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Fiscal impact of municipal annexations in Alberta, Canada: A prolific growth strategy

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Abstract
Annexation is the process where a municipality permanently expands its boundary through the acquisition of land from a neighbouring municipality. Annexing municipalities are often motivated by acquiring development and population on the newly annexed land, both of which are associated with fiscal benefits. This study examines the financial implications of municipal annexations in Alberta, where annexation rates are among the highest in Canada and pervasive across municipalities with varying growth trends, including those with declining populations and density loss. This brings the financial benefits associated with annexation into question, as well as Alberta's permissive annexation policy. In this study, we test if Alberta annexations are associated with financial benefits, and examine how fiscal outcomes vary across municipalities with differing population and density growth patterns. Using local financial, annexation, and population data from 240 municipalities, over a 10-year period; 2006-2016, we confirm that fiscal effects of annexation vary with local populations and density growth trends. However, the study results contradict theoretical expectations, suggesting that annexation in Alberta municipalities with the greatest density growth are associated with expenditure expansion and revenue contraction, while Alberta municipalities with zero or negative growth face no fiscal consequences.

Keywords: Municipal annexation; municipal finances; density tradeoff, economic development

Résumé
L'annexion est le processus par lequel une municipalité étend de façon permanente ses limites par l'acquisition de terres d'une municipalité voisine. Les municipalités annexées sont souvent motivées par l'acquisition de développement et de population sur les terres nouvellement annexées, qui sont toutes deux associées à des avantages fiscaux. Cette étude examine les implications financières des annexions municipales en Alberta, où les taux d'annexion sont parmi les plus élevés au Canada et omniprésents dans les municipalités avec des tendances de croissance variables, y compris celles avec des populations en déclin et une perte de densité. Cela remet en question les avantages financiers

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associés à l'annexion, ainsi que la politique d'annexion permissive de l'Alberta. Dans cette étude, nous testons si les annexions de l'Alberta sont associées à des avantages fiscaux varient entre les municipalités ayant des modèles de croissance de la population et de la densité différents. À cette effet, l'utilisation des données financières locales d'annexion et de population de 240 municipalités, sur une période de 10 ans, 2006-2016, confirme que les effets fiscaux de l'annexion varient avec les populations locales et les tendances de croissance de la densité. Cependant, les résultats de l'étude contredisent les attentes théoriques, suggérant que l'annexion dans les municipalités de l'Alberta avec les plus fortes croissances de la densité est associée à une augmentation des dépenses et à une contraction des revenus, tandis que les municipalités de l'Alberta avec une croissance nulle ou négative ne subissent aucune conséquence fiscale.

Mots-clés : annexion municipale Alberta; finances municipales; compromis de densité urbaine; développement économique

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Introduction

Since the 1800s, annexations have not only played a major role in defining boundaries for most major cities in North America (Meligrana 2007; Edwards 2008), they have also been critical to the political and economic development of cities (Carr and Feiock 2001). Annexation is the process where a municipality permanently expands its boundary through the acquisition of land from a neighbouring municipality or county, claiming jurisdiction over the new territory. While municipalities initiate annexations for a variety of reasons, (such as political advantage, growth management, development, and land use control) some argue that local governments primarily pursue annexation for its fiscal benefits (Cho 1969; Heim 2007).

While several studies provide empirical evidence that highlight the fiscal benefits for annexing municipalities, many of them are outdated and focus on large central cities within the United States (US) (Edwards 2008; Gonzalez and Mehay 1987; Heim 2007; MacManus and Thomas 1979). However, municipal annexations in highly developed metro areas in such cities rarely occur. Instead, they continue to be a popular vehicle of growth with suburban and nonmetro municipalities, in regions with an ample supply of land (Carr and Feiock 2001; Wang and Gorina 2018), such as western Canada (Meligrana 1998; 2007; Singh 1982). This is the case for the Province of Alberta in particular, where annexation has become a *de facto* regional planning tool and model of municipal governance (Agrawal 2018). Due to the availability of land, this is true for all types of municipalities within the province. However, our concern is that annexations occurring within this context may not yield financial benefits.

Theoretically, municipalities that annex surrounding land benefit because they capture revenue from fringe development and populations beyond their municipal boundaries. Furthermore, the new land can provide opportunities to promote development densities and land uses associated with financial benefits, in the future (Carruthers and Ulfarsson 2002; Rusk 2003; 2006; 2010). Likewise, in Alberta, many municipalities pursuing annexation prepare plans and financial impact analyses that suggest the new land from annexation will yield cost efficient dense development, taxes and charges from commercial or industrial land uses and population gains (Agrawal 2018). Population is particularly important since population changes associated with annexation can predictably alter the tax burden distribution (Edwards and Xiao 2009; Wang and Gorina 2018).

However, in cases with stagnant population growth, or in cases where development neither exists nor materializes, the annexing municipality may incur growing costs from providing services to new land that yields no or minimal revenue (Edwards 2008; Edwards and Xiao 2009). This is a concern especially in Alberta, where in many cases fiscally beneficial population growth and development patterns never appear, instead annexed lands remain either vacant or underdeveloped (Agrawal 2018; Agrawal et al 2022).

Despite the scope, persistence, and complexity of annexation in Alberta, no study, to date, estimates the fiscal impacts of annexation for local municipalities. Thus questions remain: are annexations associated with financial benefits? How do fiscal outcomes vary across municipalities with differing population and density patterns? If fiscal outcomes are negative, why does annexation remain so prolific with Alberta municipalities?

Meligrana (2007), the only researcher to investigate the relationship between annexation, population trends, and local economic growth in the Canadian context, finds that annexing non-metropolitan municipalities in British Columbia exhibit neither stronger population growth nor economic development than non-annexing municipalities. Instead, he finds that the annexing municipalities have lower population densities and contribute to rural sprawl more than non-annexing cities. Previous fiscal annexation studies also find that fiscal outcomes vary with population and population densities (Edwards and Xiao 2009; Wang and Gorina 2018) such that providing municipal services in low-density outlying developments are associated with higher costs than high-density developments within central cities (Slack 2002).

While Meligrana (2007)'s findings suggest negative fiscal outcomes, he does not test annexation effects specifically on fiscal measures. Our study will address the gap in the literature by analyzing local annexation data from 2006 to 2016 and financial data from 2007 to 2017 for 240 municipalities across the Province of Alberta. To do this, we estimate ordinary least squares (OLS) regressions to uncover how population and population density (independent variables) moderate annexation effects on expenditure and revenue (dependent variables).

The province provides an ideal laboratory to test the fiscal outcomes of annexation for three primary reasons. First, analyzing annexations within an Albertan context will contribute to fiscal annexation literature in a number of ways. Other studies, especially those in the US, find that fiscal outcomes of annexation vary with numerous regional and local policies: revenue and tax limitations, the contentiousness of annexation, and relationships between senior and local governments (Eran and Greg 2017; Skaburskis 1992; Smith and Afonso 2016; Wang and Gorina 2018). However, the analysis in Alberta allows us to compare annexation outcomes within a relatively consistent legal and or political environment. As a result, municipalities have many opportunities to annex, and their decisions are unrelated to intuitional or legal factors (Meligrana 2007).

