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Fiscal Gains from Real Estate Development: The Case of Québec Municipalities

Jean-Philippe Meloche

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Institute on Municipal Finance and Governance
School of Cities
University of Toronto
55 St. George St., Suite 853
Toronto, Ontario, Canada M5S 0C9
e-mail: info.imfg@utoronto.ca
http://imfg.org

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Author

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Jean-Philippe Meloche

Abstract

This paper examines the relationship between real estate development and property taxation in Québec municipalities. Regression analysis shows a fiscal gain associated with municipal growth in Québec. For municipalities with a population of 1,000 or more that registered higher population growth or a higher increase in the number of real estate units from 2008 to 2018, property tax rates either increased by a smaller amount or declined by a larger amount compared with municipalities that had lower levels of growth or that experienced decline. Current spending per capita in these municipalities also increased by a smaller amount over this period. However, a larger share of their revenues came from fees, permits, and development charges, which may have covered part of their current spending. Ultimately, however, this growth-related fiscal gain was temporary. The analysis also shows that municipalities with larger populations had higher per-capita spending, financed by higher property values, which suggests that the property tax is well suited to pay for the costs associated with municipal growth.

Keywords: municipal finances, real estate development, property tax, growth machines, Québec.

JEL Codes: H71, R110, R30, R51

1. Introduction

Many experts consider property taxes to be the source of revenue best suited to finance infrastructure and public services provided by municipalities (Kitchen, McMillan, and Shah 2019). For this reason, and because the historical and institutional contexts favour them, property taxes are the main source of funding for municipalities in Canada (Kitchen 2013; Slack 2011). In Québec and Nova Scotia, compared with the other provinces, this source of financing accounts for the largest share of own-source revenues, representing more than 70 percent of these revenues (Meloche and Vaillancourt 2021). Although some authors have argued that this level of dependency on a single revenue source weakens the financial health of municipalities (Slack 2011), there is no empirical evidence of property tax saturation in Canadian cities (Tassonyi, Bird, and Slack 2015).

Representatives of several Québec municipalities have complained that this level of dependency on property taxes acts as a brake on the expansion of municipal services (Ferraris 2018; Ouellette-Vézina 2020). In their view, this dependency forces municipalities to increase their tax base to avoid raising tax rates.

This perspective, which presupposes that real estate development leads to fiscal gains, is not new. It evokes the theory developed in the United States by Molotch (1976), according to which municipalities act as growth machines; because municipal leaders are influenced by pro-real-estate-development interests, they will find arguments to support real estate growth at all costs. Yet studies have shown that urban growth also entails costs for local communities (Ladd 1994; Leo and Anderson 2006), and that these costs are not necessarily offset by fiscal gains from real estate development (Clapp et al. 2018; Dekel 1994; Kotchen and Schulte 2009). How, then, do Québec municipal leaders justify their claim that municipalities benefit from real estate development?

As Kushner and Ogwang (2017a, 2017b) and Ladd (1994) point out, the relationship between real estate development and municipal expenditures is not necessarily stable over time. They argue that in the short term, population growth, which translates into new building construction, can either help amortize oversized infrastructure or cause a decline in the quality of services, thereby providing a temporary fiscal gain for the municipality. Growth-related revenues, such as building permits, land transfer taxes, and development charges, can also generate temporary revenues that allow growing municipalities to ease rates on general taxes (Shu et al. 2018; Solé-Ollé and Viladecans-Marsal 2007). Infrastructure development subsidies, too, can generate a temporary fiscal gain (Paulsen 2014).

In the long term, however, population growth puts a strain on services. When growth slows down, the revenue derived from growth declines, thereby worsening the fiscal situation. Following this logic, it could be argued that Québec municipal leaders are being short-sighted when they claim to improve their fiscal situation through real estate development. This type of short-sightedness has been documented by Solé-Ollé and Viladecans-Marsal (2007) in Spain and by Shu et al. (2018) in China. Are Québec municipalities facing a similar situation?

This paper looks at the relationship between real estate development and municipal taxation in Québec. It draws on the work of Ladd (1994) in the United States and Kushner and Ogwang (2017a, 2017b) in Ontario, although these authors measured the financial situation of municipalities using per-capita or per-household spending rather than changes in taxation rates. Unfortunately, comparable data on tax rates are not available for U.S. municipalities. Ontario provides data on municipal tax rates, but these vary according to classes of property and the use of different fiscal tools. They are not directly comparable.

In Québec, the Ministry of Municipal Affairs and Housing (Ministère des Affaires municipales et de l'Habitation or MAMH) produces data on a standardized aggregate taxation rate (SATR).[1] These data make it possible to compare changes in the tax burden of municipalities and to get a better picture of the effects of growth on their financial situation. The studies by Ladd (1994) and Kushner and Ogwang (2017a) also measured municipal growth based on changes in population size, number of households, and property assessment. This paper uses change in the number of units on the property assessment roll and in population size to measure growth. These data give a better picture of the evolution of real estate development, independently of the effects of inflation on building prices and property assessment.

The financial data used here, which were produced by MAMH, cover the period from 2008 to 2018. The purpose of the estimations was to verify whether municipalities with stronger growth over this period actually saw a smaller increase or a larger decrease in their tax rates than did municipalities with weaker growth or even decline over the period. The estimations could also show whether municipalities with larger populations had lower per-capita spending and whether growth-related revenues, such as permits, land transfer taxes, and development charges (not included in the calculation of the SATR), could in part explain any growth-related fiscal gain.

The second section of this paper reviews the literature and concepts used to study the relationship between real estate development and municipal taxation. The third analyses the relationship between changes in taxation rates and municipal growth and describes the analytical model, data, and main results. The fourth examines the dissonance between the dynamic and static effects of growth and highlights the importance of growth-related revenues in the fiscal gains associated with real estate development. The conclusion considers how municipalities depend on property taxes and whether their financing tools should reward real estate development.

2. The fiscal profitability of real estate development

It is difficult to find clear evidence in the literature of a positive and systematic link between real estate development and the financial health of municipalities. The claims made by Québec municipal leaders that they have no choice but to increase their tax base to guarantee their financial health (Ferraris 2018; Ouellette-Vézina 2020) are based on two imprecise and contradictory concepts: growth machines (Molotch 1976) and "homevoters" (Fischel 2002).

It is also difficult to find evidence of economies of scale in municipal spending. Larger cities do not appear to enjoy a fiscal advantage (Found 2012; Hanes 2015; Hortas-Rico and Rios 2020; Kushner and Ogwang 2017b), a finding that raises questions about the benefits to smaller cities of growing beyond a certain size. Studies point to temporary revenues derived from development to explain the positive but temporary impact of growth on municipal finances (Shu et al. 2018; Solé-Ollé and Viladecans-Marsal 2007).

2.1 Growth vs. property value appreciation

Policies favouring real estate development in municipalities are inspired by the growth machine theory proposed by Molotch (1976). According to this theory, municipalities act as coalitions geared to real

1 The standardized aggregate taxation rate (SATR) is the sum of tax revenues divided by the standardized taxable property assessment. It includes fees and charges related to water and waste services. The assessment is standardized to correspond to the market value of the same date for all municipalities. The SATR corresponds to the theoretical tax rate if municipal tax revenues came solely from a unique rate on all taxable property assessment.

estate growth. They are influenced by pro-real-estate-development interests such as developers, owners of vacant properties, and economic development agents. These individuals sit on municipal councils or influence local elected officials, urging them to support real estate growth. The perception that urban growth is necessary prevents the consideration of alternatives to real estate development to improve the quality of local services and creates a fear of demographic or economic decline and its consequences (Dekel 1994; Leo and Anderson 2006). According to Solé-Ollé and Viladecans-Marsal (2007), the fiscal gains associated with real estate development can encourage the formation of growth machines.

