increase $\theta$. The tax base retention function clearly combines the effects of capitalization and investment.

### 3.3.5 Property Tax Regimes and Policies

Before heading into the empirical strategy, it is of interest to consider how different property tax regimes and policies can be characterized within the theoretical framework. This exercise is worthwhile to undertake as it will develop some intuition and context for different property tax regime settings, refine the direction of the empirical strategy and illustrate the need for empirical studies such as this to recognize the dynamic nature of the property tax. It is also worthwhile to undertake because it will help relate the model herein to the real world of property taxation, and in particular to tax polices (e.g. dynamic revenue-neutral tax rate setting) typically practiced or compared to as benchmarks.

Recall that the effective tax rate function is defined as:

$$\tau(t) = \frac{\tau_0 V(K, 0) e^{\theta t}}{V(K, t)}$$
Differentiation with respect to $t$ yields

$$\frac{\tau_t(t)}{\tau(t)} = \theta - a(t)$$

where $a(t) \equiv \frac{V_t(K,t)}{V(K,t)}$ is the rate of property appreciation. This expression gives the rate of change of the effective tax rate as a function of the levy growth rate and the appreciation rate. To derive expressions for $\tau(t)$ and $a(t)$ in terms of the model’s parameters, start with the property value function at time $t$:

$$V(K, t) = Q(K)R(t) - \tau_0V(K, 0)\int_t^\infty e^{-(u-t)+\theta u} du$$

$$V(K, t) = Q(K)\frac{p_0e^{nt}}{r-n} - \tau_0V(K, 0)\frac{e^{\theta t}}{r-\theta}$$

Substituting the previously derived expression $V(K, 0) = \left[1 + \frac{\tau_0}{r-\theta}\right]^{-1} Q(K) \frac{p_0}{r-n}$ yields:

$$V(K, t) = Q(K)\frac{p_0}{r-n}\left[\frac{(r-\theta + \tau_0)e^{nt} - \tau_0e^{\theta t}}{r-\theta + \tau_0}\right]$$

Differentiation with respect to time $t$ gives:

$$V_t(K, t) = Q(K)\frac{p_0}{r-n}\left[\frac{n(r-\theta + \tau_0)e^{nt} - \theta\tau_0e^{\theta t}}{r-\theta + \tau_0}\right]$$

Substituting these derivations into the above effective tax rate and appreciation functions, we have the following expressions upon simplification:

$$\tau(t) = \frac{(r - \theta)\tau_0}{(r - \theta + \tau_0)e^{(n-\theta)t} - \tau_0}$$

$$a(t) = n - \frac{(n - \theta)\tau_0}{(r - \theta + \tau_0)e^{(n-\theta)t} - \tau_0}$$
As is required, the effective tax rate function satisfies the initial condition \( \tau(0) = \tau_0 \).

Additionally, since \( \theta \leq n \) is a necessary condition for positive property value, \( n \) is an upper bound for \( \theta \), ruling out negative effective tax rates.\(^71\) When there is no property tax (i.e. when \( \tau_0 = 0 \)), it is intuitive that we then have \( \tau(t) = 0 \) and \( a(t) = n \), the growth rate of rent. Since \( \theta \leq n \), when there is a tax the sign of the premium over the no-tax appreciation rate of \( n \) is always non-positive, as one would expect. Given the previously derived equation for the growth rate of the effective tax rate, \( \frac{\tau(t)}{\tau(t)} = \theta - a(t) \), various policy scenarios can be defined and compared. Of particular interest and relevance, especially to the Province of Ontario, are the following three policy scenarios:

1. **Fixed Effective Rate (FER) Policy**: Defined by \( \tau_t(t) = 0 \), implemented by \( \theta = a(t) \) which implies \( \theta = n \).\(^72\)

2. **Real Revenue Neutral (RRN) Policy**: Defined by \( \frac{\tau_t(t)}{\tau(t)} = \pi - a(t) \), implemented by \( \theta = \pi \) where \( \pi \) denotes the inflation rate.

3. **Nominal Revenue Neutral (NRN) Policy**: Defined by \( \frac{\tau_t(t)}{\tau(t)} = -a(t) \), implemented by \( \theta = 0 \).

It is interesting to note that \( a(t) = n \) under the FER policy, implying that introduction of a property tax does not affect the equilibrium no-tax appreciation rate when the effective tax rate is held constant over time. Since \( \tau(0) = \tau_0 \), then the FER policy is equivalently implemented by setting \( \tau(t) = \tau_0 \) for all \( t > 0 \), which is the tax environment often implicitly or explicitly assumed in the literature. For cautious businesses averse to overestimating the returns to investment, a prudent assumption would be that the tax regime is characterized by an FER policy, especially in the absence of a clear government policy announcement stating otherwise.

\(^{71}\) If \( \theta > n \), then \( \tau(t) < 0 \), in which case \( V(K, t) < 0 \) for some \( t \) sufficiently large. These are unrealistic results, therefore it is assumed \( \theta \leq n \). Since \( \theta \) can be any number less than \( n \), then \( n \) is the least upper bound for \( \theta \). Moreover, for \( 0 \leq \theta \leq n < r \), we have \( \frac{\partial r(t)}{\partial \tau_0} > 0 \), \( \frac{\partial r(t)}{\partial \theta} \geq 0 \), \( \frac{\partial r(t)}{\partial n} \leq 0 \), and \( \frac{\partial r(t)}{\partial r} \geq 0 \) for all \( t \geq 0 \), as intuition would suggest.

\(^{72}\) Another candidate solution for \( \theta = a(t) \) is \( \theta = r + \tau_0 \), however this possibility is ruled out since it causes the finite property value requirement to be violated; that is, the condition \( \theta > r \) is violated.
for future tax rates and levies. The RRN and NRN policy scenarios on the other hand cause effective tax rates to decline over time, creating tax environments that cannot be captured by models assuming a time-invariant effective tax rate.

In reality, businesses in Ontario’s municipalities operate under combined municipal-provincial tax regimes lying between the FER and NRN policy extremities, where \(0 < \theta < n\) so that effective tax rates decline over time similar to how they would under an RRN policy. For tax regimes falling in this range, the appreciation premium is negative but vanishes in the long run since \(\lim_{t \to \infty} a(t) = n\) when \(\theta < n\). Moreover, if the growth rate of rent is equal to inflation, so that \(n = \pi\), then the FER and RRN polices coincide. In fact, in jurisdictions where market rents tend to track inflation, a reasonable conjecture for the average municipal tax regime might be \(\theta \cong n \cong \pi\). My dataset indicates that recent Ontario history however has been characterized by \(0 < \theta \cong \pi < a(t) < n\) overall.

Since \(\tau(t)\) defines a future time path for the effective tax rate, I define a property tax change in the present period as follows: a one-time unanticipated change in either \(\tau_0\) or \(\theta\) in the present period that results in a change in \(K^*(\tau_0, \theta)\). Since \(\frac{\partial K^*(\tau_0, \theta)}{\partial \tau_0} < 0\) and \(\frac{\partial K^*(\tau_0, \theta)}{\partial \theta} < 0\) for \(0 \leq \theta \leq n < r\), then a property tax cut can be achieved by lowering either \(\tau_0, \theta\) or both. For the purpose of the present analysis, variation in an exogenous change in \(\tau_0\) across municipalities is the source of identification of the property tax effect.