Second, Alberta has an abundance of land from incorporated rural municipalities, e.g. counties. Therefore the majority of annexation activity involves cities, towns, and villages, annexing largely undeveloped land from rural municipalities. The abundance of rural land may have allowed annexation to become a prolific strategy in many municipality types, with various growth trends. We aim to examine if population and density growth of annexing municipalities is a contributing factor in annexation.

Third, many of the annexing municipalities in Alberta do not exhibit the development patterns most associated with fiscally beneficial annexations—like density and population growth—characteristic of large urban centres in the US (Edwards and Xiao 2009; Rusk 1998; 2003; 2006; Wang and Gorina 2018). This suggests that annexation may instead be costing municipalities. We examine in the study if this hypothesis indeed holds true.

Ultimately, uncovering the fiscal impact of municipal annexation within Alberta will help local and provincial decision-makers, as well as private landowners, make informed policy and development decisions in the future. Furthermore, much of current annexation activity occurs in regions similar to Alberta: that is, those with a high proportion of non-central and/or nonmetro municipalities, relatively low population densities, and ample land availability (Meligrana 2007; Wang and Gorina 2018). Thus, this analysis will further inform local governments around North America with similar circumstances.

Background: Annexation in Alberta

The Province of Alberta currently has 333 municipalities and the highest frequency of annexations per municipality, compared to the rest of the country (Statistics Canada [Stats Can], n.d.-f). Between 1951 and 1971, 348 municipal annexations took place in Alberta. In the next 20 years (1971 to 1991), an additional 484 annexations occurred (Meligrana 1998). More recently, from 2006 to 2016, nearly 70% of the municipalities that we investigated (168 of 240) chose to annex land; on average, annexing municipalities' land area grew by nearly 19% over this 10-year study period (Stats Can, n.d.-a,).

Notably, well over 50% of all municipal types (cities, counties, villages, and towns) annex. A relatively unencumbered annexation process likely facilitates the province's high annexation rate (Municipal Affairs 1999). In Alberta, all municipalities are free to choose annexation and can initiate the process by simply submitting a formal written notice to the responding municipality, local authorities operating in the area, and the Municipal Government Board[1] (MGB), an independent land planning and assessment board for the province. After submitting the written notice, all stakeholders (municipalities and landowners) formally negotiate the terms of the proposed annexation. If all stakeholders can come to an agreement, the proposed annexation is uncontested, and the annexing municipality can

then submit a full application to the MGB. After evaluating the application, the MGB, the Minister of Municipal Affairs, and the Lieutenant Governor officially approve, deny, or amend the annexation terms (Municipal Affairs, 1999) . While contested annexations have a much more arduous and often costly process, more than two-thirds of all provincial annexations have been uncontested (Agrawal 2018); further, the majority of contested annexations eventually materialize under amended terms since the MGB rarely outright denies annexation proposals.

When submitting their full application to the MGB, the annexing municipalities must provide reasons for annexation. Agrawal (2018) found cities that experienced high-growth in the mid-2000s initiated annexations to facilitate their rapidly increasing populations. He also found that many municipalities pursued annexation to promote beneficial land use principles, proposing to develop the new land with relatively high-density development and promote balanced land use mix. Finally, Agrawal found that land speculation also played a role for the annexing municipalities. In anticipation of a boom period or rapid growth associated with oil and gas expansion, municipalities seek annexation to take advantage of future increased demand for residential properties, commercial land uses, and possible employment expansion opportunities (Agrawal 2018; Agrawal et al 2022).

Regardless of the motivation, Alberta municipalities treat annexation as a vehicle to expand the local economic base through revenue expansion from taxes on the annexed land; or they operate on the premise that annexation does not contribute substantially to expenditure expansion (Agrawal 2018; Agrawal et al 2022). These views contradict theoretical and empirical views of annexation from the literature. Given that annexed land remains either vacant or underdeveloped for many Alberta municipalities, yielding density loss, some researchers find that annexation under these circumstances will yield increasing expenditure. As a result the objective of this study is to test both municipal and literature views on annexation.

Literature review

Theoretical perspectives on annexation

Historically, boundary expansion in central cities in the US were associated with population and economic growth critical to economies of scale and economic development (Edwards 2008). Beginning the mid-20th century however, fiscal annexation studies took place within this context of splintering large cities and creation of suburbs. Consolidationists, or metropolitan reformers, viewed annexation as a method to recapture lost revenue arising from the exodus of residents from the city centre to the periphery (Rubin 1982). Consolidationists also argue that the fiscal benefits of annexations are realized through cost-savings from service duplication and economies of scale in service provision. (Boyne 1992).

Over time, annexation has become less about central cities preventing urban fragmentation and more about suburban and non-metropolitan communities, hoping to acquire land with existing or prospective development and population growth. Within this context, theorists recognize that the fiscal implications of annexation on municipalities rely on land developers. While development in general is associated with positive change in revenue, service costs can rise in scenarios where developers shift capital costs to eager local governments, thereby causing municipal expenditure to grow. Likewise, land that remains undeveloped or developed at low densities can also be associated with rapid expenditure expansion (Burchell and Mukherji 2003; Burchell et al. 1998; Carr and Feiock 2001; Carruthers and Ulfarsson 2003; Soule 2006).

Carruthers and Ulfarsson (2002) suggest that a trade-off occurs between annexation and densification, since annexing municipalities often acquire undeveloped land, thereby decreasing overall density, effective immediately. Nevertheless, better growth management and development strategies could ultimately result instead in density increases that expand municipalities' local tax base. Annexation can also lead to density increases if the annexed land has a population density greater than its current levels (Edwards 2008).

Fiscal outcomes in annexation studies

Given the potential for diverse outcomes, many papers have explored the effect of annexation and identified favourable fiscal outcomes (Bollens 1949; Cho 1969; MacManus and Thomas 1979; Müller and Dawson 1973; Rusk 2006; Smirnova and Ingalls 2007; 2008), while others find the opposite (Gonzalez and Mehay 1987; Mehay 1981; Meligrana 2007; Smith and Afonso 2016). Most of these studies' estimate OLS regressions using fiscal, annexing, and demographic data drawn from a large sample of municipalities within the US (Edwards 2008). Significantly,

conclusions from these studies are ambiguous. Studies that are more recent however, focus on smaller urban or non-metro environments and teasing out annexation effects from other covariates; they consistently conclude that municipal financial outcomes vary significantly with population trends (Edwards and Xiao 2009; Liner and McGregor 2002; Wang and Gorina 2018).

Using OLS regression, Rusk (2006) tested the elasticity concept among central cities and new metropolitan areas. The study results indicated that "more elastic" municipalities—those that seize available unincorporated land—are associated with better bond ratings than less elastic municipalities. More recently, Smith and Alfonso (2016) evaluate annexation in North Carolina from 1990 to 2000 and find that annexation is associated with greater levels of debt and debt service costs. In the only Canadian study to date, Meligrana (2007) specifically tested Rusk's (2006) elastic cities theory on non-metropolitan areas of British Columbia. The author examined the relationship of elasticity, among several indicators, but found no support for the theory that "elastic cities," which can easily adjust their boundaries, experience enhanced economic and financial prosperity. Further, he found no statistically significant relationship between annexation and housing starts, population and job growth, or household income. His results indicate that annexation activity within non-metropolitan areas is associated with decreases in population density and that the ease of annexation may be facilitating urban sprawl, which is linked to percent change in expenditure (Slack, 2002). The findings underscore that annexation may not be associated with the revenue it once was, outside of the context of cities trying to capture fringe development.