However, not all municipal leaders pursue development at all costs. According to Fischel (2002), "homevoters" prefer local governments that limit urban growth. By restricting real estate development in municipalities where demand is high, this coalition seeks to control the building inventory, since scarcity results in higher rents or higher property values for homeowners (Hilber and Robert-Nicoud 2013). This is why many municipal leaders choose to slow down urban growth rather than speed it up.

Empirical studies have shown that both types of coalitions exist and can even co-exist (Been, Madar, and McDonnell 2014). Recent studies have shown more restrictive forces on real estate development in the United States relative to growth machines (Been 2018; Glaeser and Gyourko 2018). Moreover, real estate growth is not systematic and is not predicated on the presence of growth machines. Many municipalities have relatively weak demand for real estate development (Leo and Anderson 2006; Meloche et al. 2018). This context calls into question the attitude of Québec municipal leaders towards growth. Does the presence of a fiscal gain really justify the adoption of a pro-real-estate-development position?

2.2 Measuring the fiscal impact of real estate development

Various authors have examined the relationship between real estate development and municipal finances both in the United States (Clapp et al. 2018; Kotchen and Schulte 2009; Ladd 1994) and in Canada (Dekel 1994; Kushner and Ogwang 2017a, 2017b). In these countries, property taxes are the main source of revenue for municipalities.

Property taxes are based on the market value of real estate (Kitchen, McMillan, and Shah 2019). Real estate development therefore has a direct impact on the tax base, since it increases the value of the real estate inventory covered by this tax source. Nevertheless, any addition to the property base does not automatically improve municipalities' financial situation. New properties bring new activities, and these activities require municipal services. Consequently, to have a positive impact on municipal finances, real estate development must increase tax revenues by an amount greater than the spending for services required for that development.

The fiscal impact analysis methods developed in the 1970s by Burchell and Listokin (1978) can be used to determine whether a real estate project has a positive or negative long-term impact on municipal finances. This type of analysis is still relatively widespread in the United States (Burchell, Listokin, and Dolphin 1994; Kotchen and Schulte 2009). Using these methods, analysts can identify developments or zoning changes most likely to benefit municipal finances (Clapp et al. 2018).

Kotchen and Schulte (2009) produced a meta-analysis of 125 fiscal impact studies on various U.S. localities published between 1986 and 2007. According to the data they collected, residential land use commonly generated more spending than revenue for municipalities, whereas commercial, industrial, and agricultural uses usually had a positive impact on municipal taxation. Their results confirmed

those previously reported by Burchell, Listokin, and Dolphin (1994) and were corroborated, in turn, in a more recent study by Clapp et al. (2018) based on data from Florida counties. This study ran regressions on land lots that had changed use. Their results showed that the conversion of agricultural land to allow for residential development had little or no negative effect on municipal finances, but that the impact was slightly positive for commercial development (usually taxed at higher rates). Condos and multi-unit residential buildings had a less damaging impact on municipal finances than did detached houses, suggesting that density influences the fiscal profitability of real estate developments.

Fiscal impact analysis studies are rarer in Canada. We have found no reviews like those by Kotchen and Schulte (2009) or Burchell, Listokin, and Dolphin (1994). The only study found for Canada that used fiscal impact analysis is one by Dekel (1994), which examined the fiscal profitability per hectare of residential, commercial, and industrial developments in four rural Ontario municipalities. It showed that the majority of residential developments in these municipalities did not generate a fiscal benefit. The shortfall in revenue from these developments was offset by the profitability of commercial and industrial developments, although the latter developments sometimes generated a fiscal deficit. On the whole, then, one cannot conclude that real estate development automatically has a positive impact on municipal finances, according to empirical studies using fiscal impact analysis in the United States and Canada.

Other studies have focused on the relationship between population growth and municipal spending levels, regardless of the type of real estate development. These studies used regression analysis involving datasets covering a large number of municipalities rather than specific cases (unlike fiscal impact analyses). A study by Kushner and Ogwang (2017a) used a dataset covering 68 Ontario municipalities over the period from 1996 to 2006, while one by Ladd (1994) considered 248 large counties in the United States from 1978 to 1985.

The results showed that the relationship between growth and change in per-capita spending was sometimes negative, but only for municipalities with low or moderate growth rates (Ladd 1994) or for a certain type of spending, such as security services (Kushner and Ogwang 2017a). According to Ladd (1994), the relationship between the two variables was not linear. She concluded that municipalities with strong growth tended to increase their spending to support this growth, whereas municipalities experiencing moderate growth reaped fiscal benefits from the growth. Ladd determined that the threshold at which the benefits of growth faded was 7 percent over a seven-year period, or 1 percent population growth per year. Beyond this threshold, population growth worsened municipalities' financial situation.

2.3 Fiscal reversals in the long term

In the longer term, municipal growth beyond a certain point appears to worsen municipal finances. Several studies in Canada have observed that the level of spending per capita or per household was higher for municipalities with larger populations (Boulenger et al. 2018; Kushner and Ogwang 2017b) because very few municipal services are subject to economies of scale, at least over a specific threshold (Found 2012; Hortas-Rico and Rios 2020). Paulsen (2014) showed that infrastructure-intensive municipal services (such as watermains and roads) hold potential for economies of scale, but that this is not true for labour-intensive services (such as education and public safety). According to Kushner and Ogwang (2017b), economies of scale do not exist for general municipal spending in Ontario, only for specific expenditures. Larger municipalities may also provide a greater variety of services than smaller ones, which explains why they have higher spending per capita.

There are four possible explanations for the finding that real estate development improves municipal finances in the short term but contributes to their deterioration in the longer term. The first, put forward by Kushner and Ogwang (2017a), is that municipalities usually build oversized infrastructure to accommodate future development. As the population grows, the cost of infrastructure is spread over an increasing number of taxpayers, gradually reducing everyone's tax burden. As municipalities grow beyond the optimum size intended for the infrastructure, however, taxes must increase to extend the infrastructure again. Moreover, some municipalities invest excessively in infrastructure to stimulate real estate growth, and this expense affects their long-term financial health if the hoped-for growth does not follow (Kirkpatrick and Smith 2011).

The second explanation can be found in Ladd (1994), who argued that the decline in municipal spending per capita in the short term reflects a deterioration in the quality of services in growing municipalities. During the period in which municipalities organize services for new arrivals, spending per capita is lower because service levels are lower. In the long term, adjusting the level of services results in higher spending. While Ladd did not measure service quality in her study, Zolnik (2011) showed that resident satisfaction with municipal services is generally lower in municipalities that have experienced a recent phase of real estate development. This finding partly confirms Ladd's hypothesis of deteriorating service quality in the short term.

The third explanation has to do with the difficulty of taking account of indirect impacts on revenue and spending forecasts associated with real estate development projects. According to Paulsen (2014), real estate development can be considered a shock to a fiscal environment. The direct impacts of this shock are well covered by fiscal impact analysis models, but indirect impacts are usually excluded, because the price adjustment process is lengthy and complex. Take, for example, the arrival of a large shopping mall in a municipality. The mall may generate tax benefits in the short term, but it may also bring about the decline of small businesses on the main retail strip or in a pre-existing mall in the longer term. These business failures contribute to the deterioration of the tax base.