A perhaps more intuitive way of conceiving of a tax burden change is to compare the tax regime \(\{\tau_0, \theta\}\) to one in which the effective tax rate is time-invariant. Let this comparator tax regime be characterized by \(\{\tau_f, \theta_f\}\) where \(\tau_f\) is the fixed effective tax rate and where \(\theta_f\) is the levy growth rate generated by the time-invariance structure of the effective tax rate. Recognizing that the time-invariance of \(\tau_f\) generates \(\theta_f = n\), we can find the fixed effective tax rate \(\tau_f\) that solves:

\[
K^*(\tau_0, \theta) = K^*(\tau_f, n)
\]

\[
\left(\frac{\alpha p_0}{(r-n)P_k}\right)^{\frac{1}{1-\alpha}} \left(1 + \frac{\tau_0}{r-\theta}\right)^{-\frac{1}{1-\alpha}} = \left(\frac{\alpha p_0}{(r-n)P_k}\right)^{\frac{1}{1-\alpha}} \left(1 + \frac{\tau_f}{r-n}\right)^{-\frac{1}{1-\alpha}}
\]

\[
\frac{\tau_0}{r-\theta} = \frac{\tau_f}{r-n}
\]
\[ \tau^E_f (\tau_0, \theta) = \frac{r - n}{r - \theta} \tau_0 \]

where \( \tau^E_f (\tau_0, \theta) \) is the “equivalent” fixed effective tax rate representative of tax regime \( \{\tau_0, \theta\} \). Businesses investing in the present period are indifferent between the tax regimes \( \{\tau_0, \theta\} \) and \( \{\tau^E_f (\tau_0, \theta), n\} \), hence a tax cut occurs with a change under tax regime \( \{\tau_0, \theta\} \) if and only if the change decreases \( \tau^E_f (\tau_0, \theta) \). The \( \tau^E_f (\tau_0, \theta) \) equation explicitly offers an alternative definition of the FER policy: namely \( \tau^E_f (\tau_0, \theta) = \tau_0 \), confirming that the FER policy not only implies \( \theta = n \) but is also implied by this condition.

It is obvious that failing to account for the dynamic nature of the effective tax rate would likely result in structural misspecification and bias in the estimated property tax effect to the extent that businesses’ expectations over the growth rate of tax liabilities \( \theta \) deviate from the growth rate of rent \( n \). In particular, in the case of Ontario where for most municipalities \( \theta < a(t) < n \) so that effective tax rates have been declining over time, failing to account for the dynamic nature of \( \tau(t) \) would likely lead to upward bias in the property tax effect (see Appendix 3.2 for a test of this hypothesis). Only in the special case of when tax levies grow at the same rate as rents \( \theta = n \) is the time-invariance assumption valid. When analyzing the effect of property taxes econometrically, proper accounting for the effective tax rate’s time path is clearly essential. It is important to obtain data not only on today’s tax rate \( \tau_0 \), but also data that can be used to form rational expectations over the rate of levy growth \( \theta \).

### 3.4 Empirical Strategy and Data

The empirical strategy and the data used in the present study can be somewhat characterized as a fusion and extension of Smart (2012) and Bird et al. (2012). While both studies examine Ontario municipalities, Smart (2012) centres on estimating the sensitivity of business location (as measured by business establishments) to the property tax while Bird et al. (2012) centre on estimating the tax-base elasticities of Ontario’s GTA municipalities. Through a combination of structural modelling, exploitation of a major 2007 provincial BPT reform and employment of high-calibre assessment data, I am able to simultaneously estimate the tax elasticity and revenue hill functions for each municipality and for the province as a whole.
3.4.1 Ontario’s Business Property Tax

In Ontario, both the province and its municipalities independently levy a BPT on a common tax base composed of commercial, industrial and other non-residential property. Since changes to a municipality’s tax rates may be correlated with unobservable factors affecting businesses within its boundaries, my empirical strategy exploits exogenous total BPT rate variation induced by an unanticipated 2007 provincial BPT reform.

When the province took over the education property tax from school boards in 1998, it completed the transformation of this tax into the equivalent of a general revenue tax. This transformation had by all practical accounts already been underway for years prior as the province strived to equalize per pupil funding across school districts using provincial grants, thus eroding any local benefit (or benefit differential) that could in any clear sense be directly linked to the education property tax (Bird, et al., 2012). Any residual link that may have been left was definitively severed once the education property tax was assumed by the province in 1998.

Each school board in Ontario now receives two mains sources of funding: the education property tax revenue generated within its jurisdiction and a provincial grant topping up that tax revenue so as to equalize per pupil funding province-wide. Since for every school board in Ontario education tax revenue falls far short of actual expenditure, per pupil spending for every school board is independent of the amount of education tax that is raised in its jurisdiction by the provincial property tax. In 1998, therefore, the province converted the local education property tax into the equivalent of a general revenue provincial property tax. Even though this tax revenue passes directly from municipalities (that collect the tax) to school boards (that expend the tax), because it is controlled by the province it is reported in provincial budgets as provincial revenue, as it should be, alongside other sources of provincial revenue such as CIT.

Since school districts typically encompass many municipalities, prior to 1998 school boards were required to set municipality-wide education tax rates separately for each upper and single-tier municipality within their jurisdiction. Hence, the province inherited a set of business education tax rates (now provincial BPT rates) with wide variation when it assumed the tax in 1998. During 1998-2003, the government systematically reduced provincial BPT rates at the high end of the spectrum in an effort reduce the provincial BPT burden where it was worst. These reductions were more than just tax rate reductions offsetting assessment appreciation; they
achieved targeted dollar-value levy reductions for businesses in municipalities with especially high initial (i.e. inherited) provincial BPT rates (Ontario, 2003).

For those municipalities with relatively lower provincial BPT rates and thus not targeted for such levy reductions, the government adjusted BPT rates annually on a revenue-neutral basis, offsetting the effects of reassessment (i.e. the government adopted an NRN policy). These adjustments took place at the municipality level, with each municipality treated as an isolated provincial BPT revenue silo. During 2004-2006, the government adopted an NRN policy for all municipalities, and discontinued the levy reductions (although effective tax rates generally declined with the NRN policy since assessed values increased). However, these rate changes did little if anything to move Ontario toward provincial BPT rate harmonization across municipalities.

Then in early 2007, the government initiated a new provincial BPT reduction program, adopting an asymmetric strategy for achieving near BPT rate harmonization where existing and new buildings would be treated differently initially. This program mirrored that of the 1998-2003 one in that municipalities with relatively high provincial BPT rates would receive correspondingly larger tax rate reductions. The difference, however, was the establishment of a uniform statutory provincial BPT rate for new business construction (including renovations and additions) in the province initiated after the program’s announcement in the 2007 Ontario budget. This rate was labelled the “target rate” and starting in 2008 all higher provincial BPT rates would be gradually brought down to it by 2014 for existing buildings, a move expected to reduce the CVA-weighted average statutory provincial BPT rate by approximately 10% (Ontario, 2007).

---

73 Provincial BPT silos were coterminous with upper and single-tier municipalities.

74 The target rate would not apply to existing buildings in municipalities with provincial BPT rates above 1.60% until 2014 or the few municipalities with a 2006 provincial BPT rate already lower than the target rate. Section 15 of the Education Act amends the Assessment Act to define “new construction” as improvements to the land initiated by application for a building permit after March 22, 2007 (the date the 2007 Ontario budget was announced) such that the improvements increase assessed value of the subject property by at least 50%.

75 Since the province maintains the revenue-neutral adjustment policy for municipalities not yet brought down to the target rate, the exception would be a municipality that appreciates its way down to the target rate. Moreover, the target rate serves as a “truncation rate” for municipalities for which revenue-neutral adjustments would have pushed the applicable provincial BPT rate across the target rate line. Once a municipality reaches the target rate, it remains there permanently under current practice. The target rate is adjusted annually to offset appreciation of the business assessment base of the group of municipalities at, or about to appreciate to, the target rate.
In light of difficult fiscal circumstances however, the 2012 Ontario budget suspended the final two years of the 2007-2014 provincial BPT reduction program for existing properties, with resumption expected in 2018. The suspension though has no effect on the provincial BPT rate levied on new investment initiated after the program’s announcement on March 22, 2007.

Inadvertently, the provincial government’s adoption of the 2007 BPT reduction program set in motion a natural experiment that can now be exploited. Initial variation in 2006 effective provincial BPT rates across municipalities means that the program induced variation in total effective BPT rate reductions (by reducing 2006 legacy rates to the target rate in 2007) for new investment across municipalities. Since the province exclusively controls the provincial BPT, which is entirely a net tax on Ontario’s businesses, this unanticipated change is exogenous to municipalities and their businesses, meaning the induced variation in total BPT rate reductions for new investment across municipalities is also exogenous.\textsuperscript{76} I exploit this exogenous variation at the municipal level to estimate the effect of property taxes on structure investment and the tax base.

### 3.4.2 Econometric Model

Recall that analyzing the equation for $\ln V(K^*(\tau_0, \theta), 0)$ is equivalent to analyzing that of $\ln K^*(\tau_0, \theta)$ directly in terms of estimating the tax elasticity function $\varepsilon(\tau_0, \theta)$. That is, the tax elasticity is identical to the tax-base elasticity. By sidestepping the need to observe or measure structure capital directly, this modelling approach represents a considerable improvement over previous studies often using blunt measures or substitutes for structure capital such as number of business establishments or business employment. However, the empirical application of this approach must account for the fact that any changes in property development induced by a tax regime change will take time, likely years (Dahlby & Ferede, 2011).