While aforementioned studies focus on a variety of outcome variables, a large number of studies examine annexation's impact on either percent change in revenue or percent change in expenditure explicitly. Many find that annexation is associated with a positive effect on percent change in revenue and expenditure (Cho 1969; Edwards and Xiao 2009; Gonzalez and Mehay 1987; Mehay 1981; MacManus and Thomas 1979; Smirnova and Ingalls 2007; 2008). Using a sample from California, Mehay (1981) finds population growth from annexation is associated with increases in expenditure and revenue in both. One limitation of this study was that it failed to recognize that expenditures inevitably rise with population growth, irrespective of where the population growth came from within the municipality. In a follow up study, Gonzalez and Mehay (1987) extended the previous analysis to over 300 cities across 24 states in the US, examining instead how percent change in land area from annexation affected per capita expenditure, and revenue. This perspective thus accounted for fiscal effects of population within the dependent variable. This second study confirmed their previous results: annexation is associated with greater *per capita* expenditures and revenues. Noting that while expenditure expansion is typically a negative fiscal outcome, if accompanied by positive revenue change, it likely indicates economic expansion overall.

Liner (1992) further tested Mehay's (1981) and Gonzalez and Mehay's (1987) findings, but instead found that annexation was associated with reductions in per capita police and fire spending and revenue. Liner and McGregor (2002) describe a U-shaped relationship, where the fiscal impact of annexations depends on prior annexation activity. They describe contrasting phenomena, where early annexation activity increases local government efficiency up to a certain point; thereafter, distortionary monopoly behaviour overtakes this effect, leading to increases in per capita expenditures as well as revenue from taxes. This indicates that an "optimal amount" of annexation may exist, one that minimizes the growth in per capita expenditures and per capita taxes

More recently, Edwards and Xiao (2009) claim that the relationship between annexation and per capita expenditures varies with changes in population density. Their sample includes approximately 1000 American municipalities. They estimate per capita expenditures as a function of changes in land area, population density, demographic controls, revenue sources, housing tenure, income, and geographic regions. They also account for spending in neighbouring municipalities, by using a spatial lag model. They find that annexation in combination with increases in population density is associated with decreases in per capita expenditure. According to their results, a 1% increase in land area is associated with a 0.17% decrease in per capita expenditures. They also found that the annexation coefficient was negative and statistically significant across total, library, police, and fire per capita expenditures.

Wang and Gorina (2018), like Edwards and Xiao (2009), find that the fiscal effects of annexation depend on population changes. Using a sample of 1129 American cities with populations over 25,000, they estimate the impacts of land area expansion on per capita expenditures and revenues. The controls in their regression models include changes in population or population density, demographics, and regional indicators, as well as measures of fiscal capacity. They find that land growth from annexation has a strong negative effect on both revenues and expenditure per capita. However, when they replace population density for population growth, the annexation coefficient's statistical significance disappears, and the model fit improves. They assert that annexation, by itself, has no fiscal effect; rather,

municipal population density growth from land expansion or by other means primarily drives fiscal benefits. Ultimately, Wang and Gorina conclude that municipal governments no longer benefit from annexation as they once did. Their findings suggest that fiscally beneficial scenarios, as described by Rusk (2003; 2006), may no longer be available.

Still it is noteworthy that some studies that also accounted for population dynamics still found fiscal benefits for annexing municipalities (Edwards and Xiao 2009; Liner and McGregor 2002). While Meligrana (2007) does not test expenditure and percent change in revenue specifically, his study concludes that annexation by non-metro municipalities is associated with minimal changes in population or in economic development.

The changing environment surrounding annexation suggests that theoretical and empirical support for fiscal annexations may need to be updated in order to reflect the realities of annexation today, which is often the prolific acquisition of inexpensive land, irrespective of growth patterns. We address this gap in the literature by testing fiscal outcomes in such an environment.

Hypothesis statements

Based on long-standing traditional expectations that the acquisition of new land is associated with higher revenue and servicing costs (Edwards 2008; Heim 2007, 2012; Honadle, Cigler, and Costa 2004; Gonzalez and Mehay 1987; Lindsey and Palmer 1998; MacManus and Thomas 1979; Wang and Gorina 2018) *we hypothesize that annexation is associated with positive change in expenditure (H1a) and revenue (H1b).*

Next, we hypothesize that the fiscal effects of annexation vary with municipal population and population density (density) changes, which we generally refer to as growth patterns, from here onwards. More specifically, due to inefficiencies associated with population and density declines, i.e. negative growth patterns, *we hypothesize that annexation by municipalities with stagnant or declining growth will be associated with expenditure increases (H2a)* (Burchell and Mukherji 2003; Burchell et al. 1998; Carr and Feiock 2001; Carruthers and Ulfarsson 2003; Meligrana 2007; Soule 2006). Theoretical expectations for revenue changes among annexing municipalities with population loss appear to be missing from the fiscal annexation literature. However, based on findings from Wang and Gorina (2018) and Meligrana (2007), *we also hypothesize that annexation by non-growth municipalities will be associated with no change in revenue (H2b), since they are not annexing positive population growth patterns associated with revenue gains.*

Method

To tests our stated hypotheses, we estimate a series of ordinary least squares (OLS) regressions, with robust standard errors (Cho 1969; Edwards and Xiao 2009; Liner and McGregor 2002; MacManus and Thomas 1979; Mehay 1981; Meligrana 2007; Smith and Afonso 2016; Wang and Gorina 2018; Rusk 2006).

In all of our models, we test if annexations from 2006 to 2016 explain the change in municipal fiscal outcomes from 2007 to 2017. In addition to annexations, we also account for changes in population and population density growth (which we refer to as growth in general) , fiscal capacity, and local socioeconomic characteristics from 2006 to 2016. Similar to previous studies, we are unable to account for land use changes due to a lack of data. Finally, we incorporate a series of fixed indicator variables that account for municipal status and location within economic regions (ERs). We provide more detailed descriptions of all explanatory variables, including ER's below.

To discern the role of annexation in municipal finances in Alberta, we define two model specifications. In Model 1, our base model, we test hypothesis H1a and H1b—that annexation is associated with positive changes in per capita expenditure and revenue. While we focus on annexations with constant growth in Model 1, the constant growth scenario is not emblematic of all the annexing municipalities in Alberta (Agrawal 2018). Thus, in Model 2, we estimate how fiscal effects of annexation vary for municipalities with differing growth scenarios, i.e. negative, mid, and high growth scenarios and test hypothesis H2a and H2b. Each model, in turn, is described below.