The fourth and final explanation for the dissonance between the short- and long-term effects of real estate developments on municipal finances is the presence of temporary development-related revenues. These revenues take various forms: building permits, development charges, government transfers, and land transfer taxes. In the United States, Paulsen (2014) noted that the decline in subsidies to municipalities for infrastructure funding forced municipalities to plan for the impact of growth and to invest in fiscal impact simulation models. In the short term, subsidies enable municipalities to develop their infrastructure without having to pay its entire cost. In the long term, however, the costs of maintaining and renovating the same infrastructure have to be borne in full, contributing to a deterioration in municipal finances.

The impact of building permit revenues on municipal operating expenses has been investigated by Shu et al. (2018) in China and by Solé-Ollé and Viladecans-Marsal (2007) in Spain. The former used the term "land finance" for the mechanism by which Chinese municipalities use revenues from the sale of land use rights to finance current spending. The latter used the term "revenue-machine" to describe the use of development revenues to feed growth machines. In all cases, development revenues were non-recurring and became available only when construction began on new buildings or when buyers took possession of them. If these revenues were used to finance current spending or infrastructure, they helped reduce general tax rates in the short term. As long as development continued, these revenues gave the impression of a fiscal gain. In the long term, however, these revenues dried up, which is why the financial situation of municipalities experiencing growth eventually deteriorated.

2.4 The harmful effects of property tax dependency

As noted earlier, Québec municipal leaders often consider dependency on property taxes the reason for stimulating real estate development to improve their financial situation (Ferraris 2018; Ouellette-Vézina 2020). Although real estate development increases the municipal tax base, the research cited above shows that the impact on their financial situation is not necessarily positive. Other studies have also shown that municipalities with access to sources of revenue other than property taxes, particularly those in Europe, also claim to have an incentive to stimulate real estate development to attract commercial activities or high-income households to their territory to improve their financial situation (Götze and Hartmann 2021). It would appear, then, that dependency on property taxes is not a determining factor for growth machines.

The relationship between property taxes and real estate development is also ambiguous. Although real estate development can generate fiscal gains for municipalities that finance themselves through property taxes, some research studies have shown that property taxes may also slow down real estate development (England, Zhao, and Huang 2013; Lutz 2015).

The same holds true for growth-related revenue tools such as building permits, land transfer taxes, and development charges. Although they generate a direct fiscal gain for municipalities, some researchers have argued that these tools restrict development rather than stimulating it (Glaeser and Gyourko 2018; Sancton 2021), because real estate developers tend to build where tax burdens are lowest (all else being equal), while municipalities with the highest demand for development try to derive the greatest gains from growth-related revenues.

In the most attractive municipalities, permits and development charges may be priced to maximize fiscal gains rather than stimulate real estate development. From this perspective, municipalities act as monopolies. The objective is not to encourage real estate development, but to set the pace of development to maximize its benefits. According to Glaeser and Gyourko (2018), California municipalities like San Francisco have adopted such a stance. By comparison, growth-oriented municipalities tend to derive more modest revenues from each real estate development project. Under these circumstances, one cannot conclude that the encouragement of real estate development is motivated by the pursuit of fiscal gains.

It has also been posited that property taxes contribute to the deterioration of public finances because they affect the density of real estate development. As Blöchliger et al. (2017) have pointed out, several authors have claimed that the use of property taxes contributes to urban sprawl. Others have suggested that municipal services become more expensive in fragmented, lower-density environments (Carruthers and Úlfarsson 2008; Goodman 2019; Ihlanfeldt and Willardsen 2018). These two effects together suggest that property taxes contribute to an increase in municipal service costs. However, studies of the relationship between property taxes and urban sprawl have produced mixed results (Brandt 2014).

According to Blöchliger et al. (2017), property taxes affect urban sprawl in two ways. Because the supply of land is less elastic than the supply of buildings, property taxes affect the quantity of buildings more than they do the quantity of land. Consequently, for the same level of economic activity, property taxes reduce real estate development per land lot, leading to a reduction in land-use density. This results in more spread-out urban development, as Brueckner and Kim (2003) demonstrated in their work. On the other hand, the activities conducted in buildings are generally more elastic than the supply of buildings. Therefore, if real properties are taxed, individuals can be expected to use buildings more efficiently and either fewer buildings will be needed to support the

same level of economic activity, or smaller land lots will be required, which should ultimately lower the demand for space and, in turn, reduce urban sprawl. England, Zhao, and Huang (2013) and Song and Zenou (2006) demonstrated this point in their work.

In conclusion, the arguments put forward by Québec municipal leaders are based on premises that are open to debate. Is there really a link between real estate or population growth and changes in property tax rates for Québec municipalities? If there is a fiscal gain, can it be maintained over the long term? Can this effect be validated by examining the relationship between municipality size and level of municipal per-capita spending? And what roles do property taxes and growth-related revenues play in the gains from real estate development? The remainder of this paper seeks to answer these questions.

3. The relationship between tax rates and real estate development

This paper uses municipal finance data produced by the Québec Ministry of Municipal Affairs and Housing (MAMH) to analyze the relationship between real estate and population growth and changes in tax rates for Québec municipalities with a population of 1,000 or more over the period from 2008 to 2018. This section presents the analytical model and data used, and the estimation results.

3.1 A model specific to Québec municipalities

The property tax base of Québec municipalities is measured by an estimate of the market value of properties at a specific time. These estimates are recorded in an assessment roll updated by local authorities.[2] MAMH collects the data and makes them available to all Québec municipalities. The data are standardized because the reference year of assessment rolls may differ across municipalities. The result is referred to as a municipality's standardized property assessment (SPA). The SPA is used as the measure of the municipal tax base, even if some assessed properties do not pay municipal taxes.[3]

Municipal tax revenues are largely based on property values. In 2018, taxes on property values accounted for 52 percent of all municipal revenues in Québec (Gouvernement du Québec 2020), or 56 percent, if compensation in lieu of tax for institutional buildings on the assessment roll is included. Municipalities also collect revenues that are not necessarily based on property values, most of which finance services such as water supply and wastewater treatment, as well as the collection and treatment of waste. They may be levied in the form of a user fee set in proportion to services consumed, an additional rate on the property tax, or a lump sum per unit of assessment (Meloche, Vaillancourt, and William 2020). Together, these taxes and fees account for nearly 64 percent of municipal revenues (Gouvernement du Québec 2020). Municipalities also generate other own-source revenues from the sale of goods and services (direct pricing), fees and permits, fines and penalties, and financial activities. These other sources accounted for 24 percent of municipal revenues in Québec in 2018. The remaining revenues (12 percent) came from Québec government transfers (Gouvernement du Québec 2020).

Municipal spending is therefore largely financed by taxation, and municipal taxes are based essentially on a municipality's standardized property assessment (SPA). The relationship between municipal revenues and spending can be expressed as follows:

$$Spending = Rate \times SPA + other\ revenues \quad (1)$$

2 In Québec, regional county municipalities (RCMs) or equivalent entities are responsible for keeping property assessment rolls up to date according to provincial standards.

3 Not all properties included in the estimation of the SPA are subject to property taxes. The federal and provincial governments that own these properties pay compensation to municipalities in lieu of taxes.

where the rate applied to the SPA generates the tax revenue. Tax rates vary widely from one municipality to another, depending on the presence of taxes based on considerations other than property value. Different rates also apply according to building use (residential, commercial, industrial, or agricultural) and number of dwellings on a property (fewer than six vs. six or more). This makes it difficult to compare tax rates across municipalities. The MAMH does, however, calculate a standardized aggregate tax rate (SATR) that encompasses all tax revenues, including those not based on property values, and reports it as a ratio of the taxable SPA. This rate can be used to compare tax effort across Québec municipalities.

