Toronto vs Everybody: The Effect of Property Taxes on Business Establishments

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Business property taxes are a significant revenue source for municipalities, but what is their impact on local business establishments? Utilizing a change in provincial policy which forced the city of Toronto to lower business property tax rates, I examine the effect of business property taxes on business activity. I estimate that the elasticity of establishment employment with respect to the property tax rate is less than one, although the results are imprecise. I find larger elasticities for establishments utilizing industrial property versus commercial property, suggesting that industrial establishments are more sensitive to business property taxes. Contrasting with the previous literature I conclude that the impact of establishments from business property taxes can be minimized by maintaining updated property assessments and excluding fixed capital from the property assessment base.

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In Canada and the United States, local property taxes account for approximately 2.75% of GDP (Slack, 2011), amongst the highest in the OECD (OECD, 2023). Local property taxes fund local public goods provided by municipalities and schools, typically through local school boards. Businesses face property tax rates approximately 2.8 times that of residential rates across Canada (Altus Group, 2022) and allege that this harms their competitiveness and reduces business activity (Bird et al., 2012). Despite the high reliance of Canada and the United States on business property taxes, there is little evidence on the effect of business property taxes on business activity. What are the impacts of the heavy reliance of Canada and the United States on the business property tax? How do business property taxes affect business activity in areas levying these taxes?

There are significant challenges to identifying the effect of business property taxes on business activity. Establishments may sort across municipal boundaries to take advantage of lower business property tax rates. In response municipalities can behave strategically when setting business property tax rates to maximize business activity occurring within the municipality. Business activity itself responds to other local conditions like agglomeration externalities and local public goods, which themselves are funded by property taxes. Finally, municipalities may not all have the same financing tools available to them. Municipalities could tradeoff between residential and business property taxes (Bird et al., 2012), although at the risk of angering local residents (the "Homevoter Hypothesis" (Fischel, 2005)), although this will not be a focus of this paper.

To overcome the possibility of municipalities behaving strategically and the endogeneity of local public goods, this paper examines the unique experience of Toronto, Canada, and the surrounding municipalities. Reforms by the province of Ontario (which contains Toronto and its surroundings), forced Toronto to lower its business property tax rates compared to the neighbouring municipalities. From 2003 - 2011, the industrial property tax rate was cut by 35% and the commercial property tax rate was cut by 28%. These reforms had a significant economic cost for Toronto: business property taxes represent approximately 10% of the total city revenue (City of Toronto, 2023). The imposition of lower tax rates by Ontario on Toronto overcomes the concern that municipalities are setting tax rates strategically.

To rule out the effect of local public goods or other unobservables, this paper utilizes the spacial differencing methodology of Duranton et al. (2011), comparing establishments with the same characteristics on either side of a municipal boundary. Spatial differencing ensures that any location specific time varying trends are controlled for. Over small enough distances this should also effectively control for the provision of public goods which are likely to have spillovers in space.

Combining data from the annual financial reports of Ontario municipalities with a longitudinal survey of establishments I estimate the impact of business property taxes on the employment of establishments, as a proxy for business activity. I find that the effect of property tax rate changes on employment is negative,

but the estimates are imprecise. I estimate that the elasticity of employment with respect to tax rate is -0.59. I find some some evidence that manufacturing establishments respond more strongly to property tax rate differences than non manufacturing establishments. To address concerns that changes in property assessments a driving changes in the property tax rate, I repeat the estimation strategy using the total property taxes paid to the municipality, and find an elasticity of -0.23. The difference between these two estimates suggests that there is still some variance in business property tax rates being explained by local business conditions, which is reflected in property assessments.

Interpreting these results, I draw a comparison with Duranton et al. (2011) and Belotti et al. (2021), which also utilize spatial differencing. The results suggest that the elasticity of employment with respect to the property rate is lower than Duranton et al. (2011)'s estimate of -1.02 for the United Kingdom. This discrepancy explained by the business property tax having a minimal effect on establishments so long as property assessments reflect market values of property and do not include other forms of capital in the assessment. These results are in line Smart (2012), which uses municipally aggregated data and estimates an elasticity of -0.23. In contrast to Duranton et al. (2011) and Belotti et al. (2021) I include separate estimates of the impact on manufacturing and non-manufacturing establishments, finding a minimal effect on non-manufacturing establishments. This supports the focus in the previous literature on the impact of business property taxes on manufacturing establishments. I conclude that different elasticities of employment with respect to the property tax rate imply different optimal municipal policies by property class.

Background

Toronto's decrease in business property taxes occurred within the context of a larger reform to the property tax system in Ontario. The Ontario property tax reform of 1998 was the most significant change to the property tax system in Ontario's history and a model for property tax reforms around the world (The Economist, 2021). The reform introduced market value assessments across the province in 1998, and in 2001 forced some municipalities to lower property tax rates on business property. The goal was to make the property tax system fairer and to ultimately remove both the non-residential and residential property tax from the provincial political agenda[1]. The reform successfully shifted the burden of the property tax away from business property in an attempt to help businesses, and reduced property tax heterogeneity between Ontario municipalities (Bird et al., 2012).

Prior to 1998 property assessments were non uniform across municipalities in Ontario. The 1998 reform created the Ontario Property Assessment Corporation (later renamed the Municipal Property Assessment

[1]Bird et al., 2012 is the most comprehensive review of the Ontario property tax reform. Any errors in the background are mine and mine alone.

Corporation or MPAC) which took over property assessment for the entire province. Assessments were then updated to the Current Value Assessment (CVA) of a property, which should reflect the value if sold to an independent party. Prior to the 1998 reform residential properties were undervalued relative to their market value, while commercial properties were valued at approximately their market value (Smart, 2012). As a result, imposing a uniform property tax with CVA assessments would have resulted in a large shift in the burden of taxations onto residential property. To avoid the shift to residential property and the disapproval of homeowners, the province established multiple property classes. Multiple property classes allowed municipalities tax each property class at different rates and to maintain the existing property tax burden on each property class after the assessments were updated.

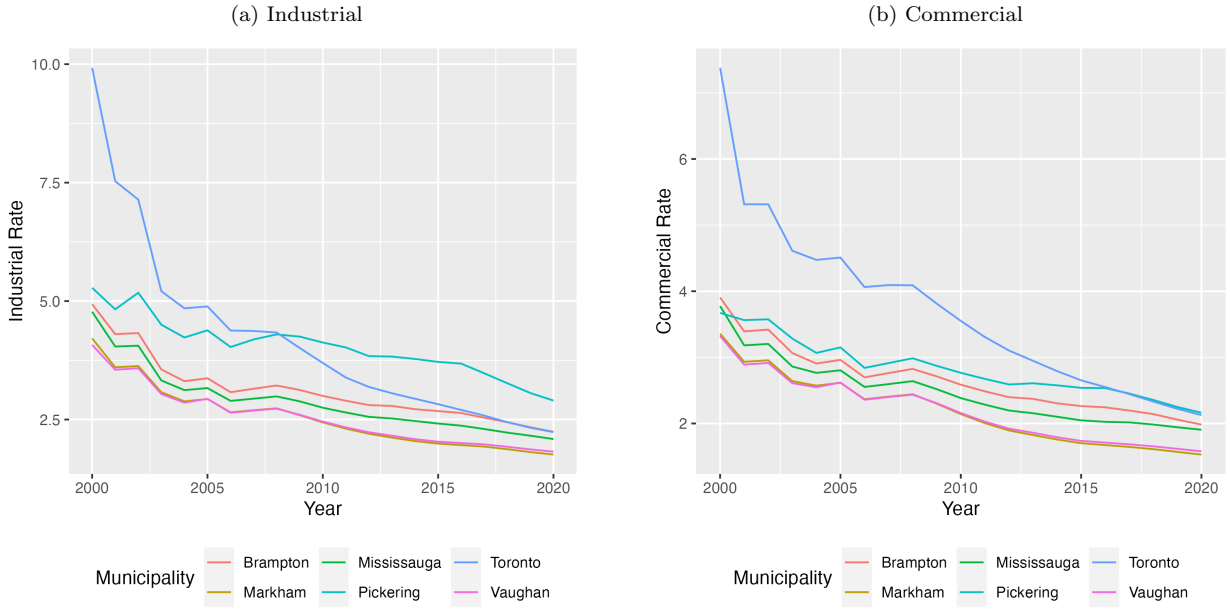
After the creation of the classified property tax system there were significant complaints that business concerns were not addressed with the updated property assessments (Bird et al., 2012). In response Ontario established rules to regulate the ratio between the residential and non-residential property classes to limit the ability of municipalities to shift the property tax burden onto businesses. The property tax ratio for a given property class was defined as the ratio of the property tax rate for a given class relative to the residential property tax rate. For example, if the property tax rate for residential property was 1.25% and the property tax rate for commercial property was 2.5%, then the property tax ratio would be 2.5%/1.25% = 2.0. The province then established a target range for property tax ratios of between 0.6 - 1.1, depending on the property class. These targets were known as the "range of fairness". Starting in 1998, municipalities could set property tax rates for each class that moved towards the range of fairness, but not rates that moved away from it. The goal was to gradually shift the property tax burden away from businesses.