\textsuperscript{76} One may wonder whether the 2007 BPT reduction program affected provincial expenditures sufficiently to cause an appreciable reduction in provincial services and corresponding benefits going to businesses, and therefore lead to an appreciable degree of endogeneity. In short, this is not remotely possible since the 2008-2012 BPT cuts thus implemented for existing properties cumulate to only about $240M (Ontario, 2012), which is less than 0.2% of the $127.6B 2013-2014 provincial budget (Ontario, 2013). Moreover, the provincial BPT is entirely a net tax just as much as any other general revenue provincial tax. Even if this sort endogeneity did occur, it would attenuate the property tax effect, in which case estimates of this effect would be rendered conservative.
To set up a structural equation that accounts for the time lag in development, I revisit the previous section where property value is expressed as a function of time \( t \):

\[
V(K, t) = Q(K) \frac{p_0}{r - n} \left[ \frac{(r - \theta + \tau_0)e^{nt} - \tau_0 e^{\theta t}}{r - \theta + \tau_0} \right]
\]

Suppose at time \( t = 0 \) there is an effective tax rate change from \( \tau_0 \) to \( \tau_0' \), so that \( V(K^*(\tau_0', \theta), t) \) is the property value at time \( t \) given the new tax rate and \( V(K^*(\tau_0, \theta),0) \) is the initial property value at the time of the tax rate change. Interpreting a municipality’s commercial tax base as one large commercial property, these values are observable in the municipal data collected.

Recalling that \( Q(K) = K^\alpha \) and \( K^* = \frac{\alpha p_0}{(r-n)p_k} \left( 1 + \frac{\tau_0}{r-\theta} \right)^{\frac{1}{1-\alpha}} \), dividing the above expression by that for \( V(K^*(\tau_0, \theta),0) \) yields:

\[
\frac{V(K^*(\tau_0', \theta), t)}{V(K^*(\tau_0, \theta),0)} = \frac{(r - \theta + \tau_0')e^{nt} - \tau_0' e^{\theta t}}{r - \theta} \cdot \frac{1 + \frac{\tau_0}{r - \theta}}{1 + \frac{\tau_0'}{r - \theta}} \left[ 1 + \frac{\tau_0'}{r - \theta} \right]^{-\frac{1}{1-\alpha}}
\]

Taking the natural log of both sides gives a first-difference structural model that can be used to estimate the price elasticity \( \rho \):

\[
\ln V(K^*(\tau_0', \theta), t) - \ln V(K^*(\tau_0, \theta),0) = \delta(\tau_0', \tau_0, \theta, n, t) + \rho \left[ \ln \left( 1 + \frac{\tau_0'}{r - \theta} \right) - \ln \left( 1 + \frac{\tau_0}{r - \theta} \right) \right]
\]

where \( \delta(\tau_0', \tau_0, \theta, n, t) = \ln \left( \frac{(r-\theta+\tau_0')e^{nt} - \tau_0' e^{\theta t}}{r-\theta} \right) \) is a term resulting from the structural model, \( \rho \equiv \frac{-1}{1-\alpha} \) is the price elasticity and \( \alpha \) is the share of development cost attributable to structure capital (as opposed to land). Once \( \rho \) is known, the tax elasticity function \( \varepsilon(\tau_0, \theta) = \frac{\rho \tau_0}{r-\theta+\tau_0} \) is then known for any given tax regime \( \{\tau_0, \theta\} \) and discount rate \( r \).
Adopting this structural modelling approach and notationally suppressing the dependence of $V$ on $t$ as well as the arguments of $K^*$, I employ the augmented first-difference model

$$\ln V_{13}(K_{13,m}) - \ln V_{07}(K_{07,m}) = C + \gamma \delta_m + \rho \left[ \ln \left( 1 + \frac{\tau_{07,m}}{r - \bar{\theta}_m} \right) - \ln \left( 1 + \frac{\tau_{07,m}}{r - \bar{\theta}_m} \right) \right] + \varphi X_m + e_m$$

where:

- The subscript $m$ indicates the municipality.
- $V_y(K^*_y,m)$ is commercial assessment base on January 1 of year $y$.
- $\tau_{07,m}$ and $\tau_{07,m}'$ are the effective property tax rates immediately before and after the 2007 provincial BPT reform, respectively.
- $r$ is the discount rate and is set to a realistic common value for all municipalities.
- $\bar{\theta}_m$ is the 2006-2011 average annual levy increase on existing properties (i.e. net of that generated by construction).
- $X_m$ is a vector of variables appended to the structural model to control for transitory effects related to the time lag of analysis.
- $e_m$ is a random error term.
- $\delta_m = \delta(\tau_{07}, \tau_{07}', \bar{\theta}, \bar{\eta}, t)$ is as defined above where $\bar{\eta}_m$ is the 2006-2011 average growth rate of rent implied by the data and $t = 6$ to reflect the 2007-2013 time lag.
- $C$ is a constant term appended to the model.

The theory suggests that $\gamma = 1$ and $C = 0$, implications that can be compared to the corresponding estimated parameters.\footnote{A constant term is appended to the structural model because the regression technique used to estimate the model does not permit suppression of the constant term.}
As established earlier theoretically, a decrease in the current effective tax rate leads to an increase in the tax base via both capitalization and investment effects. While market values of existing properties are likely to adjust quickly to a tax change, the planning and construction of new properties, as well as the detection of changes in the states of existing properties, will invariably lag tax changes. Hence I use the above first-difference approach to account for the unavoidable development lag. Since the full extent of the development lag in all likelihood exceeds the 6-year window under study, the estimated property tax effect emanating from the model should be viewed as somewhat conservative. To test this implication, in Appendix 3.2 I re-estimate the model using $V_{10}(K_{10,m}^*)$ in place of $V_{13}(K_{13,m}^*)$ to verify that reducing the timeframe of analysis reduces the estimated impact of the 2007 BPT reform, suggesting the 6-year timeframe used is likely conservative to some extent.

The price elasticity $\rho$ (which is negative) can be estimated by OLS, and its estimate can be substituted into the $\varepsilon(\tau_0, \theta) = \frac{\rho \tau_0}{r-\theta+\tau_0}$ equation to obtain the estimated tax elasticity function.\(^{78}\) Table 3.4-1 summarizes my sense of the graduated sensitivity to the property tax, and I use it as a guide to interpreting tax elasticity results.

### Table 3.4-1 Ranges of Sensitivity to the Property Tax

<table>
<thead>
<tr>
<th>Elasticity</th>
<th>Sensitivity</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>-0.10</td>
<td>Mild</td>
</tr>
<tr>
<td>-0.10</td>
<td>-0.40</td>
<td>Moderate</td>
</tr>
<tr>
<td>-0.40</td>
<td>-0.70</td>
<td>Substantial</td>
</tr>
<tr>
<td>-0.70</td>
<td>-1.00</td>
<td>Extreme</td>
</tr>
<tr>
<td>&lt; -1.00</td>
<td></td>
<td>Destructive</td>
</tr>
</tbody>
</table>

Even an elasticity of -0.15 is low enough to conclude that the property tax has an economically significant effect on investment decision making (Bartik, 1992). As mentioned earlier, my sense is that any tax elasticity below -0.10 should definitely be considered evidence of the capital tax view. Indeed, one may even insist that any tax elasticity below zero should be considered

\(^{78}\) In fact, $\rho < -1$ since production of floor space is Cobb-Douglas and subject to constant returns to scale. If the constant returns Cobb-Douglas specification is sufficiently correct, the data should verify this relation.
evidence of the capital tax view because the benefit view holds that structure investment is entirely insensitive to the property tax.\textsuperscript{79}

As established earlier, a municipality with a tax elasticity less than -1 is on the wrong side of the revenue hill and would actually see a boost in property tax revenue if the current effective tax rate were reduced (recall that the tax elasticity and tax-base elasticity are identical in the structural model) unexpectedly. In general, the lower (i.e. more negative) is the tax elasticity the more sensitive is structure capital and the tax base to the property tax and hence the more compelling is the case for reducing property taxes on structures and shifting them onto land at a uniform tax rate for all property types. Estimation of how this elasticity depends on the tax rate is crucial to settling the debate between the benefit and capital tax views of the property tax, and therefore crucial to evaluating the benefits of reducing property taxes and/or converting them into land taxes.