Equation 1 indicates that municipal spending is in part a function of the standardized aggregate tax rate (SATR) and standardized property assessment (SPA). If spending is held constant, there is an inverse relationship between these two variables. That is, for the same level of spending, a higher SPA means a lower SATR. Therefore, a municipality that improves its property assessment should eventually be able to lower its tax rates.

Most municipalities improve their property assessment by stimulating real estate development on their territory. Municipal councils are not real estate developers, but they can promote or restrict real estate development by adjusting municipality's regulations or levies on real estate construction. The review of the literature showed that two mechanisms can be used to improve the SPA: (1) increasing the number of property units, or (2) increasing the value of existing property units. The former effect stems from the theory of growth machines (Molotch 1976), while the latter is associated with "homevoters" (Fischel 2002).

But real estate development does not have an impact just on the SPA. Research based on fiscal impact analysis shows that it also affects municipal spending. Accordingly, real estate development that increases spending faster than revenues drives the SATR upwards, whereas real estate development that increases spending more slowly than revenues reduces the SATR. Most Québec municipal leaders claim that real estate development improves their financial situation. This means that, in their eyes, there is an inverse relationship between real estate growth and change in SATR.

The relationship with respect to change in SATR can be expressed by the following equation:

$$\Delta SATR_i = a + b_1 \Delta Units_i + b_2 \Delta SPA/cap_i + B_3 X_{ij} + B_4 Reg_{ik} + e_i \quad (2)$$

where:

- Δ represents percentage change over the period from 2008 to 2018;
- b_1 corresponds to the measure of the marginal impact of the variable $\Delta Units_i$, that is, change in the number of assessment units (i.e., the number of properties registered on the assessment roll) in municipality *i* from 2008 to 2018;
- b_2 corresponds to the marginal impact of the variable $\Delta SPA/cap_i$ (that is, the change in the value of SPA per capita in municipality *i*) from 2008 to 2018

When the change in SPA per capita is held constant, the number of units measures the effect of real estate development, that is, the number of units added, regardless of growth in property values. It is the most direct measure of real estate growth available. According to the arguments put forward by Québec municipal leaders, one should expect the coefficient b_1 to have a negative value. When the change in number of units is held constant, an increase in SPA per capita means an increase in the value of existing properties. For a given change in spending level, an increase in property values can be expected to result in a decrease in the SATR. The estimated value of the coefficient b_2 is therefore expected to be negative as well.

The vector B_3 contains the coefficients associated with the control variables *j* included in the matrix X_{ij}. The two control elements in the analysis are volume effects and convergence effects.

- Volume effects are measured by a population variable for the baseline year 2008. This variable takes into account the fact that larger cities, with more complex governing structures, tend to have less volatile tax rates than smaller ones, which means that the corresponding coefficient, if significant, will be positive.
- Convergence effects use the SATR at the 2008 baseline year to control for regression toward the mean. In any random distribution, outliers are expected eventually to return to the mean. This regression effect has no explanatory value, but could affect the relationship between the explanatory variables and change in SATR from 2008 to 2018.[4] The convergence coefficient, too, is expected to be negative.

Vector B_4 contains the coefficients associated with regional effects *k*. Regional effects are measured by a set of dichotomous variables corresponding to two types of regions: census metropolitan areas (CMAs) and Québec administrative regions.

- The first type takes into account the effects associated with large cities and their suburbs relative to municipalities outside the metropolitan areas. Québec has six CMAs: Montréal, Québec City, Gatineau, Sherbrooke, Saguenay, and Trois-Rivières. The definition of CMAs used for all years is taken from the 2016 census.
- The second type corresponds to Québec's administrative regions, of which there are 17 (see Table A4 in the Appendix).

To ensure consistency with previous studies and to validate the results in relation to assessment units, real estate growth is measured by two separate variables.

- The first is the one shown in equation 2, that is, change in the number of assessment units (or the number of properties) on the municipal roll from 2008 to 2018.
- The second is the change in municipal population from 2008 to 2018. These two variables are used in the estimations as alternative measures of municipal growth.

3.2 MAMH data

The estimations are based on the MAMH municipal finance databases from 2008 to 2018. The number of municipalities in the database held steady at 1,087 over this period. However, to avoid unit and population growth outliers, all municipalities with a population of less than 1,000 in 2008 were omitted from the analysis, since smaller municipalities are often outliers in the percentage of population change.

A population of 1,000 is also the level set by Statistics Canada for municipalities to qualify as a rural area (outside an urban agglomeration).[5] Most municipalities below this size are rural communities. As Québec has about 400 of these municipalities, they might have had a disproportionate influence on the results of the analysis, which focuses primarily on urban development. All municipalities for which data were not available in the MAMH database or which presented as outliers were also eliminated from the analysis, representing about 90 additional municipalities, most of them small. In the end, the database covered 597 municipalities. Descriptive statistics on the data used for these municipalities are given in Table 1.

4 Municipalities with very high tax rates in 2008 would probably work harder at reducing their tax rate than municipalities with very low rates. Also, municipalities facing unusual events that resulted in higher (or lower) tax rate in 2008 will apply rates closer to the mean in 2018 as the event not longer affects them.

5 For Statistics Canada's definition of rural areas, see: https://www12.statcan.gc.ca/census-recensement/2021/ref/dict/az/Definition-eng.cfm?ID=geo042.

Table 1: Statistics for Variables Used in the Analysis				
	Mean	**Std. Dev.**	**Minimum**	**Maximum**
Population in 2008 (n)	12,049	74,892	1,003	1,659,962
Assessment units in 2008 (n)	4,728	18,320	515	367,609
SATR in 2008 (%)	1.31	0.43	0.36	3.29
SPA in 2008 ($M)	970	6,609	30	150,402
Spending in 2008 ($000)	24,290	197,205	688	4,517,275
SPA/capita in 2008 ($)	77,417	40,285	23,829	377,048
Spending/capita in 2008 ($)	1,471	738	585	7,493
Population in 2018 (n)	13,148	80,710	908	1,777,058
SATR in 2018 (%)	1.10	0.34	0.33	2.67
Spending/capita in 2018 ($)	1,843	695	331	8,807
Variation in population 2008–2018 (%)	5.7	14.6	-22.5	98.6
Var. in assess. units 2008–2018 (%)	9.4	9.5	-14.3	69.6
Var. in SATR 2008–2018 (%)	-14.4	12.5	-44.1	36.1
Var. in SPA 2008–2018 (%)	75.7	28.6	-19.3	236.2
Var. in spending 2008–2018 (%)	40.1	32.2	-67.6	172.1
Var. in SPA/capita 2008–2018 (%)	67.4	25.7	4.1	158.8
Var. in spending/capita 2008–2018 (%)	34.2	33.6	-66.4	199.3

Source: Québec Ministry of Municipal Affairs and Housing: https://www.mamh.gouv.qc.ca/finances-et-fiscalite/information-financiere/profil-financier-et-autres-publications/

The top part of Table 1 presents the raw statistics for all variables in 2008 or 2018, and the bottom part presents the percentage change for these same variables between 2008 and 2018. The population variable corresponds to the official MAMH population count on July 1. The smallest municipality in the set had a population of 1,003 in 2008, while the largest, Montréal, had a population of nearly 1.7 million. Smaller municipalities dominate the set. The mean population of the municipalities in the set was about 12,000 in 2008, with a significant standard deviation of almost 75,000. Population growth was also highly heterogeneous over the period. Mean growth was 5.7 percent, but almost 40 percent of municipalities showed population decline. The greatest rate of decline was -22.5 percent, while the municipality with the highest growth almost doubled its population (+98.6 percent) over this period.