Model 1

$$\Delta Finance_i = \beta 0 + \beta 1 \Delta Area_i + \beta 2 \Delta Growth_i + \beta 3 \Delta X_i + \varepsilon_i$$

$\Delta Finance_i$ refers to percent change in either per capita expenditure or property taxes. We formulate the per capita nature of the dependent variables (expenditure and property tax) in accordance with the prior literature (Edwards

and Xiao 2009; Liner 1992; Liner and McGregor 2002; Mehay 1981; Mehay and Gonzalez 1987), and measure both dependent variables as percent changes in nominal dollars.

The primary independent variable, $\Delta Area$, is the percent change in municipal land area, due to annexation activity, $\Delta Area$ is our annexation variable. The second salient independent variable, $\Delta Growth_i$ measures the percent change in either population density (density) or population. Change in density is change in population relative to changes in land area:

$$\Delta density_i = \Delta \frac{Population_i}{Area_i}$$

The final independent variable ΔX_i refers to several variables: fiscal capacity, local socioeconomic characteristics, and location and municipal type indicators. We explain all Model 1 variables in detail below.

Accounting for growth in both models is particularly important, since changes in population and density significantly influence fiscal outcomes and can occur with annexing and non-annexing municipalities. Holding growth constant allows us to differentiate annexation effects from changes in population and density.

Modelling the effects of change in area, while holding density constant, requires the new (annexed) land to have the same number of people per unit of area as the municipality had prior to annexation. Thus, a change in area with constant density illustrates the effect of annexing areas with prevailing municipal development patterns. Next, we model the effects of a change in area, holding population constant; this illustrates the effect of annexing land that has no new residents. Percent change in area where population remains constant, can also occur if population additions on the new land are offset by population decreases in the municipality overall.

Similar to Wang and Gorina (2018), we first estimate Model 1 with a density control, and then replace it with a population control. Wang and Gorina (2018) took this approach to compare annexation effects with and without population controls. While some could argue that separating area effects from population changes seems theoretically and empirically unfounded since often local government's decision to annex is to acquire the population on the new land. However, in reality, population change could be minimal: this can be the case where the annexed land remains agricultural, commercial, or vacant, which is often the case in suburban and nonmetro regions (Meligrana 2007; Wang and Gorina 2018).

Model 2

$$\Delta Finance_i = \beta 0 + \beta 1 \Delta Area_i + \beta 2 Growthdummy_i + \beta 3 \Delta Area_i * Growthdummy_i + \beta 4 \Delta X_i + \varepsilon_i$$

While $\Delta Finance_i$, $\Delta Area$, and ΔX_i and remain the same as in Model 1, the growth variable is no longer continuous. Instead, $Growthdummy_i$ represents a series of indicator variables that measure if a municipality has *negative, midrange,* or *high growth,* where growth refers to changes in either density or population. We provide further details about growth definitions below and in Table 1. Finally, the coefficient estimates for the $\Delta Area_i * Growthdummy_i$ interaction reveals percent change in area effects in non-, midrange-, or high-growth municipalities.

Due to concerns with multicollinearity, we estimate Model 2 with only one municipal growth indicator at a time. As a result, our first iteration of Model 2 (see Table 4, column 1) contains a negative density indicator and interaction term, where the interaction term shows the fiscal effect of increasing area for negative density municipalities, relative to midrange and high density municipalities, thus allowing us to test hypothesis H2a and H2b. We repeat this process with mid- and high-density indicators and area interaction terms. We provide further details about the consequences of multicollinearity below.

By including area and growth interaction effects in Model 2, we can see how fiscal annexation effects vary with growth scenarios. Thus, Model 2 will yield more insightful results with respect to the diverse municipal environment in Alberta.

Dependent variables

Per capita changes in expenditure and revenue from property taxes are among the most common dependent variables in annexation research (Cho 1969; Edwards and Xiao 2009; Gonzalez and Mehay 1987; Liner 1992: Liner and McGregor 2002). The per capita nature of the outcome variables further control for population effects on financial

outcomes. More specifically, our dependent variables measure percent change in per capita expenditure and property tax revenue between 2007 and 2017. As mentioned earlier, municipalities frequently annex to acquire land for future development. Since it takes time to develop undeveloped land, we lag fiscal effects so that it is one year after changes in area have occurred (Wang and Gorina 2018).

We chose to focus on property taxes, instead of the change in overall revenue in general for several reasons.First, Alberta municipal revenues consist of several sources that are susceptible to a number of economic, regional, and political variables beyond local municipal control (Municipal Government 2013), property taxes however, are well within municipal control and highly responsive to land use and development changes. Second, property taxes make up the largest part of local government revenues, by far (McMillan and Dahlby 2014). As a result, large variations in property taxes undoubtedly affect municipal fiscal health. Third, annexations directly affect property taxes by expanding the total taxable assessment base. Finally, annual property tax is a function of expenditures and other revenue sources, since year over year, municipalities select property tax rates that will cover the gap between expenditures and other revenue sources, the largest of which are government transfers and oil well drilling revenue (given that the Albertan economy is heavily resource-dependent).

Explanatory variables

Our primary annexation variable, change in *Area* (Table 2), measures the percent change in total land area between 2006 and 2016 (Edwards and Xiao 2009; Liner and McGregor 2002; Wang and Gorina 2018). While annexation is the *primary* method of boundary adjustment, it is not the sole method. Municipal boundaries may also be affected by amalgamation (absorption of one municipality into the other), dissolution or creation of a new municipality .To specifically attribute area changes to annexation, we eliminated all observations involved in alternative boundary adjustment tools. We describe how we identified and eliminated these observations in the data section below.

Our next explanatory variable is growth. In Model 1, growth refers to percent change in population or density from 2006 to 2016 (Edwards and Xiao 2009; Liner and McGregor 2002; Wang and Gorina 2018). Growth controls in Model 2 are binary indicator variables that account for negative, mid or high levels of density or population growth between 2006 and 2016 (see Table 1). For example, the negative density municipality equals one if the percent change in density was less than or equal to zero. Likewise, the mid range density municipality indicator equals one if percent change in density is greater than zero and less than or equal to the median change in density. Finally, the high-density municipality indicator equals one if percent change in density is greater than the median change in density. Indicators with respect to population maintain the same cut-offs.

Several groups of fixed, variable controls are common to both Model 1 and 2. First, we use three municipal type indicators—*village, town, and city*—in accordance with Statistics Canada's administrative definitions (Puderer 2009). The indicators distinguish between differences among municipality types (Liner 1990; Smith and Afonso 2016). We exclude county indicators so all-municipal type indicators should be interpreted with respect to counties. Second, we include another set of fixed indicator variables to differentiate the effects of economic regions (ER) within the province. An ER is a standard grouping of census divisions within provinces, for the purpose of regional economic analysis.We classified these ERs according to Statistics Canada's economic region boundary file (Stats Can, n.d.-e). ER boundaries are determined to maximize within-group similarities and minimize external variation in socioeconomic characteristics (Stats Can,n.d.-e). Alberta has eight such ERs. In this analysis, we exclude the Capital City economic region associated with the City of Edmonton, so all coefficients are relative to the Capital City region.