3.4.3 Municipal Data

The Municipal Property Assessment Corporation (MPAC) is provincially mandated to maintain the assessment rolls for Ontario’s municipalities. In an effort to build greater stability into Ontario’s property tax system, the government changed the \textit{Assessment Act} in 2006 so as to require MPAC to reassess the province every 4 years (using a valuation date of January 1 of each year divisible by 4) and phase in assessment changes between reassessments. Like almost all assessment agencies, MPAC employs regression techniques to analyze sales and other property attribute data to estimate market value, the result of which is called current value assessment (CVA). Assessment increases for each property are phased in using equal annual installments to reach the “destination CVA” in the 4\textsuperscript{th} year of the assessment cycle, whereas assessment decreases are implemented immediately with the destination CVA fixed for the entire cycle.\textsuperscript{80}

Under a special academic research agreement, MPAC has generously provided year-beginning assessment data by property class for 2006-2013 for each municipality in Ontario. To my

\textsuperscript{79} At any rate, as will soon be seen, the tax and tax-base elasticities estimated by the present study are sufficiently low and conservative so as to render any debate about interpreting their magnitude moot.

\textsuperscript{80} I direct the interested reader to \url{www.mpac.ca} for more information and Bird et al. (2012) for an informative chapter on MPAC.
knowledge, this is the first time assessment data of this calibre and currency has been made available for either property tax elasticity or revenue hill analysis. To avoid unnecessary complications, I focus on the commercial class as it represents about 84% of the BPT base in Ontario (Found, 2013a). The CVA data is detailed such that physical growth and appreciation of a municipality’s assessment base can be disentangled, permitting accurate measurement of the value of property improvements as well as effective tax rates. This ability represents a substantial improvement upon previous studies that have typically relied upon crude measures for structure capital investment, potentially unreliable market-to-assessed value equalization ratios or otherwise crude measures for effective property tax rates.

Statutory tax rates and requisitions levied by municipalities and the province during 2006-2011 are retrieved from the municipal Financial Information Return (FIR), a database maintained by the Ministry of Municipal Affairs and Housing of Ontario. In two-tier systems where an upper-tier municipality (i.e. county or regional municipality) federates a group of lower-tier municipalities, each municipality levies tax rates independently. In order to render two-tier systems comparable to single-tier municipalities, upper-tier tax rates are added to those of their constituent lower-tier municipalities so that observation takes place at the lower-tier and single-tier municipality level. In other words, upper-tier municipalities are disaggregated into their constituent lower-tier municipalities. Since there are 30 upper-tier municipalities in Ontario, this disaggregation means the maximum number of observations is 414 out of the 444 municipalities in the province.

The CVA dataset is pillared by the valuation dates of January 1 for the years 2005, 2008 and 2012, permitting interpolation of market values and average annual appreciation rates for the 2005-2012 period. I use the interpolated market values where required to construct the

81 The other business classes are industrial and pipeline, which represent approximately 14% and 2% of the provincial BPT base, respectively (Found, 2013a).

82 At the time of writing, complete FIR data were not yet available for 2012 onward. I consider only tax rates applied to taxable commercial property that does not receive an automatic tax rate discount under the Municipal Act or City of Toronto Act. Special tax rates for subclasses such as excess land and vacant land are ignored on the grounds that they are largely applied to land exclusively and to a relatively insignificant portion of the overall assessment base. Moreover, vacant/excess land status ceases to apply once vacant/excess land is developed with an investment. Among the municipal tax rates considered, I use only general purpose rates for analysis; special area tax rates are uncommon and even when they are levied they usually represent an insignificant portion of the total tax rate.
dependent variable and I use the interpolated appreciation rates to deflate and thus convert 2005-2011 annual statutory property tax rates from the FIR dataset into effective rates. With appreciation and effective tax rates in hand for each year and assuming a value for the discount rate \( r \), the rate of levy growth \( \theta \) and rent growth \( n \) are calculated for each municipality for each year using the previously established relations \( \theta(t) = \frac{\tau(t)}{\tau(0)} + a(t) \) and \( n(t) = \frac{(r-\theta)a(t) - \theta \tau_0}{r-\theta-\tau_0} \). These values are then averaged over 2006-2011 to construct the values \( \bar{\theta}_n \) and \( \bar{n}_m \), respectively, appearing in the specified econometric model.

Depending on a municipality’s structure, the effective tax rate in year \( y \), \( \tau_{y,m} \), comprises either two or three additive components. For single-tier municipalities, \( \tau_{y,m} = \tau_{y,m}^{ST} + \tau_{y,m}^P \) where \( \tau_{y,m}^{ST} \) is the single-tier municipal rate and \( \tau_{y,m}^P \) is the provincial rate. For lower-tier municipalities, \( \tau_{y,m} = \tau_{y,m}^{LT} + \tau_{y,m}^{UT} + \tau_{y,m}^P \) where \( \tau_{y,m}^{LT} \) is the lower-tier municipal rate, \( \tau_{y,m}^{UT} \) is the upper-tier municipal rate and \( \tau_{y,m}^P \) is the provincial rate. While for co-constituent lower-tier municipalities the statutory upper-tier and provincial BPT rates are identical, there is still variation across these municipalities in terms of corresponding effective rates \( \tau_{y,m}^{UT} \) and \( \tau_{y,m}^P \) due to likewise variation in property appreciation rates.

Municipalities may elect to separate the following subclasses from the regular commercial class: office building, shopping centre, parking lot and professional sports facility. With this separation, municipalities may levy tax rates on these subclasses that differ from that levied on the (usually much larger) residual commercial class. While the public policy merit of this municipal option is debateable, it was put in place by the province to enable municipalities to prevent tax shifting among these subclasses by converting them into insulated municipal tax silos (Bird, et al., 2012). For the very small number of municipalities that exercise this option, I have aggregated assessment and taxes for these subclasses with that of residual commercial in order to arrive at CVA-weighted statutory tax rates for the commercial class as a whole.

83 The expression for \( n(t) \) is derived by rearranging the appreciation equation \( a(t) = n - \frac{(n-\theta)\tau_0}{(r-\theta+\tau_0)e^{(n-\theta)t}-\tau_0} \) derived in the previous section.

84 The City of Toronto has the special privilege of optionally designating a “theatre” property class. Theatres so designated are exempted from the provincial BPT. This special class, with its negligible contribution to the tax base, is excluded from the analysis.
The control variables in $X_m$ are similar to those used by Smart (2012) and are largely geared toward controlling for possible time-variant effects; the first-difference structure of the econometric model controls for time-invariant (i.e. fixed) effects. To control for possible transitory effects across time with regard to the dependent variable and the independent variable of interest, the natural logs of base year CVA and effective tax rate are included in $X_m$. Similarly, the natural log of base year commercial property count is also included in $X_m$. In an effort to generally control for any unobserved time-variant regional effects, the province is divided into 42 contiguous regions of neighbouring municipalities, each associated with a regional indicator included in $X_m$.\textsuperscript{85} Most of these regions are defined by the Ministry of Municipal Affairs and Housing so as to be coterminous with upper-tier municipality and district boundaries.\textsuperscript{86}

One parameter of the model needs to be calibrated: the discount rate $r$. In practice, this parameter will vary across development projects based on investor preferences, structural depreciation and perceived risk, so I assume a constant average discount rate across developments and the 2007-2012 timeframe for analysis. In absence of any method for assigning different discount rates to different municipalities, I assign a common discount rate to all municipalities in Ontario. Ideally, the choice of a uniform $r$ should reflect discount rates actually used in the Ontario commercial property market.

During the time period analyzed, the Royal Bank of Canada applied discount rates in the range of 7.0%-11.0% when financing and appraising commercial property in Ontario, with 9.0% as the baseline value.\textsuperscript{87} By considering discount rates in this range, the number of observations

\textsuperscript{85} The raw data from the Ministry of Municipal Affairs and Housing groups municipalities into 49 regions, however due to some extremely large municipal amalgamations having taken place since 1997, some of these regions now contain only one municipality. In such cases, I moved the lone municipality into the most geographically logical neighbouring group, reducing the number of regions to 42.