The number of assessment units corresponds to the number of units (properties) on the municipal assessment roll. This is not a perfect measure of real estate development, because units can be merged or divided without buildings being removed or added. This is why both population and number of units are used as proxies for real estate development. Neither variable is a perfect estimate, but using them both validates the stability of the estimates for different growth measures. The number of assessment units is a less volatile variable than population.

Table 1 shows that the municipality with the fewest units had 515 properties on its assessment roll for 2008, while the largest had 367,609. The number of units also varied less over time than did the population. In a few municipalities, just 6 percent, the number of assessment units decreased from 2008 to 2018. In the worst case, 14.3 percent of units were eliminated. The maximum growth rate over this same period was 69.6 percent.

Population and number of units are closely linked variables. They show similar proportions and similar change by municipality. Analysis of these two variables showed that growth from 2008 to 2018 was particularly strong in municipalities on the periphery of the Montréal and Québec City metropolitan areas. Municipalities that experienced population decline or very low growth were mostly in the outlying regions of Québec, far from the major urban centres. Some are resource regions, others are vacation areas. Some aging suburbs in the Montréal metropolitan area were also among the slowest-growing regions.

The dependent variable in this analysis is the municipal tax rate (SATR), a measure of the value of the tax revenues collected by municipalities relative to their taxable property assessment (SPA). Depending on the composition of spending and the corresponding level of property assessment, annual rates vary considerably from one municipality to another. Table 1 shows that they ranged from 0.36 percent to 3.29 percent for 2008. Mean SATR for that year was 1.31 percent, meaning that all taxes paid on a municipality's territory in 2008 corresponded on average to 1.31 percent of the taxable SPA.

Because the taxable SPA is, by definition, the denominator of the SATR, the two measures are closely linked. Consequently, the level of a municipality's SATR is largely explained by the level of its SPA. The link also affects change in these two variables over time. Mean change in the SATR for the municipalities in the set from 2008 to 2018 was -14.4 percent, since rates are constantly adjusted downwards to compensate for the increase in property values. Despite this trend, however, rates rose in about 11 percent of municipalities from 2008 to 2018. The highest growth observed over this period was 36.1 percent.

In Table 1, the SPA variable is given in both relative and absolute terms. The relative SPA is calculated in relation to the population, yielding SPA per capita. The absolute SPA is both a measure of the size of the municipality and a measure of its wealth. In terms of size, the SPA reflects a proportion equivalent to that of the population or the number of assessment units. To get a better idea of the relative wealth of municipalities, per-capita SPA was used instead. This statistic shows that property wealth varies widely across municipalities. The highest-ranking municipality had per-capita property assessment of $377,000, more than 15 times that of the municipality that ranked last, which had only $24,000 of SPA per capita. Table 1 shows that SPA per capita is also the only variable that did not decrease for any municipality for the 2008–2018 period. Even in municipalities in which the SPA declined over this period, in all cases SPA per capita did not decline because population losses outweighed SPA losses.

The spending variable presented in Table 1 corresponds to municipalities' annual operating expenditures. As with the SPA, this variable is given in both relative and absolute terms in Table 1. The relative measure is per-capita spending. Although this variable is not identified in Equation 2, some researchers consider it to be a relative measure of the municipal tax effort (Kushner and Ogwang 2017a; Ladd 1994).[6] For the sake of consistency with their studies, it is used here as an alternative to the SATR to measure change in municipal tax burden.

As Table 1 shows, per-capita spending varied considerably across the municipalities. For 2008, mean spending was $1,471 per capita. The municipality ranked lowest in this category spent $585 per capita, while the municipality ranked highest spent $7,493 per capita that year. These differences could be explained by the fact that not all municipalities provide the same services; some municipalities provide

6 As municipal budgets need to balance, per-capita spending is equivalent to per-capita revenues. In municipalities with a high level of autonomy, which means few transfers from central governments, per-capita revenues is a fair measure of taxes, fees, and charges paid by residents.

a significant proportion of their services to businesses located in their territory, rather than to the population.

Because this analysis focused on variations from 2008 to 2018 and not on the level of spending per capita, it is not important to control the explanatory factors for cross-sectional differences in spending per capita across municipalities (the same applied to the composition of the SPA). Mean change in per-capita spending from 2008 to 2018 was 34.2 percent (the standard deviation is 33.6). In the municipality that reduced spending the most over this period, per-capita spending shrank by 66.4 percent, while the one in which spending increased the most almost tripled its per-capita spending (an increase of 199 percent). However, these cases are exceptional. Less than 3 percent of municipalities more than doubled their spending per capita from 2008 to 2018, all of them small municipalities, and barely 12 percent reduced their per-capita spending over this period.

3.3 Estimation results

The objective of this paper is to test the hypothesis that real estate development generates a fiscal gain for growing municipalities. The first step is to check for a correlation between real estate growth and change in certain fiscal variables, such as municipal spending, SPA, and SATR. Table 2 summarizes the results presented in the Appendix on the correlation coefficients and simple regression coefficients estimated using the ordinary least squares method for the two growth variables relative to various fiscal variables (Tables A1 and A2).

This table shows that the growth in number of assessment units in Québec municipalities with a population of 1,000 or more is positively correlated with a change in municipal spending and with SPA. Since the purpose of real estate development is to increase the tax base, the positive relationship between growth in number of assessment units and growth in SPA illustrates this reality. Moreover, real estate development is correlated not only with increases in the SPA, but also with increased spending. This finding illustrates the fact that real estate development not only contributes to an increase in the tax base, but also to an increase in municipal spending.

For real estate development to generate a net fiscal gain, its contribution to SPA must be greater than the effect of growth on spending. The fact that a statistically significant negative relationship emerged between growth in number of units and the tax rate (SATR) as it appears in Table 2 shows that this condition seems to have been met by Québec municipalities with a population of 1,000 or more over the 2008–2018 period. However, this result was not due to a wealth effect, since growing municipalities did not increase their relative property assessment relative to other municipalities over the period. The relation with SPA per capita was not statistically significant. On the other hand, the impact on relative spending proved negative and statistically significant, meaning that in Québec municipalities with a population of 1,000 or more that grew faster from 2008 to 2018, per-capita spending increased more slowly over the period.

Table 2: Summary of Simple Regression Results for Urban Growth Relative to Spending, SPA, SATR, Spending Per Capita, and SPA per Capita, for Québec Municipalities with a Population of 1,000 or More, 2008–2018

	Spending	SPA	SATR	Spending/ capita	SPA/capita
Growth in assessment units	(+)	(+)	(-)	(-)	(=)
Population growth	(+)	(+)	(=)	(-)	(-)

(+) positive and significant correlation. (-) negative and significant correlation. (=) no correlation.
Source: Tables A1 and A2 in the Appendix.

Using population to measure municipal growth shows similar results, except that the coefficient for the relationship between population growth and SATR is not significant (see Table 2). If population growth provided a fiscal gain, it was not directly reflected in the tax rate. Nevertheless, population growth was still significantly associated with a lower increase in municipal spending over the 2008–2018 period, although these estimations show a negative relationship between population growth and per-capita SPA growth. This result raises questions about the arguments put forward by Québec municipal leaders that real estate development makes municipalities richer. Rather, the analysis shows that population growth was associated with a smaller increase in property assessment per capita in Québec municipalities with a population of 1,000 or more between 2008 and 2018.