In addition to fixed municipal and regional indicators, each model controls for municipal fiscal capacity. With respect to models explaining expenditure, we include a control for local revenues, such as percentage change in total revenue from 2006 to 2016 (see Table 1). Changes in revenue represent a change in spending power for a municipality (Knaap and Juelich 1992; McMillan and Dahlby 2014). Likewise, variations in municipal property taxes are a function of expenditures and additional revenue sources (Municipal Affairs 2013a, b). As a result, we control for changes in expenditure and two major revenue sources, government transfers and oil well drilling revenue. We exclude other revenue types, such as user-fees and development charges, due to their relatively small values and little variation over the 10-year period.

To account for changes in demand for municipal services, we consider percent change in several socioeconomic characteristics, including median income and percentage of the population that is college-educated (Edwards and Xiao 2009; Holcombe and Williams 2008; Liner 1992). While previous studies also include the school-aged popu-

Table 1
Summary statistics (n=240 observations)

Variable	Description	Mean	Std. Dev.	Min	Max
Dependent Variables					
Per capita expenditure 2007–2017	% change in per capita expenditure 2007–2017	27.3160	24.0950	-46.797	132.420
Per capita property tax rev 2007–2017	% change in per capita property tax rev. 2007–2017	61.1490	48.1328	-44.542	382.531
Population Controls					
Change in density	% change in density 2006–2016	-0.7670	22.8500	-66.199	94.740
Change in population	% change in population 2006–2016	11.5060	21.7560	-27.105	112.884
Indicator: neg-density municipality	Binary variable equals 1 if municipality has negative to 0% change in density (2006–2016)	0.4750	-	0	1
Indicator: mid-density municipality	Binary variable equals 1 if municipality has greater than 0 to median % change in density (2006–2016)	0.2750	-	0	1
Indicator: high-density municipality	Binary variable equals 1 if municipality has greater than median % change in density (2006–2016)	0.2500		0	1
Indicator: neg-pop municipality	Binary variable equals 1 if municipality has negative to 0% change in population (2006–2016)	0.2670	-	0	1
Indicator: mid-pop municipality	Binary variable equals 1 if municipality has greater than 0 to median % change in population (2006-2016)	0.3630	-	0	1
Indicator: high-pop municipality	Binary variable equals 1 if municipality has greater than median % change in population (2006–2016)	0.3710	-	0	1
Area Change*Population Indicator					
Change in area*neg-dens municipality	Change in area of municipalities with negative to 0% change in density (2006–2016)	2.1660	15.9850	-8.720	183.709
Change in area*mid-dens municipality	Change in area of municipalities with greater than 0 to median % change in density (2006–2016)	5.4200	19.5670	-23.693	150.306
Change in area*high-dens municipality	Change in area of municipalities with greater than median % change in density (2006–2016)	.2837	3.7140	-23.690	36.130
Change in area*neg-pop municipality	Change in area of municipalities with negative to 0% change in population (2006–2016)	17.9720	43.8890	-8.720	286.569
Change in area*mid-pop municipality	Change in area of municipalities with greater than 0 to median % change in population (2006–2016)	0.7290	6.7200	-7.951	95.763
Change in area*high-pop municipality	Change in area of municipalities with greater than 0 to median % change in population (2006–2016)	11.4000	38.8200	-7.580	286.570
Municipal Type Indicator					
Indicator: village	--	0.2250	-	0	1
Indicator: town	---	0.4540	-	0	1
Indicator: city	---	0.0630	-	0	1
Municipal Fiscal Capacity					
Change in revenue	% change in revenue 2006–2016	47.7090	54.192	-73.184	320.683
Change in govt. transfer	% change in govt. transfer 2006–2016	137.0050	299.546	-88.782	2235.926
Change in well drilling	% change in well drilling taxes 200–2016	-0.9440	48.438	-100.000	410.051
Change in expenditure	%change in expenditure 2006–2016	74.1290	58.822	-29.092	660.011
Socioeconomic Characteristics					
Change in home	% change in home ownership rate 2006–2016	-0.0060	0.062	-0.156	0.231
Change in median	% change in median household income 2006–2016	-0.3040	0.102	-0.559	0.150
Change in college	% change in college education rate 2006–2016	4.9880	6.173	-19.017	27.919
Density in 2006	---	323.4710	286.630	0.083	1647.434
Homeownership in 2006	---	3652.9790	21801.880	70.000	280080.000
Median household income 2006	---	57477.7500	13808.280	29278.000	111673.000
College educated in 2006	---	0.4120	0.076	0.134	0.635
Economic Region Indicator					
Indicator: Athabasca Region	---	0.2250	-	0	1
Indicator: Banff Region	---	0.0460	-	0	1
Indicator: Calgary Region	---	0.0750	-	0	1
Indicator: Camrose Region	---	0.2580	-	0	1
Indicator: Lethbridge Region	---	0.1580	-	0	1
Indicator: Red Deer Region	---	0.0790	-	0	1
Indicator: Wood Buffalo Region	---	0.0380	-	0	1

lation as a measure of demand, we did not. In Alberta, the provincial government funds local schools, thus making the median age variable theoretically unnecessary in either model specification. Prior studies also found that the percentage of the population that owns their own home also affects the demand for municipal services. Theoretically, if renters perceive that they will not bear the burden of increases in property taxes, they will demand more services at a higher cost to property tax payers, who are often likely homeowners (Bergstrom and Goodman 1973; Edwards and Xiao 2009; Liner 1992). In addition to percent changes in socioeconomic characteristics, we control for socioeconomic characteristics in 2006, such as home ownership, median household income, and college education (Wang and Gorina 2018). These accommodations control for the factors that might predetermine fiscal outcomes.

Empirical Consideration

OLS regression models are associated with several empirical threats, including multicollinearity, heteroskedasticity, and omitted variable bias. Despite these potential limitations, researchers continue to rely on OLS analysis, and simply address, test, or minimize threats. We describe below our strategies to address these various threats.

Multicollinearity occurs when variables in regression models are highly correlated, causing the variance of coefficient estimates to be very sensitive to minor changes (Kennedy 2003). To test for "multicollinearity," we calculate variance inflation factors (VIF) for all model variables and remove those with VIFs greater than the common cut-off of 10 (Hair 1995). While no variables in Model 1 have a high VIF, estimating Model 2 with more than one percent change in area interaction led to severe multicollinearity. To remediate these problems, we estimate Model 2 with one area interaction term at a time; as a result, Model 2 estimates are free from multicollinearity.

Heteroskedastic residuals imply that error terms are biased, rather than random and uniform across observations. To combat any potential issues with heteroskedasticity, we run all of our models with robust (Huber-White) standard errors (Huber, 1967; White, 1982). Finally, omitted variable bias occurs when influential variables are missing from the model, falsely attributing their impact to either an included independent variable or the error term. While omitted variable bias is a possibility in this (or any) study, variables were selected using the existing body of literature as a guide, and a wide selection of variables were tested and included to minimize the risk of omitted variable bias.

Data

We retrieved municipal level annexation, growth, and socioeconomic data from Statistics Canada's Standard Geographical Classification (SGC) census subdivision files (Stats Can, n.d.a,b). A census subdivision refers to a municipality that includes counties, villages, towns, and cities (Stats Can, n.d.-c). Choosing 2006 to 2016 as the study period provided us with the most recent decennial census information, and hence the most reliable demographic data for the study. Additionally, 147 annexations occurred in Alberta within the study period, providing a sufficient number of annexations to discern contemporary fiscal effects.

