Public spending and strategic interactions among Canadian provinces.*

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Abstract

This paper addresses the issue of fiscal mimicking among Canadian provinces. We confirm the existence of horizontal interactions for most of categories of public expenditures (regional and economic develoment being the exception) focused in this paper. What is interesting is the good fitness of the model for education and health spending where yardstick competition seem to arise whatever the yardstick (or weighting scheme). What we have shown is that provincial governments adjust their decisions to their neighbors but also to those of other governments with which they tend to compare themselves because they share economic and political characteristics.

JEL Classification: D72, H2, H7

Keywords: Spending interactions, Canada, politics, local government, dynamic panel data.

1 Introduction

The fiscal federalism literature has grown rapidly these last ten years by improving our understanding of important issues regarding interactions between different governments. In particular, the literature has focused on externalities inherent to any decentralized governmental structures. Externalities arise whenever the existence of multi-tiered structure of government is considered, and jurisdictions choose some tax or regulation policy independently. In this case, indeed, the expenditure or tax setting decisions of a given jurisdiction may have positive or negative consequences on

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the fiscal choices of other governments. These externalities are called "horizontal" when interactions occur at the same government level or "vertical" if they are related to two different tiers. Most of the theoretical papers deal with "horizontal externalities" which are mainly due to both mobility and information asymmetries between voters and their representatives in a world where policymakers adopt non-cooperative behavior. However, local governments are also concerned about how their expenditures compare with those of their neighbors. The reasons for this behavior are broadly the same as for tax rates.

Externalities also arise whenever information asymmetries between voters and politicians exist. In such a setting, an action chosen by a politician in one jurisdiction affects the decision of imperfectly informed voters in other jurisdictions. If voters use the quantity of public goods provided by other governments as a benchmark, increasing spending in one jurisdiction may induce neighboring politicians to do the same in order not to be signaled as bad incumbents. This informational externality may yield fiscal mimicking behavior. As far as economic efficiency is concerned, yardstick competition has beneficial effects either by encouraging revenue-maximizing Leviathans to tilt tax rates toward their efficient level, or by signaling voters the quality of their representatives.

The purpose of this paper is to test the existence of strategic interactions related to public expenditures among the 10 Canadian provinces, using a dynamic panel dataset covering the period 1989-2007. We will highlight what kind of decentralized public spending (health, education, regional development) is more prone to mimic behavior.

The paper is structured as follows. Section 2 briefly reviews the main empirical studies using Canadian data, emphasizing that most of them are based on cross-sectional data sets and only account for tax interactions. Section 3 presents the empirical test based on a dynamic panel data set of Canadian provinces for the period 1989-2007. The empirical framework and the econometric procedure are detailed in section 4. Results are presented in section 5. Finally, section 6 concludes.

2 Literature

The starting point of mimicking behavior is derived from theoretical papers dealing with “horizontal externalities” where policymakers try to compete other (neighbooring) representatives to keep taxpayers (voters) or firms in their own jurisdictions. At the core of this economic theory, the mobility of taxpayers and information asymmetries between voters and their representatives are likely to imply yardstick competition between jurisdictions. Even if the focus of the literature is mainly on tax setting, we argue that a policiy action chosen by a jurisdiction affects the budget constraint of another jurisdiction, through a policy-driven flow of resources between jurisdictions, leading to strategic interactions in local fiscal choices. These fiscal games typically usually give rise to inefficient taxation. In the case of horizontal tax competition, taxes are inefficiently low as each

policymaker neglects the benefit of an expanded tax base that other policymakers enjoy when it raises its tax rate (see for instance Wilson, 1999, for a survey) and drive tax base out. Externalities also arise whenever information asymmetries between voters and politicians exist. In such a setting, an action chosen by a politician in one jurisdiction affects the informational set of imperfectly informed voters in other jurisdictions. If voters use the performance of other governments as a benchmark, decreasing taxation in one jurisdiction may induce neighboring politicians to do the same in order not to be signaled as bad incumbents. This informational externality may therefore yield fiscal mimicking forms of behavior. As far as economic efficiency is concerned, yardstick competition has beneficial effects either in encouraging revenue-maximizing Leviathans to tilt tax rates toward their efficient level, or in signaling to voters the quality of their representatives (Salmon, 1987; Besley and Case, 1995a,b).