Given the limited explanatory power of simple correlations, we also ran equation 2 with the variables in Table 1, using ordinary least squares. The results of the multiple regressions are shown in Table A3 in the Appendix. Because the marginal impact of municipal growth on SATR is assumed to be non-linear, the square of the growth variable was added to the regressions for all the estimations.[7] Regressions also take into account regional and metropolitan area (CMA) effects. Estimated coefficients for these effects are reported separately in Tables A4 and A5 in the Appendix.

The estimated coefficients for the two types of growth variable in these multiple regressions are relatively similar. Whether growth is measured by change in number of units or by change in population, the estimated coefficients are of the order of -0.4 for SATR and 0.004 for SATR squared. These results confirm the negative correlation between growth and change in SATR over the 2008–2018 period for Québec municipalities in this set. However, the effect faded with more vigorous growth. Even so, assessment units have to grow by almost 85 percent over the period or the population has to grow by almost 100 percent for the impact of growth to raise rather than lower SATR. The optimal point is estimated at 42.6 percent growth for number of units and at 54.8 percent for population. These values are well above the mean growth shown in Table 1 for these two variables; no municipality exceeded the point at which growth could have a positive impact on SATR. What emerges from the analysis, then, is that in the municipalities with the greatest amount of growth, there was a larger decline in SATR over the period relative to the municipalities that grew the least or that shrank.

This relationship takes into account the wealth effect caused by growth in SPA. What this means is that when per-capita SPA growth is held constant, growth in the number of units or in the population leads to a decline in the SATR. In other words, it is not the increase in assessment that causes the SATR to decline, but municipal growth itself. The wealth effect is captured by the variable SPA per capita in the model. Not surprisingly, this variable presented a statistically significant negative coefficient in all regressions. Even when the marginal effect of increased property assessment was separated from that of municipal growth, both marginal effects were negative and statistically significant.

Because the 2008 population control variable coefficient is not statistically significant in the regressions, baseline municipality size had no impact on change in SATR from 2008 to 2018. The 2008 value of the SATR variable, however, has a statistically significant and negative impact, showing that municipalities tend to adjust their rates towards the mean, as expected. As for the regional variables, Tables A4 and A5 in the Appendix show that municipalities in the Montréal metropolitan area were primarily those in which rates declined by a greater amount over the period.[8] This regional effect is

7 Ladd (1994) and Kushner and Ogwang (2017a) also used a non-linear model.

8 Among the administrative regions concerned, Laval, Montréal, and Montérégie, all part of the Montréal CMA, were the areas that registered the sharpest declines.

independent of municipal growth dynamics or change in assessment. It captures territorial effects associated with variables not considered in the model.

These results differ from those obtained by Ladd (1994) for the United States and by Kushner and Ogwang (2017a) for Ontario, because the three studies do not measure the same things. Ladd (1994) did not analyze tax rates directly. What she found in her study is that population growth reduces municipal spending, but only if the growth is moderate. Otherwise, population growth contributes to increased spending. She suggested that population growth causes fiscal conditions to deteriorate. Kushner and Ogwang (2017a), who did not analyze tax rates either, found that, although population growth or property assessment growth have no impact on total spending, they contribute to lower per-capita spending on public safety. In the present study, tax rates are the dependent variable. What the analysis shows is that growth in assessment units or in population has a statistically significant and negative relation to tax rates. By this metric, municipalities in Québec do stand to derive a fiscal gain from promoting real estate development.

Even when population growth increases per-capita public spending, as suggested by Ladd (1994), or does not affect it, as suggested by Kushner and Ogwang (2017a), there is reason to believe that municipal tax burdens can still be reduced. All it takes is for real estate development to increase revenues from the property base more than it increases spending. In this context, it is not impossible for real estate development not only to increase a municipality's per-capita spending but also to reduce its relative tax burden. The results of the present analysis, then, do not necessarily refute those reported by Ladd (1994) and by Kushner and Ogwang (2017a).

4. Reconciling dynamic effects and the steady state

The results of this analysis show that Québec municipalities with a population of 1,000 or more that had stronger real estate or population growth from 2008 to 2018 were also those in which tax rates increased the least (or decreased the most) over that period. This suggests, as municipal leaders claim, that there is indeed a fiscal gain from real estate development. As long as municipalities keep growing, they can sustain their expenditures with lower tax rates. The divergent impacts of growth and size on municipal finances, however, call into question the sustainability of this gain.

Some Canadian studies have observed that per-capita spending levels are higher for municipalities with larger populations (Boulenger et al. 2018; Kushner and Ogwang 2017b). Kushner and Ogwang (2017b) noted this ambiguity among Ontario municipalities. They found a negative link between growth and spending per household, confirming a growth-related gain for municipalities, but also a positive correlation between municipal size (measured by population level) and spending per household. These results are perplexing. Municipalities seem to benefit from growing, but seem to be penalized by the result, that is, a larger population. How to square these two findings?

To examine this paradox for Québec municipalities with a population of 1,000 or more in 2008 and 2018, we used simple regressions to validate the relationship between municipal size and financial situation. The municipal financial situation was measured using per-capita spending and tax rate (SATR). Before analyzing the contribution of temporary revenues from real estate growth to Québec municipal finances, let us consider a few hypotheses taken from section 2.3.

4.1 Distinguishing size effects from growth effects

Table 3 summarizes the results of simple regressions for size of Québec municipalities with a population of 1,000 or more (measured by total population) on current spending per capita and on

SATR for 2008 and 2018 (see Table A6 in the Appendix for detailed results). The data used are taken from Table 1. The results are relatively similar for the two years. The first two columns show the correlation between municipal size and per-capita spending. The results are similar to those obtained by Kushner and Ogwang (2017b) for Ontario. The largest cities by population have significantly higher per-capita spending than the smaller municipalities in both 2008 and 2018.

Table 3: Summary of Simple Regressions Results of Municipal Size on Per-Capita Spending and SATR in 2008 and 2018 for Québec municipalities with a Population of 1,000 or More

	Per-capita spending 2008	Per-capita spending 2018	SATR 2008	SATR 2018
Total population	(+)	(+)	(=)	(=)

(+) positive and significant correlation. (=) no correlation.

Source: Table A6, Appendix.

Table 3 also shows an absence of correlation between total municipal population and SATR in 2008 and 2018, that is, the municipalities with larger populations did not necessarily have higher tax rates. But since they had to finance higher per-capita spending, it is fair to deduce that more populous municipalities also had greater property assessment (per capita), which means that they financed their spending with tax rates similar to those of smaller municipalities. In the case of tax rates, the dissonance between short- and long-term effects was less pronounced than in the case of per-capita spending. Growth affected the evolution of tax rates, but in the long term, rates levelled out across large and small municipalities. Here again, the growth effect was short-lived, but without a reversal of the situation, as suggested by estimations based on per-capita spending.

The literature review provides various explanations for the effect of municipal growth on municipal finances in the short term. According to Ladd (1994), the fiscal gain can be explained by a deterioration in the quality of services in growing municipalities. There is a time lag in the adjustment of services, so that during the growth period, the level of service temporarily falls. It is not possible to validate this hypothesis for Québec municipalities without data on service quality.

Kushner and Ogwang (2017a) assume that infrastructure oversizing may reduce costs when growth occurs. When infrastructure is planned to accommodate growth, the cost becomes heavier if growth fails to follow. However, fiscal gains disappear over the longer term. The reversal could be explained by the fact that municipalities eventually grow beyond their optimal size. However, the data available do not allow for the validation or invalidation of this hypothesis. There are no estimations available of infrastructure oversizing or of optimal municipal size.