In addition to the range of fairness, and in response to further complaints from the business community, the province imposed further caps on property tax increases for the commercial and industrial property classes in 2001[2]. Collectively, I refer to the industrial and commercial property taxes as the business property tax. The province defined threshold tax ratios for these property classes: 1.98 for commercial, and 2.63 for industrial. Municipalities above these cutoffs could only increase their tax rates in that property class after their tax ratio fell below those thresholds (Smart, 2012). In 2004 the province relaxed this restriction, allowing municipalities to increase tax rates for the the commercial and industrial classes only to the extent that revenue neutrality is maintained for that class in the municipality. This option is known as "tax ratio flexibility", and combined with the threshold ratios for the commercial and industrial property classes, remains in place as of the time of writing.

The policy of threshold tax ratios formed a cap that forced municipalities to reduce their commercial and industrial tax rates if they were above the threshold (Smart, 2012). It is this policy which forced Toronto to

[2]The multi-residential class was also capped in 2001, but I exclude it for the purposes of this analysis.

Figure 1: Business Property Tax Rates for Toronto and Surrounding Municipalities.

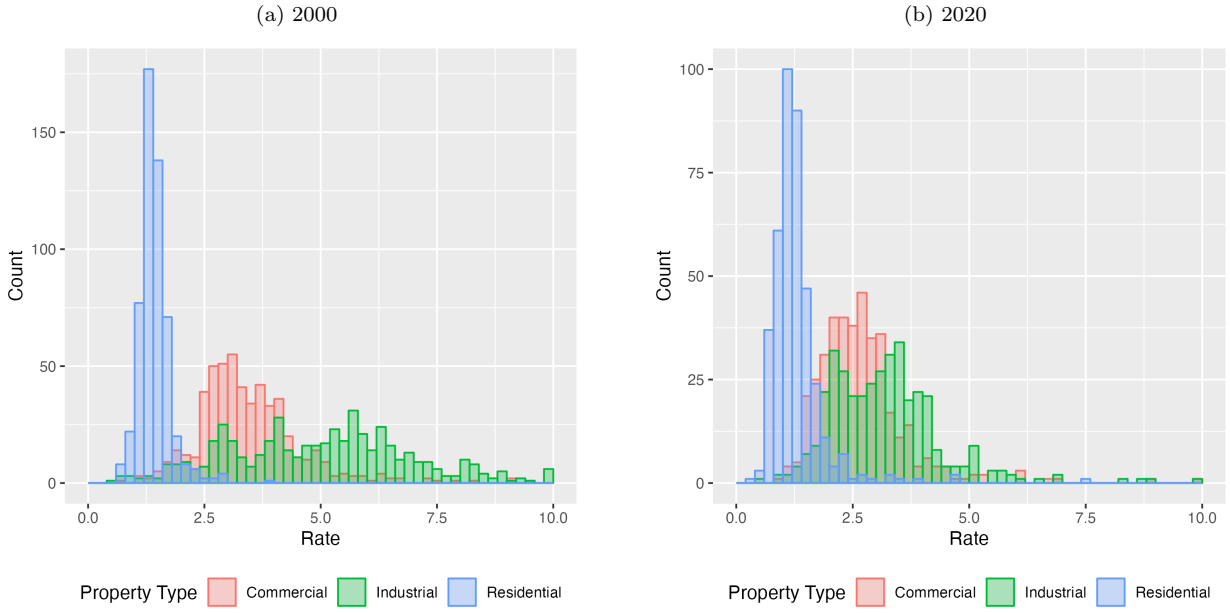


decrease its commercial and industrial property tax rates relative to the neighbouring municipalities. Figure 1 shows industrial and commercial property tax rates for Toronto and the surrounding municipalities starting in 2000. Only Toronto had industrial and commercial tax ratios above the threshold tax ratio, leading to a decrease in Toronto's commercial and industrial rates relative to the surrounding municipalities. Threshold ratios also had an impact across the rest of Ontario, leading to a narrowing of the distribution of commercial and industrial rates. Figure 2 shows the distribution of property tax rates across Ontario between 2000 and 2020. The narrowing of the distribution is largest and most notable in the industrial property class.

Although the capping policy affected many municipalities in Ontario, I focus deliberately on the comparison between Toronto and the surrounding municipalities. The imposed threshold ratios (below which a municipality had to reduce its business property tax rate) were an arbitrary choice by the province, that municipalities would have been unable to get around[3]. However, municipalities could choose how much they decreased business property tax rates by and how quickly they got below the threshold ratios. Some municipalities decreased business property taxes immediately in 2001, like Waterloo Region, while others like Toronto decreased business property taxes gradually over time. Modelling this choice of when to lower rates, and the flexibility each municipality has in its tax rates prior to the 1998 reform, is impossible as the classified system was only introduced in 1998. I instead focus only on Toronto and the adjacent municipalities where the threshold ratio affected Toronto only. In practice this selection will be refined further, as only

[3]Thresholds were set at 1.98 for commercial and 2.63 for industrial because this was the mean tax ratio for those classes in 2001. The thresholds have not significantly changed since, although the average tax ratios have fallen.

Figure 2: Distribution of Property Tax Rates Across Ontario, by Class, in 2000 and 2020.



Distribution of property tax rates across Ontario, by class, in 2000 and 2020. The relevant property classes are the commercial and industrial class, which are the focus of this paper. Between 2000 and 2020 there was a significant narrowing of the distribution of business property tax rates due to the threshold ratios imposed by the province of Ontario. Rates for the residential property class are included for reference.

Mississauga, Vaughn, and Markham will have establishments located geographically close enough to Toronto for spatial differencing.

Two other reforms occurred around the same time period that this paper will be mindful of: local services realignment in 1998, and amalgamation of municipalities. Local services realignment shifted spending responsibilities between the province and municipalities. Many services such as policing, airports, and sewer and water which were previously joint responsibilities between the province and municipalities were downloaded to be solely municipal responsibilities, and a smaller number of services were uploaded to the province. In exchange the province took over education financing, which was previously the responsibility of municipalities working with local school boards. After local services realignment the province set education tax rates, collected the revenue, then redistributed it to school boards as needed. To help with the transition, Ontario set the Business Education Tax (BET) to correspond to the pre 1998 education tax rate, preserving differences in the business education property tax between municipalities. Over time the province has decreased the differences in BET rates across municipalities (Bird et al., 2012).

A second reform and possible confounding change was the amalgamation of municipalities. In 1996 Ontario passed the Savings and Restructuring Act which was designed to encourage municipalities to merge

to make local governments more efficient. From 1996 to 2004 the number of municipalities in Ontario reduced from 815 to 445. The only relevant amalgamation for this paper was of Toronto in 1998, but this occurred prior to the estimation period. Restricting the area of focus to Toronto, Mississauga, Vaughn, and Markham ensures that municipal amalgamations will not affect the results.

Despite the original hope of the 1998 reform, municipal finance continues to be an active policy concern for both the province and municipalities in Ontario. The threshold ratios on industrial and commercial property tax rates are still in place today, and have continued to shift the burden of taxation away from businesses and towards residential property. Figure 4 in the Appendix shows the effect of this cap on Toronto over time. In addition, recent changes by the government of Ontario have limited municipalities' ability to levy development charges on new construction (Government of Ontario, 2022a), placing possible strain on municipal budgets (Found, 2021). This has increased interest by municipalities to raise business property tax rates to make up for the budget shortfall.

Literature

This paper is most closely related to the literature on the effect of property taxation on business establishments starting with Duranton et al. (2011). Duranton et al. (2011) uses micro-geographic data from the Annual Census of Production in the UK to estimate the effect of local property tax changes on manufacturing establishments. They find that business property taxes have a negative effect on establishment employment but no effect on establishment entry. They estimate the elasticity of employment with respect to the property tax rate of -1.02, suggesting that property taxes can have significant effects on employment. A key caveat is an institutional feature of the UK where property reassessments occur if buildings are expanded, magnifying the effect of property tax rate changes on employment as establishments fail to expand to avoid reassessments on existing properties. In Ontario the assessed value of properties are regularly updated after the 1998 reform so this mechanism will not be relevant.

Belotti et al. (2021) expands on the analysis of Duranton et al. (2011), finding that the Business Property Tax (BPT) in Italy has a negative impact on equipment, employment and value added for Italian manufacturing establishments. BPT rates include both the value of land and buildings as well as equipment and machinery in the assessment tax base. They find that there is no measurable change in the usage of land and buildings as a result of BPT changes. They further show that changes in employment due to BPT rates are attributable to changes in equipment and machinery. Belotti et al. (2021) excludes multi-establishment firms, which will not be the case for this paper.

Both Duranton et al. (2011) and Belotti et al. (2021) utilize spatial differencing to compare pairs of

establishments (dyads) across municipal boundaries. Cameron and Miller (2014) examines how to perform robust inference on dyadic data. Belotti et al. (2018) examines robust inference in spatial differencing models specifically, and shows how the dyadic robust estimator used in Cameron and Miller (2014) supersedes that of Duranton et al. (2011). Importantly for this paper, Belotti et al. (2018) also demonstrates that two way clustered standard errors at the establishment level is a good approximation for dyadic robust standard errors.