\textsuperscript{86} Districts group together single-tier municipalities located in northern Ontario. While they are not upper-tier municipalities, they do pool some municipal resources for the provision of a number of soft local services such as social assistance, social housing and land ambulance. The exception is the District of Muskoka, which is an upper-tier municipality.

\textsuperscript{87} Source: Scott Mancini, Senior Account Manager, Royal Bank of Canada (2013).
ultimately available for analysis is 406 due to modelling restrictions. It will prove worthwhile to model alternative discount rates within the Royal Bank of Canada’s range for sensitivity analysis.

Some summary statistics appear in Table 3.4-2, Table 3.4-3 and Figure 3.4-1. As evidenced in Table 3.4-2, effective tax rates on new commercial investment have clearly been on the decline in Ontario. This comes as no surprise as property appreciation has for many years outpaced the rate of levy increase in most municipalities, resulting from a combination of relatively high growth in rent (or expected rent), municipalities maintaining relatively low average levy increases and the province’s NRN policy for the target provincial BPT rate. Especially evident is the large 13.38% decrease in the CVA-weighted average effective tax rate, over 10 percentage points of which due to the 2007 provincial BPT reduction program.

**Table 3.4-2 CVA-Weighted Summary Statistics**

<table>
<thead>
<tr>
<th>CVA-Weighted Summary Statistics</th>
<th>Municipalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>444</td>
</tr>
<tr>
<td>Upper-Tier</td>
<td>30</td>
</tr>
<tr>
<td>Lower-Tier</td>
<td>241</td>
</tr>
<tr>
<td>Single-Tier</td>
<td>173</td>
</tr>
<tr>
<td><strong>Provincial Average CVA Data</strong></td>
<td></td>
</tr>
<tr>
<td>Annual CVA Appreciation 2005-2012</td>
<td>3.40%</td>
</tr>
<tr>
<td>Annual Physical CVA Growth 2005-2012</td>
<td>1.90%</td>
</tr>
<tr>
<td><strong>Provincial Average Taxation Data</strong></td>
<td></td>
</tr>
<tr>
<td>2006 Effective Tax Rate</td>
<td>3.14%</td>
</tr>
<tr>
<td>2007 Effective Tax Rate</td>
<td>2.72%</td>
</tr>
<tr>
<td>2008 Effective Tax Rate</td>
<td>2.53%</td>
</tr>
<tr>
<td>2009 Effective Tax Rate</td>
<td>2.52%</td>
</tr>
<tr>
<td>2010 Effective Tax Rate</td>
<td>2.47%</td>
</tr>
<tr>
<td>2011 Effective Tax Rate</td>
<td>2.41%</td>
</tr>
<tr>
<td>Annual Effective Tax Rate Change 2006-2007</td>
<td>-13.38%</td>
</tr>
<tr>
<td>Annual Effective Tax Rate Change 2007-2011</td>
<td>-2.98%</td>
</tr>
<tr>
<td>Annual Levy Increase 2006-2011</td>
<td>1.79%</td>
</tr>
</tbody>
</table>

---

88 Eight very small municipalities (two lower-tier and six single-tier) must be excluded either because one or more of their respective parameter values violate modelling constraints or because they have no commercial assessment base. Since the number of observations remaining is sufficiently large, the insignificant size of these municipalities’ assessment bases means their omission will not appreciably affect the results.
Table 3.4-3  Detailed Unweighted Summary Statistics

<table>
<thead>
<tr>
<th>Municipal Statistic</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007-2012 Increase in Tax Base</td>
<td>37.01%</td>
<td>32.67%</td>
<td>-50.34%</td>
<td>199.87%</td>
</tr>
<tr>
<td>2006 Effective Tax Rate</td>
<td>3.09%</td>
<td>1.23%</td>
<td>0.90%</td>
<td>10.73%</td>
</tr>
<tr>
<td>2007 Effective Tax Rate</td>
<td>2.84%</td>
<td>1.05%</td>
<td>0.87%</td>
<td>9.15%</td>
</tr>
<tr>
<td>2006-2007 Increase in Effective Tax Rate</td>
<td>-6.87%</td>
<td>6.12%</td>
<td>-31.38%</td>
<td>7.69%</td>
</tr>
<tr>
<td>2006-2011 Average Levy Growth Rate</td>
<td>0.95%</td>
<td>1.74%</td>
<td>-6.82%</td>
<td>6.87%</td>
</tr>
</tbody>
</table>

Figure 3.4-1  Variation in Change in Tax Base and Effective Tax Rate

While the decline in observed effective tax rates is leading to gradual improvement in Ontario’s investment climate over time, the theoretical model implies that this improvement is anticipated by investing businesses. Before and after 2007, annual decreases in effective tax rates are much smaller than in 2007 and are relatively constant in percentage terms, consistent with being driven by $\theta < n$ rather than downward shifts of $\tau(t)$ via structural cuts in $\tau_0$. That is, the data suggest that the observed $\tau_\ell(t) < 0$ trend is not the result of unanticipated cuts in the effective BPT rate, but rather simply the result of tax bills generally growing slower than rental income.
Since in the theoretical model $\theta$ and $n$ are known, post-2007 trending of $\tau(t)$ and the resultant changes in effective tax rates are assumed to be anticipated by businesses and so presumably they do not alter business’ planned investment decisions unless they are impacted by an unexpected shock. Clearly, identification of the property tax effect would be problematic if it relied heavily on anticipated changes in $\tau(t)$, hence my empirical strategy relies instead on the unanticipated and exogenous shock to $\tau(t)$ induced by the 2007 provincial BPT reform.

Also of interest are Table 3.4-2 and Figure 3.4-1, which document and illustrate, respectively, the variation in changes in tax base and changes in effective tax rates over the relevant period. In accord with intuition, the scatter plot in Figure 3.4-1 is suggestive of a negative relationship between effective tax rate increases and tax base growth.

### 3.5 Results

The first-difference structural model is estimated using OLS. However, OLS alone is likely to produce low standard errors because the observation independence assumption is violated among co-constituent lower-tier municipalities sharing subjection to a common upper-tier tax regime. Therefore, I cluster standard errors at the upper-tier and single-tier levels, creating 197 (30 upper tiers and 167 available single tiers) mutually independent clusters. I also absorb the 42 regional indicator variables into the model.

Table 3.5-1 summarizes price and tax elasticity results as well as other provincial results using the 2011 CVA-weighted provincial averages for $\tau_0$ and $\theta$ appearing in Table 3.4-2 previously. Detailed regression output, including price elasticity standard errors, corresponding to each discount rate considered is contained in Appendix 3.1. The estimated price elasticities are statistically significant for all discount rates considered, even with the use of cluster-robust standard errors.

The 2011 tax elasticity range of -0.80 to -0.90 is economically significant and suggests that investment in commercial structures and values of existing properties are highly sensitive to the property tax at current taxation levels. For instance, an unanticipated 10% cut in the present

---

89 Included in the common upper-tier tax regime would be the provincial BPT regime if the upper-tier municipality is one of the few remaining with a provincial BPT rate below the target rate.
effective tax rate (say from 2.0% to 1.8%) leads to an estimated 8.0%-9.0% increase in physical structure capital stock and tax base value in the long run.

Table 3.5-1  Price and Tax Elasticities and Other Provincial Estimates for 2011

<table>
<thead>
<tr>
<th>Price Elasticity (ρ)</th>
<th>Structural Formula</th>
<th>Discount Rate (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Structurally Estimated</td>
<td>7%</td>
</tr>
<tr>
<td>Tax-Induced Increase in MC of Capital</td>
<td>τ₀/(r-θ)</td>
<td>46%</td>
</tr>
<tr>
<td>Structure Share of Development Cost (α)</td>
<td>1+1/ρ</td>
<td>65%</td>
</tr>
<tr>
<td>Total Erosion of Tax Base</td>
<td>1-((r-θ)/(r-θ+τ₀))^ρ</td>
<td>66%</td>
</tr>
<tr>
<td>Erosion of Tax Base from Capitalization</td>
<td>1-(r-θ)/(r-θ+τ₀)</td>
<td>32%</td>
</tr>
<tr>
<td>Erosion of Tax Base from Disinvestment</td>
<td>Total Less Capitalization</td>
<td>34%</td>
</tr>
<tr>
<td>Revenue-Maximizing Effective Tax Rate</td>
<td>-(r-θ)/(1+ρ)</td>
<td>2.80%</td>
</tr>
<tr>
<td>Proportion of Maximum Revenue Raised</td>
<td>See Section 3.3</td>
<td>99%</td>
</tr>
<tr>
<td>Tax Elasticity</td>
<td>τ₀ρ/(r-θ+τ₀)</td>
<td>-0.90</td>
</tr>
</tbody>
</table>

All results dependent on τ₀ and θ are based on 2011 CVA-weighted averages τ₀ = 2.41% and θ = 1.79% for Ontario.