As of 2016 Alberta has 333 municipalities. However, during the study period, eleven municipalities dissolved, three municipalities were created, and one amalgamation occurred. To ensure that the study sample isolates the impacts of annexation, we eliminated all municipalities that engaged in boundary adjustments other than annexation and were left with 329 municipalities.

Of the remaining 329 observations, Statistics Canada suppressed data for 87 of them over privacy and data quality concerns. Next, we excluded two additional subdivisions from the analysis due to outlier property tax and expenditure values, leaving us with 240 municipalities, 70% of which annexed during the study period with a few municipalities annexing lands in multiple occurrences.

As mentioned above, we account for all observations' municipal type within our models, by including three indicators—*village, town, and city*—allowing them to be interpreted with respect to counties. Summary statistics from Table 1, indicate that just over 22% of study municipalities are villages (54). Likewise, approximately 45 and six percent of study municipalities are towns (109) and cities (15), respectively. The remaining 27% of observations are counties (62).

All financial data (specifically fiscal outcomes and capacity) came from the Government of Alberta's Department of Municipal Affairs open data portal (Municipal Affairs n.d.-a,b,c,d). Municipal Affairs collects financial statistics annually from all census subdivisions. Because of the annual nature of this data, we use financial data from 2007 to 2017 for dependent variables and financial data from 2006 to 2016 for all fiscal constraint data. The

municipal financial data includes detailed expenditure and revenue figures, tax rates, intergovernmental transfers, and total property taxes. We identified Alberta's eight ERs from Statistics Canada's ER data (Stats Can, n.d.-e). Finally, to adjust for inflation within the study period, we converted 2006 and 2007 dollars to 2016 and 2017 dollars, respectively, using the Consumer Price Index (Bank of Canada n.d.).

Results

The analysis of the multivariate results for fiscal outcomes begins with Model 1. Table 2 contains estimates from Model 1, showing the effects of change in area due to annexations from 2006 to 2016 on percent changes in expenditure and revenue from 2007 to 2017. Table 3 contains Model 2 estimates with respect to expenditure, while Table 4 contains Model 2 estimates with respect to revenue. All models have controls for municipal type, municipal fiscal capacity, socioeconomic characteristics and economic regions (ERs). For each table, we first interpret coefficient estimates for changes in area, and growth effects, i.e. density and population growth. We refrain from interpreting the remaining control variables.

Model 1 expenditure results

In hypothesis H1a, we state that annexation will be associated with positive change in expenditure. However, estimates from column 1 Table 2 indicate that a 1% change in area from 2006 to 2016 is associated with a 0.25% reduction in per capita expenditure from 2007 to 2017. Although area change in column 2 is not statistically significant, the adjusted r-squared associated with column 1 is higher, suggesting that density explains more variation in expenditure than population, and that annexation is associated with negative percent change in per capita expenditure (Wang and Gorina 2018). Nonetheless, estimates in both columns 1 and 2 provide evidence against hypothesis H1a and are associated with expenditure declines rather than expansion. Finally, with respect to both growth variables, i.e. population and density, estimates indicate that changes in both density and population are consistently associated with a negative percent change in per capita expenditure, demonstrating that population gains reduce per capita spending burdens.

Model 1 revenue results

Model 1 results with respect to revenue support hypothesis H1b that annexation is associated with revenue gains. As with expenditure results, change in area estimates vary with model specifications, however the adjusted r-squared associated with column 4 in higher than column 3, suggesting that population explains more variation in percent change in revenue than density, and that a 1% increase in area is associated with over 7.7 % increase in per capita revenue. Growth variables in both columns 3 and 4 (Table 2) are significant and associated with per capita revenue declines.While the results, for Model 1 control for population and density growth, most municipalities within the study period experience population and density changes. Furthermore, the data indicates that on average, the annexing municipalities have far lower density and higher population growth than non-annexing municipalities. To account for varying growth trends and their potential to affect the fiscal effects of annexation, we estimate Model 2 with respect to change in expenditure and revenue.

Model 2 expenditure results

Table 3 provides Model 2 estimates annexation effects from 2006 to 2016 on percent changes in expenditure from 2007 to 2017. We begin by interpreting estimates from columns 1 through 3, which include density indicators.

Change in area estimates in the first three columns contrast Model 1 results and fail to explain variation in expenditure. However, growth indicators across all three columns suggest that increasing density is associated with expenditure declines. Column 1 estimates indicate that on average expenditure expansion among negative density municipalities is nearly 13% greater than midrange to high density municipalities. At the same time, percent change in expenditure in high density municipalities (column 3) is nearly 34% lower than municipalities with negative to midrange density growth. Our hypothesis H2a in which we presume that annexation by non-growth municipalities will be associated with expenditure expansion, requires that we interpret the interaction terms. The interaction term estimates in column 1 indicate that percent change in area within negative density municipalities has no effect on

Table 2
Model 1 results for percent change in per capita expenditure and property tax revenue: 2007 to 2017

	Base expenditure models		Base property tax revenue models	
	(1)	(2)	(3)	(4)
Area Change				
Change in area	***-.2552	4.7240	-4.3340	***7.7150
Population Change				
Change in density	***-0.657		**-0.2480	
Change in population		***-0.4650		***-0.2670
Municipal Type Indicator				
Indicator: village	20.140	*20.7700	1.9360	1.5570
Indicator: town	**20.610	**22.0700	6.7250	6.2700
Indicator: city	**30.990	**33.0400	-0.9070	0.1720
Municipal Fiscal Capacity				
Change in revenue	***0.189	***0.1970		
Change in govt. transfer			***-0.0153	***-0.0156
Change in well drilling			*0.0449	*0.0452
Change in expenditure			***0.1240	***0.1240
Socioeconomic Characteristics				
Change in home	-30.960	-41.5500	3.9870	-3.2720
Change in median	-8.512	-5.6250	**39.8100	**43.1600
Change in college	0.689	*0.7390	0.2130	0.2220
Density in 2006	0.0006890	0.0026	-0.007130	-0.003880
Homeownership in 2006	-0.0000813	-0.0000915	***0.000153	**0.000136
Median household income in 2006	**0.0007000	**0.0006820	***0.000597	***0.000631
College educated in 2006	-28.350	-28.5200	5.9380	6.3430
Economic Region Indicator				
Indicator: Athabasca Region	7.480	9.6410	-0.5080	-0.4080
Indicator: Banff Region	14.530	16.5400	-2.1110	-1.8250
Indicator: Calgary Region	-4.686	-4.4050	**-11.4200	*-10.0900
Indicator: Camrose Region	6.752	9.3290	-0.1620	0.3810
Indicator: Lethbridge Region	**16.930	**19.1900	-5.4200	-4.2980
Indicator: Red Deer Region	5.567	9.2020	0.7740	2.0930
Indicator: Wood Buffalo Region	**25.200	**25.6500	11.9800	12.1800
Constant	-3.114	-5.1580	-4.9990	-6.5440
Adj. R-sq	0.152	0.1310	0.2070	0.2190

N=240, *p<0.10, **p<0.05, ***p<0.01

expenditure, thus providing evidence against hypothesis H2a. Although these estimates do not suggest positive expenditure growth among annexing municipalities with declining growth, the interaction estimate in column 2 indicates that a 1% increase in area in municipalities with midrange density is associated with a 1.06% decline in expenditure relative to negative and high density municipalities. The interaction estimate in column 3 indicates that a 1% increase in area for high density municipalities is associated with a 0.97% increase in expenditure. Overall, results from column 1 and 3 contradict theoretical expectations (Burchell and Mukherji 2003; Burchell et al. 1998; Carr and Feiock 2001; Carruthers and Ulfarsson 2003; Soule 2006) Since, annexation among high growth municipalities exhibit expenditure expansions instead of low growth municipalities. Nonetheless, the interaction term in column 2 suggests that annexation among mid growth municipalities is associated with expenditure declines, suggesting a positive fiscal effect for annexing mid range municipalities.