The history of the Ontario property tax reforms and its effects on municipalities have been extensively documented in Bird et al. (2012). Smart (2012) utilizes the reform to estimate the effect of business property taxation on business location and employment, finding an elasticity of employment with respect to tax rate of -0.23. Smart (2012) concludes that the reform has had a small positive impact on employment and productivity. A key limitation of Smart (2012) is a lack of establishment micro-data, which necessitates analysis at the municipality level using aggregate business counts and aggregate employment.

A related literature explores the effect of tax differentials in the presence of agglomeration externalities. Brülhart et al. (2012) utilize data from Swiss municipalities to show that agglomeration forces offset the effect of tax differentials on firm entry. For a review of this literature, see Brülhart et al. (2015). This paper will also draw on the empirical agglomeration literature, notably Behrens and Bougna (2015) which documents the geographical concentration of manufacturing in Canada.

This paper also relates to the literature on firm location choices under taxation. Jofre-Monseny and Solé-Ollé (2010) examines the effect of local taxation on new manufacturing firms, finding small effects from non-residential property taxes relative to local business taxes. Giroud and Rauh (2019) estimates the effect of state taxation on business activity, finding that the corporate taxes reduce employment and the number of establishments for C corporations, although pass-through entities are less sensitive with respect to the comparable personal tax rate. Fajgelbaum et al. (2019) uses state tax rate changes to show that firms are sensitive to after tax expected profits, and utilize this result to calibrate a quantitative spatial model of firms choosing locations while facing different taxation mixes. They find that the heterogeneity in state taxes is a significant source of welfare loss in the United States.

Although this paper focuses on business property taxes, there is an extensive related literature on the effects of the residential property tax on individuals and a long running debate on the progressivity of the property tax. Oates and Fischel (2016) offer a systematic review of the prior literature on this topic. Lutz (2015) uses school finance reform to show that property taxes influence new home construction in New Hampshire, although in areas with lower housing supply elasticities the shock is more capitalized into home prices. Loeffler and Siegloch (2021) provides the most comprehensive evidence of the welfare effects of property taxation, utilizing municipal tax reforms in Germany. They find that the property tax is

regressive due to its passthrough from landlords to tenant, although it takes 3 years for passthrough to occur fully. This suggests that rental rigidities could limit capitalization into property prices in the residential market as they do in the non-residential market as identified by Duranton et al. (2011). Finally, this paper ignores any discussion of Tiebout sorting, as discussed in Calabrese et al. (2012). Although Tiebout sorting is an important mechanism for households when choosing between neighbourhoods, it is unclear how establishments would form preferences over their neighbours and sort around them. As a result I leave that discussion for future work.

Establishment Behaviour and Empirical Strategy

The effect of business property taxes on business activity hinges on two key mechanisms: the incomplete capitalization of property taxes into property values, and the cost share of property in the establishments' production function. If property taxes are completely capitalized into property values than any changes in the property tax will be reflected in the price of property. Establishments which own property therefore face no marginal cost of increased property taxes. In the case of Toronto and the surrounding municipalities, the majority of business property is rented, rather than purchased (Toronto Regional Real Estate Board, 2022). For changes in property taxes to have an impact on renting establishments at least some of the change to property taxes must be passed through from landlords to tenants establishments, which would ensure that property taxes are not completely capitalized into property prices. It is difficult to know if pass through occurs in practice, especially given the possibility of multi year leases for business tenants which may limit the ability of landlords and or tenants renegotiate leases[4].

A second consideration when estimating the effect of property tax rates on establishments is the contribution of property to overall production. If the cost share of property in production is low, then any percentage changes to the cost of property may have little to no effect on the establishment. On the contrary if the cost share of property is large, then changes to the cost of property should have a larger effect on the establishment. This suggests that industries using more property should be more sensitive to property tax rate changes. For example, the effect of property tax rate changes should be larger for establishments using industrial property versus commercial property because industrial property is a larger input for industrial establishments. Finally it is also important that there be some substitutability between property and labor in the establishments' production function. Without this property, establishments will not change employment as the cost of property changes, and there will be no observable change in business activity.

Assuming these properties are met, the empirical strategy of this paper can then draw the previous

[4]A 2022 report from the city of Toronto on the new small business property class notes that "it appears that the City has limited means available to enforce a pass-through of property tax decreases to tenants." (City of Toronto, 2022)

literature. I utilize the strategy from Duranton et al. (2011), making use of the improved matching structure developed in Belotti et al. (2021). To motivate the model, consider a regression of the property tax rate on the employment for establishments:

$$e_{it} = \alpha r_{at} + X_{it}\beta + \mu_i + \epsilon_{it} \tag{1}$$

Where e_{it} is the employment of an establishment i at time t, r_{at} is the property tax rate of municipality a at time t, and α is the coefficient of interest. X_{it} is a matrix of establishment controls, and μ_i is some unobservable establishment characteristic which is invariant over time. This model is likely to be biased as the potential locations of establishments are likely to be heterogenous in suitability for business activity. Locations could vary due to municipality specific factors, which can be thought of an unobservable municipality characteristics γ_a. In addition to municipality specific factors, there are likely to be location characteristics which occur at a much finer geographic scale, and could be potentially time varying. For example the presence of local suppliers, the frequency of the bus network, or changes in local amenities are all likely to vary over time while being continuous over space. These time and space varying location factors represented by θ_{zt}. The model then becomes:

$$e_{it} = \alpha r_{at} + X_{it}\beta + \mu_i + \gamma_a + \theta_{zt} + \epsilon_{it}. \tag{2}$$

Estimating equation 2 via OLS is likely to return biased results due to the unobserved factors μ_i, γ_a, and θ_{zt}. Duranton et al. (2011) and Belotti et al. (2021) resolve this issue by making use of two transformations to account for unobserved factors. First take the within transformation on equation 2 to centre all observations around their mean. For each variable y_{it}, transform each variable by $\tilde{y}_{it} \equiv y_{it} - \bar{y}_i$. This gives:

$$\tilde{e}_{it} = \alpha \tilde{r}_{at} + \tilde{X}_{it}\beta + \tilde{\theta}_{zt} + \tilde{\epsilon}_{it}, \tag{3}$$

where variables with a $\sim$ have had the within transformation applied.

The resulting equation still contains $\tilde{\theta}_{zt}$, for time varying spatial unobserved heterogeneity. To control for this Duranton et al. (2011) and Belotti et al. (2021) perform spatial differencing between pairs of establishments located close to each other. If establishments are located closely together then the difference in any spatially continuous unobserved factor between the two establishments should be approximately zero. Performing spatial differencing recovers:

$$\Delta_d \tilde{e}_{jt} = \alpha \Delta_d \tilde{r}_{at} + \Delta_d \tilde{X}_{jt}\beta + \Delta_d \tilde{\theta}_{zt} + \tilde{\epsilon}_{jt}. \tag{4}$$

where Δ_d is the spatial differencing operator. Assuming spatial differencing is performed over small enough distances the term $\Delta_d \tilde{\theta}_{zt} = 0$, which gives:

$$\Delta_d \tilde{e}_{jt} = \alpha \Delta_d \tilde{r}_{at} + \Delta_d \tilde{X}_{jt} \beta + \tilde{\epsilon}_{jt}. \tag{5}$$

There are three practical considerations when implementing spatial differencing: how pairs are determined, the matching radius, and the induced dyadic error structure. Spatial differencing matches establishments with similar characteristics across municipal boundaries, within some distance. Matching by observable characteristics ensures the comparability between a establishment on either side of the boundary. Duranton et al. (2011) considers establishments to be similar if they operate within the same 2 digit industry, while Belotti et al. (2021) considers establishments as being similar if they are in the same 2 digit industry and in the same production quintile. This paper matches on 2 digit industry as well as the self described "type" of establishment.

The matching distance between establishments is chosen by the researcher and is a tradeoff between the number of matches (larger distances create more matches) versus the ability to control for spatial heterogeneity $\tilde{\theta}_{zt}$. As the matching distance increases and the estimate should be increasingly biased by unobserved heterogeneity. Duranton et al. (2011) choose a matching distance of 1km, which will also be followed in this paper.

After spatial differencing the unit of observation changes from establishment i to establishment pair j. This creates a dyadic data structure, necessitating a correction of the standard errors to account for the correlation between establishment pairs which contain the same establishment. Belotti et al. (2018) discusses the necessary correction to standard errors to obtain robust inference. They note that the standard errors in Duranton et al. (2011) do not perform well under heteroskedasticity, however two-way clustered errors at the establishment level return standard errors within 10% of the true dyadic standard error. I utilized two-way clustered standard errors as a result.

As demonstrated in Duranton et al. (2011) spatial differencing may not fully control for spatial features in practice as matching may occur at such a large distance that shocks to local conditions may still be correlated within municipalities. Duranton et al. (2011) and Belotti et al. (2021) both utilize the alignment between a municipal government and the national government as a time varying instrument for local property tax rates. Unfortunately, municipalities in Ontario do have the same political parties as the province of Ontario, making this instrument not feasible[5]. Given a lack of a suitable instrument, I focus on the case of Toronto

[5]A previous version of this paper utilized time variation in the cap policy to instrument the transformed tax rate $\Delta_d \tilde{r}_{at}$ to recover unbiased estimates of α. This however introduces greater complications, as different municipalities could choose when to lower taxes sufficiently to no longer have their tax business property tax rates capped.

versus the surrounding municipalities, with the narrowest matching distance possible to address this concern.