Paulsen (2014) suggests that the negative indirect impacts associated with real estate development take longer to materialize than do the positive direct impacts. The addition of new residents is associated with the creation of new infrastructure. Although in the short term, new infrastructure requires less current spending, maintenance expenditures increase as infrastructure ages, which explains the ephemeral nature of the fiscal gain from municipal growth. While this seems a plausible hypothesis to explain the situation of Québec municipalities, the available data did not allow us to test it.

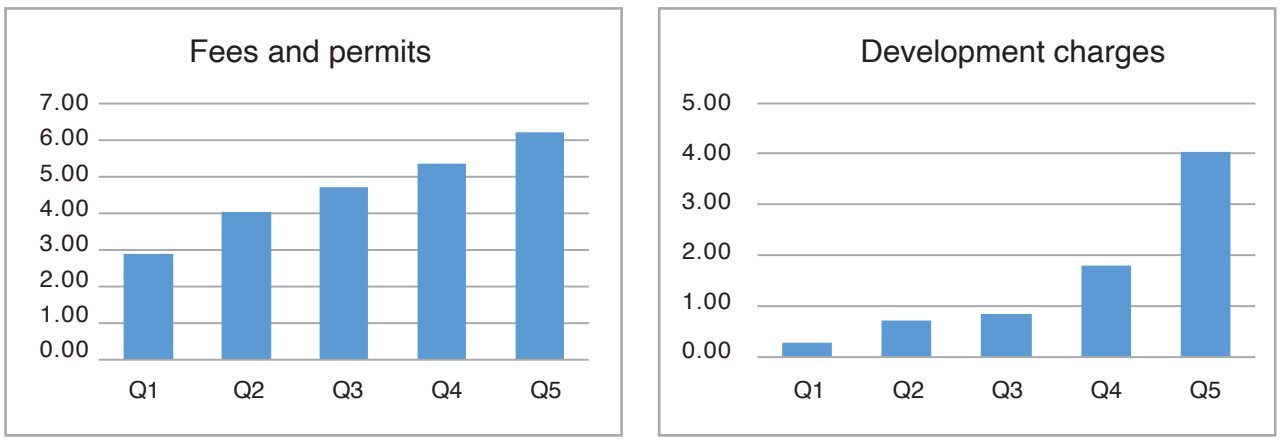
4.2 Growth-related revenues

Another argument used to justify the short-term gain from municipal growth is the gain from growth-related revenues. Some authors have shown that these gains are used not only to finance capital investments, but also to reduce the financing associated with current spending (Shu et al. 2018; Solé-Ollé and Viladecans-Marsal 2007). This finding indicates why growing municipalities have lower tax rate increases (or sharper rate reductions), but does not necessarily explain why per-capita spending levels are also lower, as suggested by Kushner and Ogwang (2017b). It is not unreasonable to assume, however, that growing municipalities use a portion of capital investment to cover what would otherwise be current spending, which would explain why the fiscal gain derived from growth-related revenues may help reduce per-capita spending.

In Québec, the revenues attributed to real estate growth include permits and fees, particularly building permits and the land transfer tax (considered a fee in Québec). Building permits are levies imposed by municipalities to cover the administrative costs associated with supervising construction. However, there is no clear standard for the cost of these permits, which vary considerably from one municipality to another (Meloche, Vaillancourt, and William 2020). Building permits represent a relatively small fraction of municipal revenues. The "licences and permits" category, into which building permits fall, made up 0.6 percent of total revenues for Québec municipalities in 2018, equivalent to 1 percent of revenues from taxation.[9]

Land transfer tax revenues are more substantial and accounted for 3 percent of municipal revenues in 2018, or about 5.5 percent of taxation revenues. However, these taxes are not exclusive to growing municipalities. Land transfer taxes are levied every time a property changes hands. Since new properties are not the only ones sold, land transfer taxes are spread across all municipalities, but are more significant in growing municipalities (see Figure 1). The "fees and permits" category, which includes building permits and land transfer taxes, accounted for 5.2 percent of municipal tax revenues for all Québec municipalities with a population of 1,000 or more over the period studied. However, these same revenues accounted for 6.2 percent of tax revenues in the quintile of municipalities with the highest population growth, while they represented less than 3 percent of tax revenues in the quintile of municipalities with the lowest population growth.

Figure 1: Share of Revenues from Fees and Permits and from Development Charges as a Percentage of Municipal Tax Revenues by Population Growth Quintile from 2008 to 2018



Note: Revenue shares are based on the average for 2013 to 2015. Municipalities are ranked by quintile according to their population growth between 2008 and 2018.

Source: Author's calculations based on MAMH (2018).

9 The percentages of municipal and taxation revenues for building permits and land transfer taxes were calculated from MAMH (2018).

Another source of revenue from real estate growth consists of development charges for real estate development. These contributions may be in cash or in kind (such as local infrastructure or parks). Because they constitute a financial contribution, they are included in municipal revenues, but represent a modest source of revenue in Québec. They accounted for around 2 percent of tax revenues in municipalities with a population of 1,000 or more, but this proportion rose to 4 percent for the quintile of municipalities with the highest population growth from 2008 to 2018, while they were almost non-existent in municipalities with lower growth (see Figure 1). Nevertheless, their impact on the fastest-growing municipalities was not negligible.

The analysis shows that growth-related revenues for municipalities in the top quintile were higher than for low-growth municipalities: about 3 percent of tax revenues for fees and permits and almost 4 percent for development charges. In other words, growing municipalities had additional revenues equivalent to almost 7 percent of their tax revenues, compared with non-growing municipalities. These revenues are supposed to cover growth-related expenditures, such as the construction of new infrastructure or urban planning services, but they might have been used to cover current spending. This would explain why the faster-growing municipalities were able to reduce their tax rates during the growth period. As these revenues are one-time levies, however, general tax rates can be expected to rise again once growth slows, which would also explain why growth effects are temporary.

5. Conclusion

This article examines the relationship between urban growth and the financial situation of Québec municipalities using MAMH financial data for Québec municipalities with a population of 1,000 or more during the period from 2008 to 2018. The analysis was designed to answer the question: in municipalities that experienced the strongest growth over this period, did tax rates increase to a greater or lesser extent compared with other municipalities? Growth is measured by population change and change in the number of units (properties) on the assessment roll. The results show that in municipalities that experienced more growth according to these two metrics, their tax rates (SATR) fell more or rose less over the period considered. It appears, then, that Québec municipalities derived a fiscal gain from real estate growth over this period.

The estimations also reveal a positive relationship between municipal size and municipal spending, showing that the gains from municipal growth were short-lived in Québec. Although growth generates fiscal gains for municipalities, a larger size leads to higher per-capita spending. Tax rates, however, seem less affected by this size effect. This finding suggests that municipal spending becomes more complex with size, but that this complexity is supported by the evolution of property values within a municipality. This result indicates that the property tax base remains appropriate for municipal spending in Québec since it grows in proportion with the needs of growing municipalities.

The study also shows that growing municipalities benefit significantly from growth-related revenues such as building permits, land transfer taxes, and development charges. As a proportion of their tax revenues, high-growth municipalities (in the top quintile) generate about 7 percent more revenue than low-growth municipalities (bottom quintile). It is difficult to know the extent to which this fiscal gain is offset by additional growth-related expenditures (such as capital investments or urban planning services) or whether it might also cover some current spending. The analysis does not show how much current spending might be absorbed by these growth revenues. This is an avenue worth exploring in future studies to explain the short-term fiscal gains associated with growth in Québec.