At the baseline discount rate of 9% and current taxation levels, the average municipality in Ontario has an estimated tax (and tax-base) elasticity of -0.85, indicating commercial property is very sensitive to the property tax: a 10% increase in the average current effective tax rate depresses structure investment and the tax base by an estimated 8.5%. Using an alternative measure of tax distortion known as the marginal cost of (public) funds (MCF) as defined in Dahlby & Ferede (2011), the -0.85 tax-base base elasticity translates into an MCF of $6.67 – this is the amount it costs the Ontario economy in terms of market distortions to raise $1.00 of additional BPT revenue at 2011 taxation levels – which is a substantial cost. Comparing this relatively high MCF to those calculated by Dahlby & Ferede (2011) for non-BPTs indicates the BPT is more damaging than even corporate income taxes in many provinces.

There are several other results of interest. One is the alignment with the results of Bird et al. (2012) for the GTA, where the average estimated tax-base elasticity for the GTA is -0.84 as calculated earlier. Another is that municipalities and the province are together pushing the limits of BPT revenue generation as effective tax rate increases beyond current levels are estimated to

---

90 The MCF is a function of the tax-base elasticity: \( MCF(\varepsilon₀(\tau₀, \theta)) = [1 + \varepsilon₀(\tau₀, \theta)]^{-1} \). This function is not defined for \( \varepsilon₀(\tau₀, \theta) \leq -1 \), that is when a government is on the downward sloping part of the revenue hill. Given the tax-base elasticity range of -0.80 to -0.90, the MCF ranges from $5.00 to $10.00 for the BPT in Ontario. However, it should be noted that these are own-revenue MCFs only; the MCF of the BPT in respect of all tax revenue sources combined may be different depending on tax base interactions. See Dahlby & Ferede (2011).
yield less than 3% of the maximum attainable revenue on average in the long run. Yet another interesting result is that structural capital cost is estimated to be 71% of development cost (structural capital cost plus land cost) at the baseline discount rate of 9%. This result is especially reassuring in that experience has shown that the share of development cost attributable to structure capital generally lies in the 60%-80% range for commercial development, with 70% being the expected share. For each discount rate the constant term is not statistically different than zero (as it should be), however the estimated value of $\gamma$ is substantially less than unity, suggesting the model may not fully capture the data generation process.

The results are also of interest in respect of how they relate to the results in the METR analysis of Found (2013a) in which Ontario’s provincial BPT is estimated to contribute 37.5 percentage points to the (unweighted) METR on structure capital. For the present study, the theoretical model indicates that the METR on structure capital is given by the expression $\tau_0 \frac{r}{r-\theta}$. Since the two studies pertain to different time periods, to permit comparison between them I populate this expression using 2013 Ontario values taken from Found (2013a). The applicable values are thus $\tau_0 = 1.039\%$ for the Ontario provincial BPT, $r = 6.81\%$ as the sum of the nominal net rate of return (4.77\%) and the nominal depreciation rate (2.04\%) and $\theta = 3.99\%$ is the 2008-2012 average annual rate of business property appreciation. Substituting these values into $\tau_0 \frac{r}{r-\theta}$ gives a 2013 METR of 36.8\% on structure capital, which is quite close to the 37.5\% METR estimated in Found (2013a) for the same tax on structure capital. It is interesting to see two different methods independently arrive at such similar results for the METR on structure capital.

---


92 In the METR model of Found (2013a), the CIT is the only capital tax regime variable to interact with the BPT. The METR impact of the BPT is identical in the following situations: (i) the CIT is included in the METR and the BPT is CIT-deductible and (ii) the CIT is not included in the METR. Since in Canada the BPT is CIT-deductible, then its METR impact is invariant to inclusion of the CIT in the METR. Since the present study’s model excludes CIT, then its version of the METR impact of the BPT on structure capital can be compared to the corresponding unweighted version in Found (2013a).

93 Recall that $r$ is the nominal rate of return gross of depreciation. Also, as is typical for METR analysis, $\theta$ is equal to the rate of appreciation of the tax base because effective tax rates are assumed to be constant over time in absence of a clear government policy establishing future tax rates specifically. As of the time of writing, Ontario has not adopted such a policy.
As has been noted previously, the tax elasticity results are likely somewhat conservative for two different reasons:

1. **Building Production**: As noted previously, the latest empirical research indicates that the substitution elasticity between structure capital and land may be somewhat above unity if not unity. The assumption that buildings are produced under Cobb-Douglas technology, for which the substitution elasticity is unity, would therefore understate the true degree of substitutability between structure capital and land.

2. **Tax Base Adjustment Lag**: Since construction projects can, and often do, take years to materialize, the full effect of the 2007 provincial BPT reform will likely require somewhat more than the 6-year window herein studied to entirely materialize.

To the extent that these issues are the case, estimated property tax effects would be attenuated, biasing the tax elasticity toward zero.

The results can also be used to evaluate the impact of the 2007 provincial BPT reform. Given the province cut the CVA-weighted average 2006 effective tax rate on business (commercial, industrial and pipeline) in excess of 10% for new investment and that the tax elasticity is an increasing function of the tax rate, the 2007 provincial BPT reform has likely resulted in at least an 8.0% increase in long run commercial capital stock and tax base that would not have otherwise materialized, all else equal.

To give a more intuitive sense of the sensitivity to the commercial property tax and to illustrate the present study’s integration of tax elasticity and revenue hill analyses, it is useful to graph the following functions together: absolute value of tax elasticity, proportion of tax base retained and proportion of maximum revenue raised. As derived or indicated previously, the general expressions for these functions are:

1. **Absolute Value of Tax Elasticity**: 
   \[ |\varepsilon(\tau_0, \theta)| = |\varepsilon_b(\tau_0, \theta)| = \frac{|\rho| \tau_0}{r - \theta + \tau_0} \]

2. **Proportion of Tax Base Retained**: 
   \[ \frac{\nu(K^*(\tau_0, \theta), 0)}{\nu(K^*(0, \theta), 0)} = \frac{K^*(\tau_0, \theta)}{K^*(0, \theta)} = \left[1 + \frac{\tau_0}{r - \theta}\right]^\beta \]

3. **Proportion of Maximum Revenue Raised**: 
   \[ \frac{M(\tau_0, \theta)}{\frac{M(\tau_0^{max}, \theta)}{\rho}} = \frac{\tau_0}{\tau_0^{max}} \left(\frac{r - \theta + \tau_0}{r - \theta + \tau_0^{max}}\right)^\rho, \tau_0^{max} = \frac{r - \theta}{1 + \rho} \]
Since tax and tax-base elasticities coincide, the proportion of tax base retained is equal to the proportion of structure capital stock retained, $K^*(\tau_0, \theta) = K^*(0, \theta)$. Figure 3.5-1 graphs the above three functions against 2011 $\tau_0$ for the case of $r = 9\%$ (for which $\rho = -3.39$ as per Table 3.5-1) holding the CVA-weighted average levy growth rate of $\theta = 1.79\%$ fixed (as in Table 3.5-1). A point of interest in Figure 3.5-1 is the top of the revenue hill, which occurs at a current effective tax rate of 3.02% given a levy growth rate of 1.79%.

**Figure 3.5-1** Sensitivity to the Commercial Property Tax in Ontario

3.6 Concluding Remarks

At the centre of this paper was examination of the sensitivity of capital investment in structures and the tax base to the commercial property tax, testing both the benefit and capital tax views. A theoretical model was developed on which a structural model was based and estimated on a first-

---

94 Analogous graphs for individual Ontario municipalities may be available from the author upon request.
difference basis. A key outcome of this modelling exercise was the ability to use market value-based assessment data to estimate the tax elasticity as a function of the effective tax rate. Other contributions to the literature included accurate measurement of effective tax rates, explicit modelling of the time-variance of effective tax rates, integration of tax elasticity and revenue hill function estimation and the separation of the capitalization and investment effects embedded in the revenue hill function.