One potential concern with this strategy is that large property tax rate differences may induce spatial sorting of establishments between municipalities. There is little evidence that this occurred in practice (Bird et al., 2012), and Duranton et al. (2011) finds no conclusive evidence that decreases in property taxes induce establishment entry. Instead they find an insignificant, but positive effect of property tax increases on establishment entry, and speculate that property tax increases induce establishment turnover, increasing both exit and entry. Jofre-Monseny and Solé-Ollé (2010) does find evidence that local property taxes can discourage firm entry, although the impact of property taxes is far smaller than that of general business taxes. I therefore set aside the question of spatial sorting and establishment entry and exit in this paper.

A second possible concern is that public goods may be endogenously changing as tax rates are changing, confounding the estimation. While I cannot measure the amount of public goods provided to each establishment directly, taking the first difference should control for any level differences in public goods. In addition changes in amount of public goods provided, such as through transportation infrastructure, should have some spillover across municipal boundaries, which spatial differencing should control for. Finally it is unclear if public goods responded at all to the decrease in business property tax revenue. Municipalities have multiple margins of response to lower business property tax revenues, including residential property taxes, which would allow municipalities to maintain the same level of public goods in response to a decline in the business property tax rate.

Data

To implement the estimation strategy requires detailed data on both the property tax in Ontario, as well as panel data of establishments and establishment outcomes. Data on the property tax by municipality are obtained from the Financial Information Return (FIR) from the provincial Ministry of Municipal Affairs and Housing (Government of Ontario, 2022b). FIRs are available from 2000 to the present. Panel data on establishments comes from Scott's National All Business Directories Database, a directory of businesses in Canada. The Scott's database is utilized in Behrens and Bougna (2015) to compute geographic concentration indices by industry in Canada. The data cover 2001 to 2019 in two year increments, with 2015 being absent. Panel identifiers are only available from 2003 onwards and are required for the within transformation, so I utilize 2003 - 2019 as the full sample period. I restrict this further in the main estimations, focussing on 2003-2011 when the majority of business property tax rate decreases occurred.

From the FIRs I assemble a panel of tax data containing the total assessed value, the tax rate, the total taxes paid to the municipality, and the tax ratio for each property class in Toronto and the surrounding

municipalities. In cases where there are property subclasses, for example separate rates for unoccupied buildings, payments in lieu[6], or separate rates reflecting recent municipal amalgamations I aggregate the subclasses together by the total taxes paid and total assessed value, then recompute effective property tax rate. I focus on the industrial and commercial property classes, as these were the classes to which the cap policy applied. All tax variables include the total tax rate and collections from both municipal and education taxes, and robustness check are completed with these taxes separately. From these data I verify that only Toronto was beyond the threshold ratio and have the cap applied in this time period, as shown in figure 5 in the appendix.

Data on individual establishment establishments come from the Scott's database. To implement the estimation strategy requires establishment data with a panel dimension and precise geolocations. The Scott's database contains panel identifiers for individual establishments from 2003 - 2019, including exact addresses and postal codes. The Scott's database is primarily focussed on the manufacturing industry, with Behrens and Bougna (2015) finding that the database is representative of the manufacturing industry when compared to Canadian Business Patterns (Government of Canada, 2022). Unlike Duranton et al. (2011) and Belotti et al. (2018) I include both manufacturing and non-manufacturing establishments, as determined by the NAICS code. A drawback of the Scott's database is that it is based on surveys, and as a result may be only an estimate of the establishment employment. Business surveys may also not fully report changes in employment, potentially downward biasing the results. An advantage is that the database is at the establishment level, ensuring multi-location firms are not a concern as in Belotti et al. (2018).

I geolocate each establishment in the Scott's database using the Postal Code Conversion File (PCCF) from Canada Post. Following Behrens and Bougna (2015) establishments are geolocated using the PCCF from the following year to account for the six month delay in updating postal codes. In some cases postal codes do not uniquely assign a census subdivision (municipality), in those cases string matching is performed between the city listed in the Scott's database and the census subdivision name. In total 99.8% of establishments are geolocated. Matching is then completed between each establishment and the municipality from the FIRs. 99.5% of establishments are located to a municipality. Details on the entire matching procedure can be found in section in the appendix.

Establishments are assigned to the relevant property class by NAICS code, as seen in table 1 These assigned property classes are accurate for NAICS codes 31-33, which correspond to industrial firms. The commercial property class is designed to apply to all property "that is not included in any other property class" (Government of Ontario, 2023), and therefore is a good assignment for NAICS codes 41, 44, and

[6]Provincial and Federal government buildings are exempt from property taxes, these governments make Payments in Lieu of property taxes (Bird et al., 2012).

Table 1: NAICS Codes and the Matched Property Classes.

NAICS Codes	NAICS Industry	Property Class
31 - 33	Manufacturing	Industrial
41, 44, 45	Wholesale and Retail Trade	Commercial

45. One possible concern with this classification is that NAICS 41, Wholesale Trade, may correspond to industrial property rather than commercial property. I show that the results are robust to this alternate classification

For each establishment I observe the address, NAICS codes, employment, whether the establishment is a headquarters, and establishment type. The establishment type is a basic description of the business activity at that location (e.g. Manufacturer, Retail, Sales Office). I utilize this as a matching variable for spatial differencing, allowing for better matches between establishments.

Several significant restrictions are made to the Scott's database to account for establishments which have moved or changed industries. Following Duranton et al. (2011) and Belotti et al. (2021) I drop establishments which have moved locations. In addition it is possible that establishments changed industries, which could change how establishments are matched to property classes as given by table 1. As a result all establishments whose property class has changed are dropped.

Results

To show the effects of changes in the property tax on establishment employment, I utilize establishments on the boundary between Toronto and the surrounding municipalities of Mississauga, Vaughn, and Markham. As discussed in the empirical strategy section this setting is ideal because only Toronto was beyond the threshold tax ratio, forcing a decrease in business property taxes in Toronto. Tables 2 and 3 show a balancing tables for 2003 between Toronto and the surround municipalities for commercial and industrial establishments respectively. There are no significant differences on any of the observable outcomes between Toronto and the surrounding municipalities. Summary statistics after spatial differencing can be found in table 4. After differencing all of the observable characteristics are indistinguishable from zero, again suggesting there is no systematic difference between Toronto and the surrounding municipalities in 2003.

Table 2: Balancing Table for Commercial Establishments in 2003.

Municipality	Establishments	Employment	Age	Head Office
Non-Toronto	61	2.45 (1.09)	3.83 (6.13)	0.09 (0.30)
Toronto	61	2.17 (1.04)	5.39 (6.91)	0.11 (0.32)

Table 3: Balancing Table for Industrial Establishments in 2003.

Municipality	Establishments	Employment	Age	Head Office
Non-Toronto	120	2.79 (1.38)	6.39 (7.44)	0.16 (0.37)
Toronto	151	2.81 (1.46)	4.93 (6.77)	0.12 (0.33)

Table 4: Summary Statistics After Spatial Differencing in 2003.

Property Class	Pairs	Employment	Age	Head Office
Commercial	203	0.06 (1.46)	1.57 (10.54)	0.07 (0.34)
Industrial	632	0.49 (1.96)	1.37 (9.72)	0.11 (0.48)

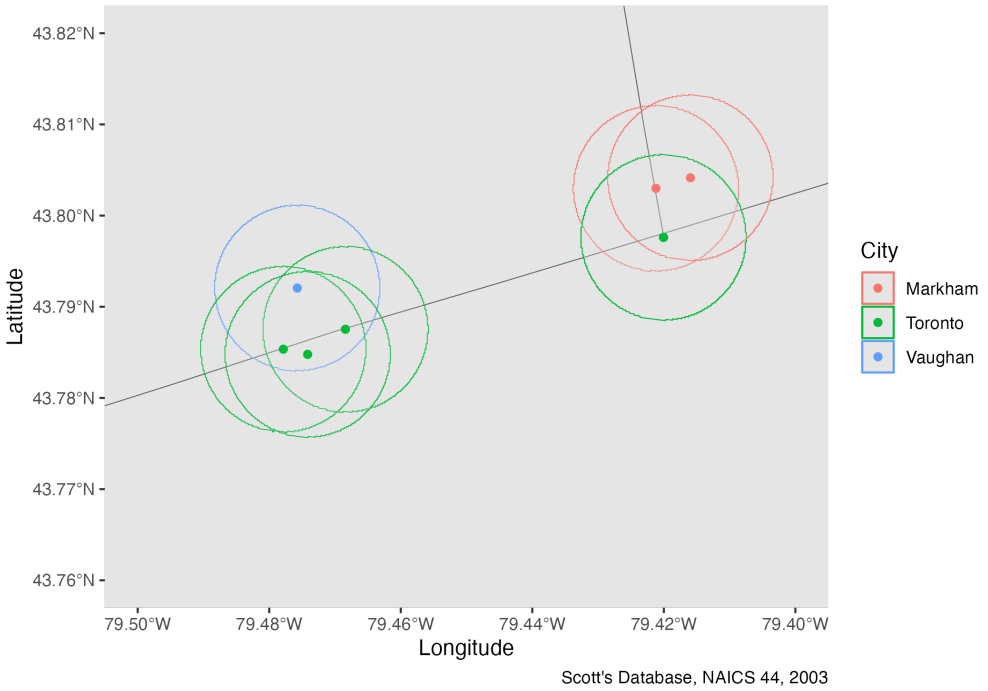
Note: Establishments may enter or exit the sample in later years, so the total number of establishments in tables 2, 3, and 4 will not exactly match the results in later tables.