Next, we replace density with population in columns 4 through 6. Similar to columns 1 through 3, we find that percent change in area is not statistically significant. Midrange to high population growth indicators are significant and reveal that population growth, like density growth, is associated with declines in expenditure. Likewise, the interaction estimate in column 4, like column 1, is insignificant. Thereby providing continued support against hypothesis H2a. The remaining interaction terms are also statistically insignificant.

As with Model 1, we find that specifications with density controls have a higher adjusted r-squared, further suggesting that change in density drives annexation effects on expenditure. Therefore we conclude that annexation has no effect on expenditure in non-growth municipalities. We do however, find that annexation is associated with expenditure declines among mid growth municipalities and positive expenditure growth in high-density municipalities.

Table 3
Model 2 results for percent change in per capita expenditure: 2007 to 2017

	Expenditure model with density controls			Expenditure model with population controls		
	(1)	(2)	(3)	(4)	(5)	(6)
Area Change						
Change in area	-44.7000	3.0060	-12.8000	-5.1310	-4.7150	8.5630
Population Indicators						
Indicator: neg-density municipality	*12.8000					
Indicator: mid-density municipality		**19.5400				
Indicator: high-density municipality			***-34.0400			
Indicator: neg-pop municipality				8.3160		
Indicator: mid-pop municipality					*15.4400	
Indicator: high-pop municipality						***-27.5000
Area Change*Population Indicators						
Change in area*neg-dens municipality	0.3630					
Change in area*mid-dens municipality		**-1.0620				
Change in area*high-dens municipality			**0.9730			
Change in area*neg-pop municipality				0.2380		
Change in area*mid-pop municipality					0.0954	
Change in area*high-pop municipality						-0.1580
Municipal Type Indicator						
Indicator: village	**29.3800	**35.1400	**29.4800	**28.6600	**33.2200	**27.2400
Indicator: town	***25.4600	***32.5800	***23.2700	***25.2600	***29.9700	**21.3100
Indicator: city	**30.1600	***35.9800	**31.8100	**29.9700	***35.6000	***33.4300
Municipal Fiscal Capacity						
Change in revenue	***0.2180	***0.2500	***0.2130	***0.2200	***0.2290	***0.1910
Socioeconomic Characteristics						
Change in home	-2.2820	16.1100	33.0800	-2.9260	10.7900	1.0170
Change in median	-11.4500	-10.6400	-21.5100	-7.1440	-18.2300	-10.6900
Change in college	*0.9370	**1.0890	0.7220	*1.0120	**1.1620	**1.0660
Density in 2006	-0.0121	-0.0110	-0.0072	-0.0062	-0.0086	0.0070
Homeownership in 2006	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0001
Median household income in 2006	**0.000891	**0.000855	**0.000946	**0.000883	*0.000834	**0.000957
College educated in 2006	-30.8500	-27.2600	-42.8000	-28.8700	-18.9400	-17.9900
Economic Region Indicator						
Indicator: Athabasca Economic Region	13.3300	14.0100	12.5800	15.8200	*17.1100	*16.5100
Indicator: Banff Region	18.0100	13.9900	13.3300	19.6800	16.1300	15.2900
Indicator: Calgary Region	-5.2040	-11.0400	-4.4920	-6.5240	-4.6420	0.2080
Indicator: Camrose Region	10.4600	12.3000	10.0100	13.4800	*14.9300	12.7700
Indicator: Lethbridge Region	**23.5900	**21.7500	**21.4400	***25.4100	**22.7100	***26.2500
Indicator: Red Deer Region	28.3100	29.2400	26.0000	28.9600	27.6900	*30.0100
Indicator: Wood Buffalo Region	**26.0100	**29.3800	***32.6700	**27.7300	***32.9500	***36.0200
Constant	-29.2500	-36.7800	-14.0800	-29.6400	-41.9200	-29.2500
adj. R-sq	0.1430	0.1660	0.2100	0.1380	0.1540	0.2040

N=240, *p<0.10, **p<0.05, ***p<0.01

Model 2 revenue results

Table 4 includes Model 2 estimates for change in revenue. Columns 1 and 3 indicate that change in area is insignificant while the negative and high-density growth indicators are significant. Column 2 estimates however, indicate an opposite result, where change in area is associated with positive percent change in revenue, yet the midrange density indicator is insignificant.

According to hypothesis H2b, annexation among non growth municipalities will yield no change in revenue. The interaction term in column 1, is insignificant and supports H2b. However, in column 3, change in area within high-density municipalities is significant, as a 1% change in area is associated with nearly a 0.8% decrease in revenue, suggesting that annexation in high growth municipalities are associated with revenue contraction.

Among the models with population growth indicators, estimates in columns 4 and 5 indicate that a 1% change in area is associated with over 7% increase in revenue. . This result is similar to that found in Model 1 (Table 2, column 4). However, change in area becomes insignificant in column 6, when we account for high-population growth. With respect to the population indicators, only indicators for negative and high-growth municipalities are significant (columns 4 and 6). Finally, the insignificant interaction variable in column 4 provides continued support for H2b, however the insignificant interaction terms in columns 5 and 6 also suggest that annexation effects do not change with population growth.

Table 4
Model 2 results for percent change in per capita property tax revenue: 2007 to 2017