The empirical strategy exploited an exogenous 2007 reduction in the provincial portion of the effective commercial property tax rate for new investment, varying by municipality for historical reasons, to identify the property tax effect. The first-difference structural model was used to estimate the price elasticity of the factor demand for commercial structure capital for various discount rates within the Royal Bank of Canada’s range of 7%-11%. All estimated price elasticities were statistically significant, ranging from -2.86 to -3.84. Among a number of other quantities and functions, these estimated price elasticities enabled the estimation of the tax elasticity and revenue hill functions for each municipality and, using CVA-weighted parameter values, the Province of Ontario as a whole.

The provincial average tax elasticity was found to lie in the range -0.80 to -0.90, given current taxation levels. The average commercial property tax burden in a municipality increases the marginal cost of structure capital by 26%-46% and depresses the commercial tax base to 59%-66% of zero-tax levels. At the baseline discount rate of 9%, the tax elasticity (and thus tax-base elasticity) function applicable to Ontario’s municipalities is estimated to be $\varepsilon(\tau_0, \theta) = \frac{-3.39\tau_0}{0.09-\theta+\tau_0}$, where $\tau_0$ is the current effective tax rate and $\theta$ is the (expected) levy growth rate.

These results indicate that capital investment in commercial structures and commercial property values are highly sensitive to the property tax at and even well below current taxation levels. These results build onto the growing consensus that property taxes on business impose a substantial economic cost. This evidence markedly contravenes the benefit view hypothesis which claims that the net portion of the property tax is fully capitalized into land values. This evidence also suggests that any capital tax (e.g. the CIT) falling onto commercial buildings has a distorting and detrimental impact on investment therein. With the results upholding the capital tax view of the property tax, they further point to the existence of economic benefits of converting property taxes into land taxes and they also vindicate the Province of Ontario’s latest
efforts to lower the burden of business property taxation specifically and that of capital taxation generally.
References


3.7 Appendix 3.1 - Price Elasticity Estimation by Discount Rate

Table 3.7-1 Discount Rate $r = 7\%$

|                        | Coef.  | Std. Err. | t     | P>|t|  | [95% Conf. Interval] |
|------------------------|--------|-----------|-------|-------|---------------------|
| dlogtax                | -3.142612 | .7545629 | -4.16 | 0.000 | -4.630717, -1.654508 |
| logcva07               | -.0361795 | .0212528 | -1.70 | 0.090 | -.078093, .0057341  |
| logtax07               | -.2817337 | .055853 | -5.04 | 0.000 | -.3918837, -.1715837 |
| logpc07                | .0647421 | .0304577 | 2.13  | 0.035 | .0046752, .1248089  |
| delta                  | .0813875 | .0336052 | 2.42  | 0.016 | .0151134, .1476617  |
| _cons                  | -.2600634 | .2787727 | -0.93 | 0.352 | -.8098424, .2897157  |

<table>
<thead>
<tr>
<th></th>
<th>Robust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of obs</td>
<td>406</td>
</tr>
<tr>
<td>F(  5,   196)</td>
<td>7.39</td>
</tr>
<tr>
<td>Prob &gt; F</td>
<td>0.0000</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.3642</td>
</tr>
<tr>
<td>Adj R-squared</td>
<td>0.2827</td>
</tr>
<tr>
<td>Root MSE</td>
<td>.19909</td>
</tr>
</tbody>
</table>

(Std. Err. adjusted for 197 clusters in ut_st_group)

Table 3.7-2 Discount Rate $r = 8\%$

|                        | Coef.  | Std. Err. | t     | P>|t|  | [95% Conf. Interval] |
|------------------------|--------|-----------|-------|-------|---------------------|
| dlogtax                | -3.142612 | .7545629 | -4.16 | 0.000 | -4.630717, -1.654508 |
| logcva07               | -.0361795 | .0212528 | -1.70 | 0.090 | -.078093, .0057341  |
| logtax07               | -.2817337 | .055853 | -5.04 | 0.000 | -.3918837, -.1715837 |
| logpc07                | .0647421 | .0304577 | 2.13  | 0.035 | .0046752, .1248089  |
| delta                  | .0813875 | .0336052 | 2.42  | 0.016 | .0151134, .1476617  |
| _cons                  | -.2600634 | .2787727 | -0.93 | 0.352 | -.8098424, .2897157  |

<table>
<thead>
<tr>
<th></th>
<th>Robust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of obs</td>
<td>406</td>
</tr>
<tr>
<td>F(  5,   196)</td>
<td>7.39</td>
</tr>
<tr>
<td>Prob &gt; F</td>
<td>0.0000</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.3642</td>
</tr>
<tr>
<td>Adj R-squared</td>
<td>0.2827</td>
</tr>
<tr>
<td>Root MSE</td>
<td>.19909</td>
</tr>
</tbody>
</table>

(Std. Err. adjusted for 197 clusters in ut_st_group)

(region | absorbed (42 categories)
### Table 3.7-3  Discount Rate $r = 9\%$

Discount Rate $r = 9\%$

<table>
<thead>
<tr>
<th>areg</th>
<th>dlogcva</th>
<th>dlogtax</th>
<th>logcva07</th>
<th>logtax07</th>
<th>logpc07</th>
<th>delta, absorb(region)</th>
</tr>
</thead>
<tbody>
<tr>
<td>vce</td>
<td>cluster</td>
<td>ut_st_group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Linear regression, absorbing indicators

|                         | Coef. | Std. Err. | t      | P>|t|   | 95% Conf. Interval     |
|-------------------------|-------|-----------|--------|-------|------------------------|
| dlogcva                 | -3.388509 | 0.8371186 | -4.05  | 0.000 | -5.039425   -1.737593 |
| dlogtax                 | -0.0371254 | 0.0214238 | -1.73  | 0.085 | -0.0793762   0.0051254 |
| logcva07                | 0.0659636 | 0.0306135 | 2.15   | 0.032 | 0.0055894    0.1263379 |
| logtax07                | 0.0790662 | 0.0332352 | 2.37   | 0.019 | 0.0133442    0.1447882 |
| logpc07                 | 0.0055894 | 0.0306135 | 2.15   | 0.032 | 0.0055894    0.1263379 |
| delta                  | 0.0055894 | 0.0306135 | 2.15   | 0.032 | 0.0055894    0.1263379 |
| _cons                   | -0.2526261 | 0.2813216 | -0.90  | 0.370 | -0.8074309   0.3021787 |

(Std. Err. adjusted for 197 clusters in ut_st_group)

---

**Figure 3.7-3**

**Figure 3.7-4**

### Table 3.7-4  Discount Rate $r = 10\%$

Discount Rate $r = 10\%$

<table>
<thead>
<tr>
<th>areg</th>
<th>dlogcva</th>
<th>dlogtax</th>
<th>logcva07</th>
<th>logtax07</th>
<th>logpc07</th>
<th>delta, absorb(region)</th>
</tr>
</thead>
<tbody>
<tr>
<td>vce</td>
<td>cluster</td>
<td>ut_st_group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Linear regression, absorbing indicators

|                         | Coef. | Std. Err. | t      | P>|t|   | 95% Conf. Interval     |
|-------------------------|-------|-----------|--------|-------|------------------------|
| dlogcva                 | -3.617334 | 0.9141661 | -3.96  | 0.000 | -5.420198   -1.814469 |
| dlogtax                 | -0.037751 | 0.0215529 | -1.75  | 0.081 | -0.0802563   0.0047544 |
| logcva07                | 0.0668518 | 0.0307336 | 2.18   | 0.031 | 0.0062409    0.1274628 |
| logtax07                | 0.0772196 | 0.0331598 | 2.33   | 0.021 | 0.0118328    0.1426153 |
| logpc07                 | 0.0062409 | 0.0307336 | 2.18   | 0.031 | 0.0062409    0.1274628 |
| delta                  | 0.0062409 | 0.0307336 | 2.18   | 0.031 | 0.0062409    0.1274628 |
| _cons                   | -0.2463968 | 0.2834429 | -0.87  | 0.386 | -0.8053863   0.3125927 |

(Std. Err. adjusted for 197 clusters in ut_st_group)