When performing spatial differencing I utilize a boundary of 1km in the base specification as in Duranton et al. (2011). A 1km buffer is drawn around each establishment location, and establishments located across municipal boundaries are matched. Figure 3 shows an example of this procedure. The resulting data consists of pairs or dyads, each of which contains two establishments which are within a 1km match radius of each other.

I estimate equation 5 taking as the outcome variable the establishment employment. The explanatory variable of interest is the total property tax rate. At the establishment level I include the time varying controls in Duranton et al. (2011) of a second order polynomial of establishment age, an indicator for if the establishment is greater than 20 years old. A significant number of observations are missing the establishment age due to the Scott's database being a survey, or quote the parent firm age rather than the establishment age. Taking a 20 year cutoff ensures that reporting errors are minimized. Additionally I include an indicator for if the establishment is a firm headquarters.

To see the effect of spatial differencing on the estimates, I also include estimates of equations 2 and 3, for pooled OLS and a within estimator. To ensure comparability between estimation strategies, I limit the set of establishments used in estimating equation 2 and 3 to be the same as those used in estimating equation 5. Spatial differencing and the within transformation limit the sample in the following ways. Taking the within transformation removes any establishment with less than two observations. Spatial differencing produces pairs of establishments, which leads to any observation which has no corresponding partner to be dropped. As a result the standardized set of establishments are those with at least two observations, matched to at least one other establishment with two observations in the same years. Time invariant establishment

Figure 3: Spatial Differencing Matching Example



An example of the matching procedure for spatial differencing. After each establishment is located in a municipality (colour coded) a 1km buffer is drawn around the location. If the circled area intersects with an establishment from another municipality, the two establishments are formed into a dyad (pair). Each establishment can be part of multiple dyads. Two establishments will only be matched if they share the same two digit industry code and establishment type.

characteristics are used to match pairs of establishments when performing spatial differencing, and are included as fixed effects in the OLS and within transformed specifications in equations 2 and 3.

Table 5 shows the results of estimating equations 2, 3 and 5 for 2003 - 2011. The coefficient of interest is the in the first row, of the log total business property tax rate on log employment. I interpret this coefficient as the elasticity of employment with respect to the tax rate. Column (1) estimates equation 2, using a pooled OLS estimation, with fixed effects for year and each of the time invariant establishment characteristics. I find that this elasticity is negative, but insignificant. Making use of the panel dimension of the data I then estimate the within estimator in equation 3, as shown in column (2). The within transformation removes any establishment fixed effects, after which the result is also indistinguishable from zero.

Spatial differencing is then performed and estimated as in equation 5. Spatial differencing changes the number of observations as each establishment can be part of multiple pairs. From the original 617 establishments, spatial differencing produces 2,060 pairs over time, for a total of 5,390 observations. The results of estimating equation 5 found in column (3) of table 5. Although the magnitude of the estimates increases slightly to -0.59, it remains insignificant at the 5% level. The point estimate of -0.59 for the elasticity of employment with respect to the property tax rate sits within the range of estimates in the previous literature. Smart (2012) estimates this elasticity as -0.23 for Ontario over the same time period, while Duranton et al. (2011) estimates an elasticity of -1.024 for the United Kingdom.

One possible concern is that the tax rate my not accurately reflect the actual property tax burden faced by establishments. This is possible if the assessed values of property evolve differently between municipalities. Given the property tax reform of 1998 was designed to ensure that assessments were consistent and reflected the current value assessment of a property across the entirety of Ontario, it is unlikely that assessment practices would be systematically different between municipalities. Instead differences in assessments could reflect changes in local economic conditions between municipalities. If the local economic conditions in Toronto improve relative to neighbouring Markham, then rents for business property may increase, which would be reflected in the assessed value of that property. If the assessed value rises, then for the same amount of revenue a lower tax rate is required, thus mechanically lowering tax rates while keeping the burden of property taxation the same. This would bias the estimate of the elasticity of employment with respect to the property tax rate downward, as large changes in property tax rates result in small changes in employment.

To overcome this concern I repeat the same estimation as in table 5, but instead utilize the total taxes paid by a property class instead of the property tax rate as the explanatory variable. Table 6 shows these results. I find a smaller elasticity of employment with respect to total taxes paid of -0.23, although the result is still not significant. Compared to the previous estimate of the elasticity of employment with respect

Table 5: Elasticity of Employment

Dependent Variable:	Employment (ln)		
Model:	(1)	(2)	(3)
	OLS	Within	Within + Spatial
Variables			
Total Rate (ln)	-0.1312	-0.1879	-0.5946*
	(0.2264)	(0.3247)	(0.3190)
Establishment Age	0.0208	0.0544	0.0239
	(0.0735)	(0.0520)	(0.0306)
Establishment Age^2	0.0004	-0.0013	-0.0006
	(0.0029)	(0.0017)	(0.0010)
Old Location Dummy	0.8788*	0.6088	0.2510
	(0.4491)	(0.4116)	(0.2537)
Headquarter Office	1.002***	0.0061	-0.0028
	(0.1958)	(0.0375)	(0.0341)
Fixed-effects			
Year	Yes	Yes	Yes
2 Digit NAICS	Yes	Yes	
Establishment Type	Yes	Yes	
Establishment ID		Yes	
Pair			Yes
Fit statistics			
Observations	1,939	1,939	5,390
R^2	0.13184	0.98294	0.98907
Within R^2	0.09402	0.01316	0.01545
Establishments	617	617	617
Pairs	-	-	2060

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Estimations of the elasticity of establishment employment with respect to the property tax rate for 2003 - 2011. Controls include the age of the establishment, age squared of the establishment, a dummy if the establishment is greater than 20 years old, and whether the establishment is the head office of the firm. Column (1) reports the estimation using pooled OLS, column (2) takes the within transformation to control for establishment fixed effects, and column (3) uses the within transformation and performs spatial differencing using a 1km threshold. Standard errors are clustered at the establishment level in columns (1) and (2), and by both establishments in (3) as an approximation to optimal dyadic robust standard errors.

Table 6: Elasticity of Employment and Total Taxes

Dependent Variable:	Employment (ln)		
Model:	(1)	(2)	(3)
	OLS	Within	Within + Spatial
Variables			
Total Taxes Paid (ln)	-0.0720	0.0362	-0.2277
	(0.0581)	(0.1321)	(0.1421)
Establishment Age	0.0243	0.0549	0.0230
	(0.0736)	(0.0519)	(0.0300)
Establishment Age^2	0.0003	-0.0013	-0.0006
	(0.0029)	(0.0017)	(0.0010)
Old Location Dummy	0.8949**	0.6088	0.2534
	(0.4504)	(0.4111)	(0.2515)
Headquarter Office	1.008***	0.0077	-0.0016
	(0.1947)	(0.0379)	(0.0329)
Fixed-effects			
Year	Yes	Yes	Yes
2 Digit NAICS	Yes	Yes	
Establishment Type	Yes	Yes	
Establishment ID		Yes	
Pair			Yes
Fit statistics			
Observations	1,939	1,939	5,390
R^2	0.13328	0.98294	0.98904
Within R^2	0.09553	0.01270	0.01196
Establishments	617	617	617
Pairs	-	-	2060

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Estimations of the elasticity of establishment employment with respect to the total taxes paid to the municipality for 2003 - 2011. Controls include the age of the establishment, age squared of the establishment, a dummy if the establishment is greater than 20 years old, and whether the establishment is the head office of the firm. Column (1) reports the estimation using pooled OLS, column (2) takes the within transformation to control for establishment fixed effects, and column (3) uses the within transformation and performs spatial differencing using a 1km threshold. Standard errors are clustered at the establishment level in columns (1) and (2), and by both establishments in (3) as an approximation to optimal dyadic robust standard errors.

to tax rate of -0.59 in table 5, the point estimate of the elasticity is smaller, but not significantly so. This result is consistent with a relative decrease in the assessed value of Toronto business property, compared to the surrounding municipalities.

A second possible concern is that changes to the education property tax rate are driving the results. As mentioned in the Background section, Ontario reformed the Business Education Tax five years prior to the imposed threshold ratio cap to municipal property taxes. Municipalities which had high municipal property taxes also had high education property taxes, which were slowly adjusted to be uniform throughout Ontario. As a result the decreases to municipal property taxes are highly correlated with decreases in education property taxes. Although education taxes and municipal taxes are equivalent from the perspective of businesses (both property taxes are collected on a single bill), it is possible that education property taxes and municipal property taxes have different effects on businesses if different public goods are affected.