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Appendix

Table A1: Simple Regression and Correlation Coefficients for Change in Number of Assessment Units Relative to Change in Different Financial Variables for Québec Municipalities with a Population of 1,000 or More from 2008 to 2018

	Spending	SPA	SATR	Spending/ capita	SPA/capita
Assessment units	**0.605**	**1.667**	**-0.197**	**-0.638**	**-0.138**
Probability *(p-value)*	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**0.215**
R^2	0.029	0.306	0.020	0.030	0.001
Correlation coefficient	0.176	0.554	-0.149	-0.179	-0.051

Note: All variables refer to their percentage change from 2008 to 2018. The dependent variables differ for each column and are identified at the top. The independent variable is the same for all columns: the change in number of assessment units. Simple regressions were calculated using ordinary least squares (OLS). Probability values *(p-value)* are given in parentheses under the coefficients. Coefficients significantly different from 0 at the 95 percent confidence level are in boldface.
Number of observations: 597.

Table A2: Simple Regression and Correlation Coefficients for a Change in Population Relative to Change in Various Financial Variables for All Québec Municipalities with a Population of 1,000 or More from 2008 to 2018

	Spending	SPA	SATR	Spending/ capita	SPA/capita
Population	**0.293**	**0.944**	-0.049	**-0.846**	**-0.646**
Probability *(p-value)*	**(0.001)**	**(0.000)**	(0.165)	**(0.000)**	**(0.000)**
R^2	0.016	0.232	0.002	0.132	0.132
Correlation coefficient	0.131	0.483	-0.057	-0.365	-0.365

Note: All variables refer to their percentage change from 2008 to 2018. The dependent variables differ for each column and are identified at the top. The independent variable is the same for all columns: population growth. Simple regressions were calculated using ordinary least squares (OLS). Probability values *(p-value)* are given in parentheses under the coefficients. Coefficients significantly different from 0 at the 95 percent confidence level are in boldface.
Number of observations: 597.

Table A3: Results of Regressions to Explain Change in SATR for Québec Municipalities with Populations of 1,000 or More over the 2008–2018 Period

	(1)	(2)	(3)	(4)	(5)	(6)
Var. assess. units	**-0.4387**	**-0.4132**	**-0.4259**			
	(0.000)	**(0.000)**	**(0.000)**			
Var. assess. units sq.	**0.0048**	**0.0049**	**0.0054**			
	(0.072)	**(0.040)**	**(0.041)**			
Var. population				**-0.4038**	**-0.3828**	**-0.3972**
				(0.000)	**(0.000)**	**(0.000)**
Var. population sq.				**0.0036**	**0.0033**	**0.0039**
				(0.001)	**(0.000)**	**(0.001)**
Var. SPA/capita	**-0.1518**	**-0.1750**	**-0.1623**	**-0.2051**	**-0.2351**	**-0.2135**
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Population in 2008	-0.000004	0.000003	0.000000	-0.000005	0.000002	-0.000002
	(0.326)	(0.136)	(0.864)	(0.122)	(0.250)	(0.493)
SATR in 2008	**-9.044**	**-14.377**	**-9.496**	**-10.997**	**-15.730**	**-11.221**
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Constant	**10.926**	**26.672**	**12.736**	**15.260**	**29.940**	**16.478**
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
R^2	0.270	0.364	0.294	0.318	0.402	0.335

Note: Regressions are calculated using ordinary least squares (OLS). Confidence intervals are robust to heteroscedasticity. The dependent variable is change in SATR from 2008 to 2018. All variables with "Var." refer to its variation over this period. Estimations (2) and (5) included fixed variables for Québec administrative region effects. Estimations (3) and (6) included fixed variables for census metropolitan area (CMA) effects (see Tables A4 and A5). Probability values *(p-value)* are given in parentheses under the coefficients. Coefficients significantly different from 0 at the 95 percent confidence level are in boldface.
Number of observations: 597.

Table A4: Fixed-Effects Coefficients for Québec Administrative Regions in Table A3 regressions		
	(2)	**(5)**
02 Saguenay–Lac-Saint-Jean	-0.674	0.082
	0.769	0.973
03 Capitale-Nationale (Québec City)	**-10.594**	**-8.665**
	0.000	**0.000**
04 Mauricie	**-6.710**	**-6.533**
	0.001	**0.001**
05 Estrie	**-9.467**	**-9.630**
	0.000	**0.000**
06 Montréal	**-16.594**	**-17.495**
	0.000	**0.000**
07 Outaouais	2.105	2.463
	0.552	0.467
08 Abitibi-Témiscamingue	-4.663	-3.140
	0.100	0.231
09 Côte-Nord	1.790	0.716
	0.727	0.886
10 Nord-du-Québec	**6.928**	0.167
	0.003	0.947
11 Gaspésie–Îles-de-la-Madeleine	-3.135	-2.639
	0.064	0.105
12 Chaudière-Appalaches	**-6.344**	**-6.191**
	0.000	**0.000**
13 Laval	**-26.237**	**-24.360**
	0.000	**0.000**
14 Lanaudière	**-9.820**	**-9.333**
	0.000	**0.000**
15 Laurentides	**-8.679**	**-7.346**
	0.000	**0.000**
16 Montérégie	**-12.286**	**-11.569**
	0.000	**0.000**
17 Centre-du-Québec	**-9.881**	**-9.056**
	0.000	**0.000**

Note: The constants for estimations (2) and (5) in Table 4 correspond to Region 1 (Bas-Saint-Laurent). The coefficients shown here correspond to the difference from the constants for this region. Coefficients significantly different from 0 at the 95 percent confidence level are in boldface.

Table A5: Coefficients for Census Metropolitan Area Fixed Effects in Table A3 Regressions		
	(3)	**(6)**
Montréal	**-4.904**	**-4.009**
	0.000	**0.002**
Québec (Québec City)	**-5.030**	-2.245
	0.039	0.384
Gatineau	4.339	5.124
	0.197	0.109
Sherbrooke	0.391	1.659
	0.870	0.472
Saguenay	1.426	3.391
	0.558	0.134
Trois-Rivières	-1.912	-0.860
	0.600	0.809

Note: The constants in estimations (3) and (6) in Table 4 correspond to the non-CMA municipalities as a whole. The coefficients shown here correspond to the difference with the constants for these municipalities. Coefficients significantly different from 0 at the 95 percent confidence level are in boldface.

Table A6: Simple Regressions of Population on Per-Capita Spending and SATR for Québec Municipalities with a Population of 1,000 or More for the years 2008 and 2018				
	Per-capita spending 2008	**Per-capita spending 2018**	**SATR 2008**	**SATR 2018**
Population	**0.00114**	**0.00141**	-0.00000003	-0.00000006
	(0.009)	**(0.000)**	**(0.912)**	**(0.709)**
Constant	**1469.6**	**1825.4**	**1.307**	**1.099**
	(0.000)	**(0.000)**	(0.000)	(0.000)
Adjusted R^2	0.0097	0.0250	-0.0017	-0.0014

Note: Dependent variables are identified at the top of the columns. The independent variable is population level. Estimates are based on data for 2008 and 2018. Simple regressions are calculated using ordinary least squares (OLS). Probability values *(p-value)* are given in parentheses under the coefficients. Coefficients significantly different from 0 at the 95 percent confidence level are in boldface. Number of observations: 597.

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