---
Table 3.7-5  Discount Rate $r = 11\%$

<table>
<thead>
<tr>
<th>Discount Rate $r = 11%$</th>
</tr>
</thead>
</table>
| areg  dlogcva  dlogtax  logcva07  logtax07  logpc07  delta,  absorb(region)  
| vce(cluster ut_st_group)  |
| Linear regression, absorbing indicators |
| Number of obs = 406  
| F( 5, 196) = 7.25  
| Prob > F = 0.0000  
| R-squared = 0.3564  
| Adj R-squared = 0.2739  
| Root MSE = 0.20031  |

(Std. Err. adjusted for 197 clusters in ut_st_group)

<table>
<thead>
<tr>
<th>dlogcva</th>
<th>Robust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coef.</td>
<td>Std. Err.</td>
</tr>
<tr>
<td>--------</td>
<td>-----------</td>
</tr>
<tr>
<td>dlogtax</td>
<td>-3.836516</td>
</tr>
<tr>
<td>logcva07</td>
<td>-.0381856</td>
</tr>
<tr>
<td>logtax07</td>
<td>-.2800993</td>
</tr>
<tr>
<td>logpc07</td>
<td>.0675241</td>
</tr>
<tr>
<td>delta</td>
<td>-.0757218</td>
</tr>
<tr>
<td>_cons</td>
<td>-.2411429</td>
</tr>
<tr>
<td>region</td>
<td>absorbed</td>
</tr>
</tbody>
</table>
### 3.8 Appendix 3.1 - Price Elasticity Estimation under Alternative Restrictions\(^{95}\)

Table 3.8-1  Variation in the 2006-2007 Effective Tax Rate Differential Only

<table>
<thead>
<tr>
<th>Variation in the 2006-2007 Effective Tax Rate Differential Only(^{96})</th>
</tr>
</thead>
<tbody>
<tr>
<td>areg  dlogcva dlogr_tax logcva07 logtax07 logpc07  delta, absorb(region)</td>
</tr>
<tr>
<td>vce(cluster ut_st_group)</td>
</tr>
<tr>
<td>Linear regression, absorbing indicators</td>
</tr>
<tr>
<td>Number of obs = 406</td>
</tr>
<tr>
<td>F(  5, 196) = 6.80</td>
</tr>
<tr>
<td>Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td>R-squared = 0.3426</td>
</tr>
<tr>
<td>Adj R-squared = 0.2583</td>
</tr>
<tr>
<td>Root MSE = .20245</td>
</tr>
<tr>
<td>(Std. Err. adjusted for 197 clusters in ut_st_group)</td>
</tr>
<tr>
<td>----------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>dlogcva</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>dlogr_tax</td>
</tr>
<tr>
<td>logcva07</td>
</tr>
<tr>
<td>logtax07</td>
</tr>
<tr>
<td>logpc07</td>
</tr>
<tr>
<td>delta</td>
</tr>
<tr>
<td>_cons</td>
</tr>
<tr>
<td>region</td>
</tr>
</tbody>
</table>

\(^{95}\) In all scenarios considered, the discount is set to the baseline level of \(r = 9\%\).

\(^{96}\) The CVA-weighted provincial average levy growth rate of \(\theta = 1.79\%\) is assigned all municipalities so that price elasticity is estimated using only variation in the 2006-2007 differential in the effective tax rate.
Table 3.8-2  Variation in the Rate of Levy Growth Only

<table>
<thead>
<tr>
<th>areg dlogcva dlogr_theta logcva07 logtax07 logpc07 delta, absorb(region)</th>
</tr>
</thead>
<tbody>
<tr>
<td>vce(cluster ut_st_group)</td>
</tr>
<tr>
<td>Linear regression, absorbing indicators</td>
</tr>
<tr>
<td>Number of obs =     406</td>
</tr>
<tr>
<td>F(  5,   196) =    2.85</td>
</tr>
<tr>
<td>Prob &gt; F      =  0.0165</td>
</tr>
<tr>
<td>R-squared     =  0.3208</td>
</tr>
<tr>
<td>Adj R-squared =  0.2338</td>
</tr>
<tr>
<td>Root MSE      =  .20577</td>
</tr>
<tr>
<td>(Std. Err. adjusted for 197 clusters in ut_st_group)</td>
</tr>
</tbody>
</table>

|                   | Coef.        | Std. Err. | t     | P>|t| | [95% Conf. Interval] |
|-------------------|--------------|-----------|-------|------|----------------------|
| dlogcva           | -3.93481     | 3.63905   | -1.08 | 0.281| -11.11153 3.241911   |
| dlogr_theta       | -0.299684    | 0.0219354 | -1.37 | 0.173| -0.732282 0.132913   |
| logcva07          | -0.1255346   | 0.0484169 | -2.59 | 0.010| -0.2210195 0.0300496 |
| logtax07          | 0.0646575    | 0.0319314 | 2.02  | 0.044| 0.0016843 0.1276306  |
| logpc07           | -0.0714562   | 0.0436341 | 1.64  | 0.103| -0.145964 0.1575089  |
| delta             | 0.0823886    | 0.2782804 | 0.30  | 0.767| -0.4664197 0.6311969 |
| _cons             | 0.0823886    | 0.2782804 | 0.30  | 0.767| -0.4664197 0.6311969 |
| region            | absorbed     |           |       |      | (42 categories)      |

The CVA-weighted provincial average effective tax rates for 2006 and 2007 are assigned all municipalities so that price elasticity is estimated using only variation in the rate of levy growth $\theta$. 
Table 3.8-3  Variation in the 2007-2010 Tax Base Growth Only

| Variable       | Coef.  | Std. Err. | t     | P>|t| | [95% Conf. Interval] |
|----------------|--------|-----------|-------|-----|----------------------|
| dlogcva07_10   | -.9012 | .4507628  | -2.02 | 0.05| -.3.790197 -1.012204 |
| logcva07      | -.0079 | .0128188  | -0.62 | 0.54| -.0331815 .0173818 |
| logtax07      | -.1885 | .0338243  | -5.57 | 0.00| -.2552628 -.1218459 |
| logpc07       | .0214  | .0178125  | 1.20  | 0.23| -.0137042 .0565554 |
| delta         | .0026  | .0128875  | 0.21  | 0.84| -.0227613 .028072  |
| _cons         | -.4694 | .1806248  | -2.60 | 0.01| -.8256997 -.1132417 |

(Std. Err. adjusted for 196 clusters in ut_st_group)

The assessment base for 2010 is used instead of 2013 in constructing the dependent variable. The results confirm that the development response to a property tax change requires a number of years to materialize, and suggest that even the 6-year timeframe used in the main analysis is likely conservative to some extent.
### Table 3.8-4  Reduced Form Model

<table>
<thead>
<tr>
<th>Reduced Form Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>areg dlogcva dlogtax_rate logcva07 logtax07 logpc07 delta, absorb(region)</td>
</tr>
<tr>
<td>vce(cluster ut_st_group)</td>
</tr>
<tr>
<td>Linear regression, absorbing indicators</td>
</tr>
<tr>
<td>Number of obs = 406</td>
</tr>
<tr>
<td>F ( 5, 196) = 8.18</td>
</tr>
<tr>
<td>Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td>R-squared = 0.3537</td>
</tr>
<tr>
<td>Adj R-squared = 0.2708</td>
</tr>
<tr>
<td>Root MSE = 0.20073</td>
</tr>
<tr>
<td>(Std. Err. adjusted for 197 clusters in ut_st_group)</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>dlogcva</td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>dlogtax_rate</td>
</tr>
<tr>
<td>logcva07</td>
</tr>
<tr>
<td>logtax07</td>
</tr>
<tr>
<td>logpc07</td>
</tr>
<tr>
<td>delta</td>
</tr>
<tr>
<td>_cons</td>
</tr>
<tr>
<td>region</td>
</tr>
</tbody>
</table>

The tax elasticity is estimated directly using the typical reduced form model, which disregards both \( r \) and \( \theta \) by replacing \( \rho \left[ \ln \left( 1 + \frac{r}{1 - \theta} \right) - \ln \left( 1 + \frac{r_0}{1 - \theta_0} \right) \right] \) with \( \epsilon \left[ \ln \left( r_0 \frac{m}{\theta_0} \right) - \ln \left( r \frac{m}{\theta} \right) \right] \) where \( \epsilon \) is the point estimate of the average provincial tax elasticity. The results support the hypothesis that failing to account for declining effective tax rates in Ontario results in an overestimate of the property tax effect: -0.98 with the reduced form model compared to -0.85 with the structural model.