Table 7 splits the total property tax rate into the municipal and education rates separately. Again, the coefficients for both property tax rates are insignificant. The third column of table 7 gives a coefficient of -0.29 for the elasticity of employment with respect to municipal property taxes, consistent with the previous estimates.

Additional Robustness Checks

As mentioned in the Data section, establishments are assigned a property class on the basis of the establishment's NAICS code. This classification is needed because the exact property class of each establishment is unknown. The largest area for concern is NAICS 41, Wholesale Trade, which is likely to correspond to larger warehouses which could be classified as industrial property. As a robustness check I repeat the same estimation as in table 5, but with NAICS 41 classified as industrial property instead of commercial property. I find an elasticity of -0.45, consistent with the main estimate in table 5. The results can be found in table 10 in the appendix.

One of the key choices when implementing spatial differencing is the choice of a 1km matching distance. Expanding the spatial differencing distance allows for more establishments to be included in the estimation, but at the cost of less precisely controlling for unobserved location heterogeneity. Table 11 in the appendix repeats the same estimations as table 5, but expanded to a 2km differencing radius. Table 12 further expands the radius to 3km. I find that the point estimates of the elasticity of employment with respect to tax rate decrease to 0.05 and -0.01 respectively. Consistent with Duranton et al. (2011), the spatially differenced estimates approach the within transformed estimates as the differencing radius is expanded and location heterogeneity is less controlled for.

Table 7: Heterogeneity by Tax Type

Dependent Variable:	Employment (ln)		
Model:	(1)	(2)	(3)
		Within + Spatial	
Variables			
Mun. Rate (ln)	0.8609	-0.1018	-0.2900
	(0.5617)	(0.1983)	(0.2007)
Educ. Rate (ln)	-3.615*	0.0359	-0.0751
	(2.021)	(0.5607)	(0.5962)
Establishment Age	0.0197	0.0546	0.0237
	(0.0737)	(0.0521)	(0.0302)
Establishment Age^2	0.0005	-0.0013	-0.0006
	(0.0029)	(0.0017)	(0.0010)
Old Location Dummy	0.8603*	0.6099	0.2488
	(0.4503)	(0.4125)	(0.2506)
Headquarter Office	1.018***	0.0053	-0.0034
	(0.1975)	(0.0377)	(0.0336)
Fixed-effects			
Year	Yes	Yes	Yes
2 Digit NAICS	Yes	Yes	
Establishment Type	Yes	Yes	
Establishment ID		Yes	
Pair			Yes
Fit statistics			
Observations	1,939	1,939	5,390
R^2	0.13471	0.98295	0.98908
Within R^2	0.09702	0.01318	0.01580
Establishments	617	617	617
Pairs	-	-	2060

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Estimations of the elasticity of establishment employment with respect to the property tax rate for 2003 - 2011, where the property tax rate is decomposed into the municipal and education rates separately. Controls include the age of the establishment, age squared of the establishment, a dummy if the establishment is greater than 20 years old, and whether the establishment is the head office of the firm. Column (1) reports the estimation using pooled OLS, column (2) takes the within transformation to control for establishment fixed effects, and column (3) uses the within transformation and performs spatial differencing using a 1km threshold. Standard errors are clustered at the establishment level in columns (1) and (2), and by both establishments in (3) as an approximation to optimal dyadic robust standard errors.

One possible concern is the spatial distribution of establishments along municipal boundaries. If establishments located near municipality boundaries are not representative of establishments closer to the centre of municipalities, any estimates will have limited external validity. I find the coefficients on the covariates for establishment age, establishment age squared, the old location dummy, and the headquarter location in all three columns of tables 5, 11, and 12 do not vary significantly as the matching distance is expanded. This suggests that establishments located near municipality boundaries are not systematically different from those located closer to the centre.

In the main specification I focus on the time period from 2003 - 2011, corresponding to the largest changes in business property taxes. Table 13 in the appendix relaxes this cutoff, and expands the time range to 2003 - 2019. The elasticity of employment with respect to the property tax remains comparable at -0.41, and insignificant. The similarity of the point estimate is reassuring that the time period chosen is not unique.

Finally I verify that fixed effects are not driving the results, table 14 shows the same estimation as the third column of table 5 with and without fixed effects. I find no change in the estimated elasticity.

Property Class Heterogeneity

It is likely that establishments in different industries will respond differently to business property tax changes due to different cost shares of property. Unlike Duranton et al. (2011) and Belotti et al. (2021), and following the earlier work of Smart (2012), I include both commercial and industrial property in all estimations. Table 8 decomposes the results into commercial and industrial property separately. The point estimate for commercial property is positive, and close to zero, although with very large confidence intervals. The estimate for the industrial class is negative with an estimate of -0.65, and also insignificant. Taking only the point estimates it appears there are significant differences in the employment responses of establishments on commercial or industrial property. The difference between the commercial and industrial estimates suggests that the earlier literature's focus on industrial property is justified as that is where the employment responses are the largest.

As before we might be concerned that variation in assessments is driving the results. Table 9 repeats the same decomposition by commercial and industrial property, but utilizing variation in the total taxes paid rather than the tax rate. As in table 6 I find smaller in magnitude estimates of the elasticity of employment with respect to the taxes paid versus the elasticity of employment with respect to the property tax rate. The discrepancy is likely driven by changes in the assessed values of property due to local business conditions. Although the coefficients remain insignificant, the point estimates for commercial property are very close to zero, while the estimates for industrial property remain negative, although insignificant at the 5% level.

Table 8: Heterogeneity by Property Class

Dependent Variable:	Employment (ln)		
Property Class	Full sample	Commercial	Industrial
Model:	(1)	(2)	(3)
Variables			
Total Rate (ln)	-0.5946*	0.2185	-0.6452*
	(0.3190)	(0.9121)	(0.3288)
Establishment Age	0.0239	-0.0235	0.0228
	(0.0306)	(0.1823)	(0.0265)
Establishment Age^2	-0.0006	0.0002	-0.0004
	(0.0010)	(0.0056)	(0.0009)
Old Location Dummy	0.2510	-0.2991	0.3119
	(0.2537)	(1.491)	(0.2269)
Headquarter Office	-0.0028	0.1764	-0.0207
	(0.0341)	(0.1069)	(0.0357)
Fixed-effects			
Year	Yes	Yes	Yes
Pair	Yes	Yes	Yes
Fit statistics			
Observations	5,390	990	4,400
R^2	0.98907	0.98203	0.99032
Within R^2	0.01545	0.01860	0.02498
Establishments	617	200	417
Pairs	2,060	410	1,650

Clustered (Establishment ID & Second Establishment ID) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Estimations of the elasticity of establishment employment with respect to the property tax rate for 2003 - 2011, for Commercial and Industrial property separately. Controls include the age of the establishment, age squared of the establishment, a dummy if the establishment is greater than 20 years old, and whether the establishment is the head office of the firm. Column (1) reports estimates for the full sample, column (2) reports results for Commercial establishments only, and column (3) reports results for Industrial establishments only. Standard errors are clustered by both establishments as an approximation to optimal dyadic robust standard errors.

Discussion

The estimates above are very imprecise, but if we take the point estimates seriously offer some insight to the effect of property tax changes on establishments. Prior to this paper the best estimate of the elasticity of employment with respect to the property tax rate changes was -1.02 from Duranton et al. (2011). The only other comparable estimate for Ontario, utilizing aggregate data, was Smart (2012)'s estimate of -0.23. The largest estimate found in this paper is -0.65 as in table 8, two thirds of the estimate from Duranton et al. (2011). Controlling for assessment changes, the elasticity of employment with respect to the total taxes paid returns an estimate almost identical to that of Smart (2012). Taken together these results suggest that the elasticity of employment with respect to the property tax rate is likely lower than has been previously stated in previous micro data estimates like Duranton et al. (2011) and Belotti et al. (2021).

What could be driving the discrepancy between these results and the previous literature? The key mechanism that Duranton et al. (2011) claims results in employment changes for establishments as a result of property tax rate changes is the property assessment process. Establishments which expand in the UK during their sample are forced to reassess their entire property. Establishments therefore choose not to expand, in order to avoid paying higher property taxes on their preexisting properties. This results in property taxes being not fully capitalized into rental prices. In contrast if property valuations are continuously updated then any change in the property tax rate should be immediately capitalized into business rents. As a result establishments do not face an additional charge to expansion, and the measured elasticity is smaller. A core outcome of the 1998 Ontario property tax reform was the continuous updating of property assessments to reflect the market values of property. Through this lens a lower elasticity of employment should be viewed as a success. Establishments are not being discouraged from expanding due to property tax rate changes.

A second contributing factor to the lower elasticity of employment with respect to the property tax rate could be the assessment base. Both Belotti et al. (2021) and Jofre-Monseny and Solé-Ollé (2010) estimate that the impact of business property taxes in Italy and Spain on land and buildings is small, but that there are significant effects on equipment and machinery. In Ontario only the value of the building and land is included in the property tax assessment base. As a result the elasticity of employment with respect to the property tax rate should be lower than estimates from Italy and Spain. This finding should also provide a guide to policy makers to not include other forms of capital in local taxes. For example a recent ruling in province of Quebéc which made "moveable assets" taxable when attached to a building could be a cause for concern for businesses (Deschamps, 2022).