Area Change	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Change in area	-21.3200	**6.594	3.2300	**7.1170	***7.3860	-0.4200
Population Indicators						
Indicator: neg-density municipality	*6.5820					
Indicator: mid-density municipality		2.0610				
Indicator: high-density municipality			**-8.8170			
Indicator: neg-pop municipality				**9.1340		
Indicator: mid-pop municipality					3.7910	
Indicator: high-pop municipality						***-12.5600
Area Change*Population Indicators						
Change in area*neg-dens municipality	0.2430					
Change in area*mid-dens municipality		-0.1390				
Change in area*high-dens municipality			**-0.7900			
Change in area*neg-pop municipality				-0.0506		
Change in area*mid-pop municipality					-0.0773	
Change in area*high-pop municipality						0.0966
Municipal Type Indicator						
Indicator: village	2.0300	3.7400	2.7310	1.2130	4.2510	2.8040
Indicator: town	7.3860	*9.0870	7.2340	5.9060	*9.6430	7.5290
Indicator: city	-1.7030	-1.0260	1.0810	-2.8260	-0.7870	-0.0708
Municipal Fiscal Capacity						
Change in govt. transfer	***-0.0154	***-0.0180	***-0.0158	***-0.0159	***-0.0190	**-0.0157
Change in well drilling	*0.0441	*0.0483	**0.0455	*0.0434	*0.0486	**0.0459
Change in expenditure	***0.1300	***0.1440	***0.1360	***0.1310	***0.1470	***0.1230
Socioeconomic Characteristics						
Change in home	1.8850	7.1550	5.0150	1.6380	6.3660	4.1360
Change in median	**38.8800	**38.9400	**39.7400	**38.3200	**38.4200	*35.7800
Change in college	0.1840	0.2280	0.1750	0.1580	0.2120	0.1770
Density in 2006	-0.0112	-0.0107	-0.0095	-0.0077	-0.0109	-0.0059
Homeownership in 2006	***0.000188	***0.000178	**0.000152	***0.000168	***0.000182	***0.000170
Median household income in 2006	***0.000553	***0.000519	***0.000555	***0.000514	***0.000512	***0.000519
College educated in 2006	2.2630	4.9770	3.1740	4.6510	6.0560	8.8270
Economic Region Indicator						
Indicator: Athabasca Economic Region	0.3730	1.1350	-0.3800	0.1570	0.8930	-0.1360
Indicator: Banff Region	-0.7020	-0.9010	-2.6610	-0.7700	-1.3900	-3.4990
Indicator: Calgary Region	**-12.5600	**-13.9300	**-12.4100	**-13.0500	***-14.3200	**-12.9700
Indicator: Camrose Region	-0.0048	1.6880	-0.9690	-0.2850	1.7100	-0.6270
Indicator: Lethbridge Region	-4.7190	-5.0930	-5.9470	-4.7990	-5.7050	-6.0990
Indicator: Red Deer Region	3.1120	2.9330	0.9740	1.6480	2.7430	1.6590
Indicator: Wood Buffalo Region	11.1500	11.9200	11.8200	10.9400	12.1600	13.8000
Constant	-5.2400	-5.2800	-0.3860	-4.1270	-6.2580	-0.5590
adj. R-sq	0.2020	0.1820	0.2220	0.2020	0.1850	0.2250

N=240, *p<0.10, **p<0.05, ***p<0.01

Unlike revenue results for Model 1 (Table 2, columns 3 and 4) the adjusted r-squares associated with population controls are only slightly higher than models with density controls. Nevertheless, both models with high-growth indicators, columns 3 and 6, have the highest adjusted r-square respectively. They suggest that growth trends rather than annexation drive revenue outcomes and annexation among high density municipalities are associated with revenue declines.

Conclusion

At the outset, the study's primary research objective was to assess the fiscal implications of annexation for Alberta municipalities. The study results overall suggest that annexation within Alberta is associated with fiscal benefits, providing insight on why it remains to be a prolific governance model used by municipalities, irrespective of growth trends. This stands in contrast with recent empirical literature suggesting annexation as a fiscally non-beneficial exercise within the context of smaller size and non-central cities (Edwards 2011; Smith and Afonso 2016; Wang and Gonina 2018). The literature also embraces theoretical views that density loss due to annexation accompanied by stagnant population growth may be associated with expenditure expansion (Burchell and Mukherji 2003; Burchell et al. 1998; Carr and Feiock 2001; Carruthers and Ulfarsson 2003). In contrast, our results indicate that annexation completed by Alberta municipalities is on average fiscally beneficial, since annexation is positive and significant with respect to local revenue expansion, and negative and significant with respect to expenditure expansion.

Furthermore, study results support our expectation that annexation among non-growth cities has no effect on local revenue due to lack of development and population growth, but they do not support our expectation that

annexation activity will yield positive expenditure growth. We based our expectation of expenditure expansion on the declining or stagnant population growth trends that appear in our data, and the belief that new land will be associated with providing services to unserved underdeveloped areas. However, area expansion in municipalities with stagnant or negative population or density growth is statistically insignificant. Hence, the result, contradicting the existing literature, suggests that while undeveloped annexed land yields little, it also costs little. This finding also provides insight into why annexation remains a prevalent tool, even with municipalities that may not have the means or opportunity to develop the land.

Our study results for high-growth municipalities indicate that annexation is associated with positive expenditure expansion, contradicting Edwards and Xiao's (2009) findings that annexing cities with higher population densities have negative spending growth. In contrast, annexation in midrange density municipalities is associated with statistically significant declines in expenditure expansion. Overall, annexation effects on revenue do not appear to vary with municipal growth trends. Instead, our results suggest that population growth drives changes in revenue rather than land expansion from annexation. Based on these results, we conclude that high-growth municipalities are associated with negative fiscal outcomes. Some potential rationale for this may be that not enough time has passed between annexation and the realization of fiscal gains. High-growth municipalities in Alberta frequently use annexation as a means of acquiring land for future development (Agrawal 2018; Agrawal et al 2022). As a result, perhaps economic efficiencies from population growth have not yet materialized within this study's 10-year period. Future studies could incorporate longer lag periods, or analyze how fiscal outcomes vary over time.

Another contributing factor may be that high-growth municipalities often annex in order to facilitate additional residential development, which is typically associated with greater expenditure expansion relative to percent change in revenue (Agrawal 2018; Agrawal et al 2022). Nevertheless, without doing further study with land use data, we cannot say this with certainty. Additionally future studies would benefit from a variable that captures population dynamics on the newly annexed areas, since this study's fiscal outcomes could be attributed to economic activity and growth patterns irrespective of dynamics on the annexed land.

The results demonstrate that municipalities are rational. Non-growth municipalities experience little to no cost, while mid growth municipalities benefit financially from annexation. Our results, however, do suggest that annexation coinciding with population growth is associated with negative fiscal outcomes. Under these circumstances, it is possible that annexation is likely a tool for accommodating future growth (Agrawal 2018; Agrawal et al 2022). Future studies can further analyze if fiscal benefits materialize later for such municipalities.

As it currently stands, most annexed lands within Alberta appear to be undeveloped and the prospect of future growth is unknown for municipalities already experiencing population and density loss. Thus the question is, will annexation eventually foster rural sprawl in the form of fringe development in these non-growth municipalities? While the current permissible annexation environment does not appear to be associated with negative fiscal consequences, it does undermine planning goals towards sustainable development (Meligrana 2007). Thus, prevailing policy for annexation could be adapted such that it is less permissible for non-growth municipalities, where annexation neither helps nor hurts. Regardless, the results suggest that Alberta's annexation process, commonly initiated by municipalities but with limited provincial oversight, makes sense—at least from a fiscal standpoint.

The province has mandated the creation of growth management boards in Edmonton and Calgary. The Edmonton Metropolitan Region Board has been functioning since 2008 while the Calgary Metropolitan Region Board was created in 2018. Also, as of 2017, the Province requires municipalities outside of growth management boards to complete an Intermunicipal Collaboration Framework, intended to facilitate cooperation between neighbouring municipalities in order to ensure efficient delivery of municipal services to residents. In future, researchers could also focus on how these regional planning efforts, and the changing fiscal climate of the province affect the frequency, size, reasons and fiscal outcomes of annexations.

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