A third possible explanation could be that establishments in Ontario are more willing to relocate relative to establishments in other jurisdictions. Although the estimating strategy has mirrored that of Duranton

Table 9: Heterogeneity by Property Class (Taxes)

Dependent Variable:	Employment (ln)		
Property Class	Full sample	Commercial	Industrial
Model:	(1)	(2)	(3)
Variables			
Total Taxes Paid (ln)	-0.2277	0.0547	-0.2552*
	(0.1421)	(0.3427)	(0.1481)
Establishment Age	0.0230	-0.0237	0.0220
	(0.0300)	(0.1797)	(0.0257)
Establishment Age^2	-0.0006	0.0002	-0.0003
	(0.0010)	(0.0055)	(0.0009)
Old Location Dummy	0.2534	-0.3037	0.3188
	(0.2515)	(1.468)	(0.2240)
Headquarter Office	-0.0016	0.1765	-0.0193
	(0.0329)	(0.1068)	(0.0343)
Fixed-effects			
Year	Yes	Yes	Yes
Pair	Yes	Yes	Yes
Fit statistics			
Observations	5,390	990	4,400
R^2	0.98904	0.98203	0.99027
Within R^2	0.01196	0.01845	0.02032
Establishments	617	200	417
Pairs	2,060	410	1,650

Clustered (Establishment ID & Second Establishment ID) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Estimations of the elasticity of establishment employment with respect to the total taxes paid to the municipality for 2003 - 2011, for Commercial and Industrial property separately. Controls include the age of the establishment, age squared of the establishment, a dummy if the establishment is greater than 20 years old, and whether the establishment is the head office of the firm. Column (1) reports estimates for the full sample, column (2) reports results for Commercial establishments only, and column (3) reports results for Industrial establishments only. Standard errors are clustered by both establishments as an approximation to optimal dyadic robust standard errors.

et al. (2011) and Belotti et al. (2021), this would downward bias the results as establishments which are more sensitive to property tax rate changes move, leaving behind only less sensitive establishments who don't change their employment. This selection mechanism has not been reported to my knowledge and the existing literature has primarily focussed on establishment entry, rather than exit.

Finally the source of data could be downward biasing the results. The Scott's Database is a business directory, and it is possible that establishments are not accurately reporting their employment or changes in employment. This criticism has been made against the NETS database in the United States (Crane & Decker, 2019), a comparable product, and is a valid criticism of the Scott's Database as well. If respondents to Scott's reported their employment the same as the previous time they were surveyed, or rounded their answers, the results would be similarly downward biased towards zero.

One interesting extension of this paper relative to the previous literature is the inclusion of non industrial establishments in the estimation. Setting aside significance, the results suggest that industrial establishments are significantly more responsive to property tax rate changes than establishments in commercial property. This evidence is consistent with industrial establishments having a larger cost share of property, resulting in increased sensitivity to changes in the property tax rate. This result has significant consequences for possible property tax incentives given to establishments to encourage economic development. If industrial establishments are more sensitive to the tax rate, it suggests property tax relief should be directed to them, rather than commercial establishments which are less sensitive to the tax rate. As a concrete example, municipalities should consider giving tax breaks to an Amazon warehouse, but not an Amazon retail location or office building. Note that this is the opposite of the policy that Ontario has pursued, with a higher threshold ratio for the industrial property class than the commercial property class.

Finally these results ignore any second order competition effects between municipalities. It is possible that Mississauga, Vaughn, and Markham lowered their business property tax rates in response to Toronto being forced to decrease it's business property tax rates. A simultaneous decrease in rates would have maintained some of the property tax differential between the municipalities, making the policy of capping Toronto's property tax rate less effective at increasing business activity in Toronto, but alleviating some of the impact in Mississauga, Vaughn, and Markham. There is unfortunately no evidence that this type of tax competition occurred after Toronto was forced to decrease business property tax rates.

Conclusion

The business property tax is a significant source of revenue for municipalities, yet its impact on establishments in Canada and the United States is not well understood. This paper has utilized a tax decrease forced on the

city of Toronto by the province of Ontario, to estimate the effect of business property taxes on employment. Comparing with surrounding municipalities, I find an elasticity of employment with respect to tax rate of -0.59, although this result is imprecise. This is lower than than previous estimates for the UK and Italy, but in agreement with Smart (2012) which estimates this elasticity as -0.23. Combing with alternate specifications I argue the true elasticity is likely lower than one.

These results suggest that business property taxes can avoid distorting business activity under some conditions. Changes in buildings should not trigger reassessments of existing property, and assessments should not include other industrial capital. Efforts to update assessments to reflect the market value of property, as in the Ontario 1998 reform, can improve efficiency of property tax. Exploring the exact extent to which a updated assessment system improves property tax efficiency remains an important avenue for future research, especially in light of possible issues with assessment regressivity as documented in McMillen and Singh (2020).

A further line of work is to consider other adjustment margins for establishments in response to property tax rate changes. Establishment mobility could be an important margin of response. This paper has not considered mobility, despite its importance for policy makers and as a mechanism for inter-jurisdictional tax competition. Further consideration of the propagation mechanism behind tax rate changes affecting establishment employment, and precisely why industrial and commercial establishments exhibit different levels of response is also needed.

The original 1998 Ontario property tax reform was motivated by the provincial government attempting to remove the property tax from the political agenda of the province. Despite that, municipal funding and the property tax system remains an in Ontario issue today, and I expect will continue to be an area of active discussion in the future.

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Appendix

Toronto Property Tax Trends

Figure 4: Toronto Property Tax Trends (City of Toronto, 2023)

Toronto property tax trends from 1998 to 2015. Note the lack of increase in non-residential (business) property taxes from 1998 to 2003, and the relative decline in non-residential property taxes compared to residential property taxes.

Robustness

Alternate Classification

Table 10: Alternate Classification of Property

Dependent Variable:	Employment (ln)		
Model:	(1)	(2)	(3)
	OLS	Within	Within + Spatial
Variables			
Total Rate (ln)	-0.1321	-0.3117	-0.4522
	(0.2258)	(0.3382)	(0.3172)
Establishment Age	0.0165	0.0578	0.0411
	(0.0702)	(0.0494)	(0.0336)
Establishment Age^2	0.0006	-0.0015	-0.0011
	(0.0028)	(0.0016)	(0.0010)
Old Location Dummy	0.8486**	0.6295	0.3825
	(0.4276)	(0.3941)	(0.3034)
Headquarter Office	0.8660***	-0.0028	-0.0140
	(0.1823)	(0.0349)	(0.0298)
Fixed-effects			
Year	Yes	Yes	Yes
2 Digit NAICS	Yes	Yes	
Establishment Type	Yes	Yes	
Establishment ID		Yes	
Pair			Yes
Fit statistics			
Observations	2,092	2,092	5,905
R^2	0.12394	0.97769	0.98392
Within R^2	0.08166	0.01183	0.00977
Establishments	663	663	663
Pairs	-	-	2251

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Estimations of the elasticity of establishment employment with respect to the property tax rate for 2003 - 2011, with NAICS code 41 classified as Industrial. Controls include the age of the establishment, age squared of the establishment, a dummy if the establishment is greater than 20 years old, and whether the establishment is the head office of the firm. Column (1) reports the estimation using pooled OLS, column (2) takes the within transformation to control for establishment fixed effects, and column (3) uses the within transformation and performs spatial differencing using a 1km threshold. Standard errors are clustered at the establishment level in columns (1) and (2), and by both establishments in (3) as an approximation to optimal dyadic robust standard errors.

Distance

Table 11: Elasticity of Employment 2km Threshold

Dependent Variable:	Employment (ln)		
Model:	(1)	(2)	(3)
	OLS	Within	Within + Spatial
Variables			
Total Rate (ln)	0.1990	0.0912	0.0500
	(0.1343)	(0.1823)	(0.2011)
Establishment Age	0.0005	0.0399*	0.0407**
	(0.0478)	(0.0217)	(0.0199)
Establishment Age^2	0.0014	-0.0009	-0.0011*
	(0.0018)	(0.0007)	(0.0007)
Old Location Dummy	0.8391***	0.4793***	0.3821**
	(0.2996)	(0.1683)	(0.1540)
Headquarter Office	0.9264***	0.0317	-0.0132
	(0.1024)	(0.0231)	(0.0199)
Fixed-effects			
Year	Yes	Yes	Yes
2 Digit NAICS	Yes	Yes	
Establishment Type	Yes	Yes	
Establishment ID		Yes	
Pair			Yes
Fit statistics			
Observations	5,883	5,883	34,459
R^2	0.13675	0.97995	0.98745
Within R^2	0.10156	0.00986	0.00581
Establishments	1,708	1,708	1,708
Pairs	-	-	11998

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Estimations of the elasticity of establishment employment with respect to the property tax rate for 2003 - 2011. Controls include the age of the establishment, age squared of the establishment, a dummy if the establishment is greater than 20 years old, and whether the establishment is the head office of the firm. Column (1) reports the estimation using pooled OLS, column (2) takes the within transformation to control for establishment fixed effects, and column (3) uses the within transformation and performs spatial differencing using a 2km threshold. Standard errors are clustered at the establishment level in columns (1) and (2), and by both establishments in (3) as an approximation to optimal dyadic robust standard errors.

Table 12: Elasticity of Employment 3km Threshold

Dependent Variable:	Employment (ln)		
Model:	(1)	(2)	(3)
	OLS	Within	Within + Spatial
Variables			
Total Rate (ln)	0.1554	0.0642	-0.0187
	(0.1034)	(0.1355)	(0.1607)
Establishment Age	0.0048	0.0345**	0.0343*
	(0.0366)	(0.0137)	(0.0178)
Establishment Age^2	0.0009	-0.0008*	-0.0009
	(0.0014)	(0.0005)	(0.0006)
Old Location Dummy	0.7669***	0.3864***	0.3493**
	(0.2304)	(0.1058)	(0.1432)
Headquarter Office	0.9835***	0.0364**	-0.0119
	(0.0749)	(0.0179)	(0.0158)
Fixed-effects			
Year	Yes	Yes	Yes
2 Digit NAICS	Yes	Yes	
Establishment Type	Yes	Yes	
Establishment ID		Yes	
Pair			Yes
Fit statistics			
Observations	9,843	9,843	86,362
R^2	0.13193	0.98172	0.98579
Within R^2	0.10389	0.00742	0.00467
Establishments	2,833	2,833	2,833
Pairs	-	-	29153

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Estimations of the elasticity of establishment employment with respect to the property tax rate for 2003 - 2011. Controls include the age of the establishment, age squared of the establishment, a dummy if the establishment is greater than 20 years old, and whether the establishment is the head office of the firm. Column (1) reports the estimation using pooled OLS, column (2) takes the within transformation to control for establishment fixed effects, and column (3) uses the within transformation and performs spatial differencing using a 3km threshold. Standard errors are clustered at the establishment level in columns (1) and (2), and by both establishments in (3) as an approximation to optimal dyadic robust standard errors.

2003 - 2019

Table 13: Elasticity of Employment 2003 - 2019

Dependent Variable:	Employment (ln)		
Model:	(1)	(2)	(3)
	OLS	Within	Within + Spatial
Variables			
Total Rate (ln)	-0.1695	-0.0320	-0.4076
	(0.2362)	(0.2151)	(0.2498)
Establishment Age	0.0276	0.0548	0.0467
	(0.0649)	(0.0402)	(0.0363)
Establishment Age^2	-5.02×10^{-5}	-0.0015	-0.0013
	(0.0025)	(0.0014)	(0.0013)
Old Location Dummy	0.8487**	0.5212*	0.4394
	(0.4127)	(0.3037)	(0.2737)
Headquarter Office	1.011***	0.0467	0.0201
	(0.1925)	(0.0391)	(0.0330)
Fixed-effects			
Year	Yes	Yes	Yes
2 Digit NAICS	Yes	Yes	
Establishment Type	Yes	Yes	
Establishment ID		Yes	
Pair			Yes
Fit statistics			
Observations	2,618	2,618	7,163
R^2	0.13219	0.97716	0.98464
Within R^2	0.08756	0.00981	0.01737
Establishments	661	661	661
Pairs	-	-	2208

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Estimations of the elasticity of establishment employment with respect to the property tax rate for 2003 - 2019. Controls include the age of the establishment, age squared of the establishment, a dummy if the establishment is greater than 20 years old, and whether the establishment is the head office of the firm. Column (1) reports the estimation using pooled OLS, column (2) takes the within transformation to control for establishment fixed effects, and column (3) uses the within transformation and performs spatial differencing using a 1km threshold. Standard errors are clustered at the establishment level in columns (1) and (2), and by both establishments in (3) as an approximation to optimal dyadic robust standard errors.

Effect of Fixed Effects

Table 14: Effect of Fixed Effects

Dependent Variable:	Employment (ln)	
Model:	(1)	(2)
		Within + Spatial
Variables		
Total Rate (ln)	-0.6073*	-0.5946*
	(0.3191)	(0.3190)
Establishment Age		0.0239
		(0.0306)
Establishment Age^2		-0.0006
		(0.0010)
Old Location Dummy		0.2510
		(0.2537)
Headquarter Office		-0.0028
		(0.0341)
Fixed-effects		
Year	Yes	Yes
Pair	Yes	Yes
Fit statistics		
Observations	5,390	5,390
R^2	0.98905	0.98907
Within R^2	0.01334	0.01545
Establishments	617	617
Pairs	2,060	2,060

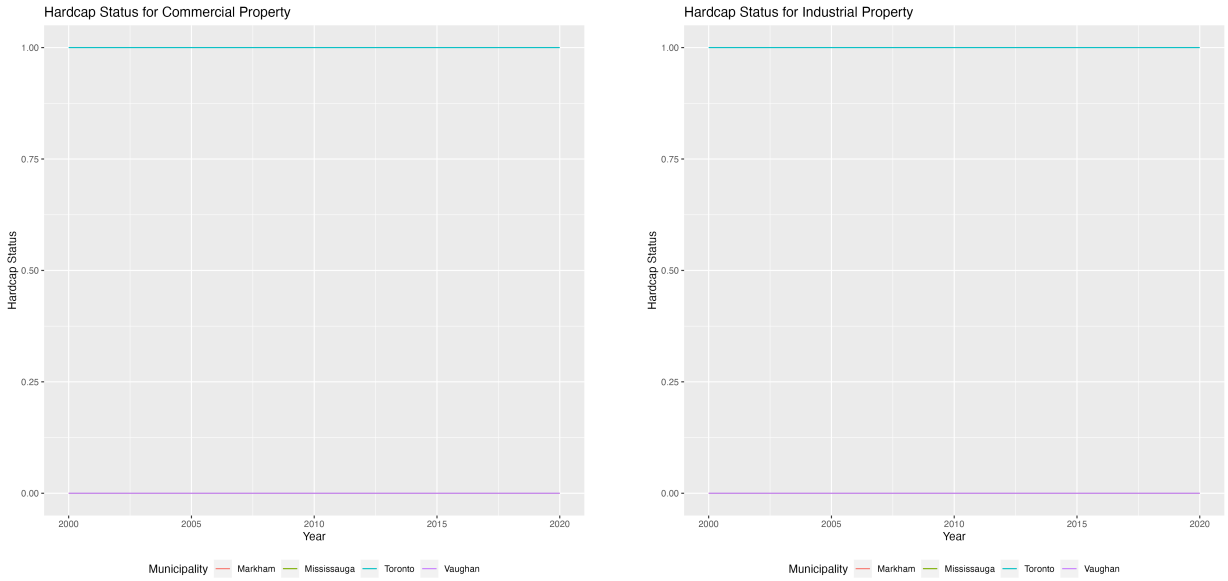
Clustered (Establishment ID & Second Establishment ID) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Estimations of the elasticity of establishment employment with respect to the property tax rate for 2003 - 2011. Controls include the age of the establishment, age squared of the establishment, a dummy if the establishment is greater than 20 years old, and whether the establishment is the head office of the firm. Columns (1) and (2) use the within transformation and performs spatial differencing using a 1km threshold. Standard errors are clustered by both establishments in as an approximation to optimal dyadic robust standard errors.

Cap Status

Matching

Merging the Scott's database to each municipality utilizes Statistics Canada's Postal Code Conversion File (PCCF). Table 15 shows the number of establishments in the Scott's database and the number of exact matches. Some postal codes are split across multiple municipalities, resulting in more exact matches than the original number of observations. The uniquely identified observations are removed, and observations with



(a) (b)

Figure 5: Cap Status for Toronto and Surrounding Municipalities

multiple possible municipalities are deduplicated using the census subdivision name and the city name listed in the Scott's database, and choosing the closest match via the Jaro–Winkler distance. After deduplicating, the data is merged, giving the total value for matched observations

Table 15: Matching results between Scott's data and the PCCF.

Match Stage	Match Rate	Number of Observations
Scotts Data	NA	611803
Exact Matches	99.8%	740454
Uniquely Identified	91.4%	559818
Multiple Possible CSDs	8.6%	51985
Matched Observations	99.8%	611043

After the Scott's database has been merged to the PCCF giving census subdivisions, each census subdivision is matched to the municipality listed in the FIR data. It is important the the largest municipalities are matched, match rates by municipality type are shown in table 17.

Table 16: Match rates between Scott's database and the FIRs. Note the low rate of municipalities matched to establishments, this is in part due to municipalities where no establishments are present, such as reserves. The figure also is not exclusive, i.e. a municipality matched in an exact match could also be matched as a fuzzy match. The match rate for establishments is much higher as establishments tend to concentrate in larger municipalities. I am able to match 99.4% of establishments to a municipality. 87.6% of municipalities have matched establishments, with Townships missing the most establishments.

Match Stage	Municipalities Match Rate	Establishment Match Rate	Total Establishment Match Rate
Exact Matches	81.8%	97.1%	97.1%
Regex Matches	4.0%	45.5%	98.4%
Fuzzy Matches	5.5%	64.7%	99.4%

Table 17

Municipality Type	Match Rate
City	0.98
County	1
Municipality	0.93
Single Tier Municipality	1
Town	0.96
Township	0.79
Village	0.93