Most of the empirical literature estimate reaction functions for taxes. However, decentralized governments are also concerned about how their expenditures compare with those of their neighbors. The reasons behind this behavior are broadly the same as for tax rates. One reason may be the fear of driving away tax payers or attracting recipients from other states, if their social benefits are too generous. Another reason concerns "yardstick competition" and, more generally, the existence of spending spill over effects on neighboring jurisdictions.

The empirical literature relies on two principal types of strategic-interaction models (Brueckner 2003). The first type can be referred to as the spillover (or externalities) model. In this framework, each jurisdiction i chooses the level of a decision variable X_i, but the jurisdiction is also directly affected by the X's chosen elsewhere, indicating the presence of spillovers. Thus, jurisdiction i's objective function is written $V(X_i, X_{-i}; Z_i)$ where X_{-i} is the vector of xs for other jurisdictions and Z_i is a vector of economic, social and political characteristics of i, which help determine preferences. Jurisdiction i chooses X_i to maximize V, setting $\partial V/\partial X_i \equiv V x_i = 0$. Because the derivative depends on X_{-i} and Z_i, the X_i solution depends on choices elsewhere and on jurisdiction i's characteristics. The solution can thus be written $X_i = R(z_{-i}; X_i)$ where R represents a reaction function which gives jurisdiction i's best response to the choices of other jurisdictions. For instance in transport infrastructures matters, a negative slope for R means that the decision of the jurisdiction i to not invest in roads is the best response to the j's decision to invest. In such a way i will benefit from other local governments some positive spillovers.

There are a few papers, that focus explicitly on public expenditure side. Exceptions are papers written by Case, Rosen and Hines (1993), Figlio, Kolpin and Reid (1999), Baicker (2001) and Redoano (2003, 2007). Most of these papers are based on US datasets. For instance, Case, Hines and Rosen (1993) estimate the effect of one state's spending on that of its neighbors using a spatial lag model. The authors find that states' per capita expenditures are positively and significantly correlated with their neighbors' spending. These results are confirmed by Figlio, Kolpin and Reid

(1999), who check the existence of spillovers in welfare spending. Baicker (2001) also finds that each dollar of state spending causes spending in neighboring states to increase by 37 to 88 cents. Finally, Redoano (2003) estimates reaction functions for taxes, public expenditures, both aggregated and disaggregated, using a dataset including EU countries for the period 1985-95. She finds that governments behave strategically with respect to those expenditures that are more directly comparable, such as expenditures in education: An increase by 1 dollar spent in education by the neighbors increases the same expenditure in a country by over 40 cents.

In the case of Canada, no empirical study has attempted to measure the existence of strategic fiscal interactions between decentralized governments. The only result in terms of strategic interactions concerns the Canadian business income tax. Hayashi and Boadway (2001) established that provincial tax rates respond negatively to the federal tax rate (vertical interactions), while at least some provinces increase their tax rates to response to increases in the tax rates of other provinces (horizontal interactions).

3 Public Expenditures Patterns in Canada

Figure 1 shows the evolution of public spending for education, health, and economic development over time for all ten provinces combined (per capita in constant 2002 dollars). In considering these results it is important to keep in mind that education is almost exclusively a provincial field (except for student loans, which are jointly administered by the federal and provincial governments), that health services are delivered by provincial governments (which themselves delegate to municipalities and/or special public bodies) but that the federal government plays a major role in funding, through federal transfers, and in establishing national standards that the provinces must meet to qualify for assistance. As for regional development, the two orders of governments are actively involved, mostly independently of each other; "provincial activities often parallel and supplement federal programs" (Finances of the Nation, 2003, 14:15).

Health is the most important spending item for Canadian provincial governments, and it is also the item where expenditures are growing the fastest. This pattern is not peculiar to Canada, since spending for health has been increasing substantially in almost all OECD countries (OECD 2006). Education is the second most important provincial activity, and it has been also increasing over the time period examined here, though not quite as much as in the case of health. Regional development, for its part, has remained relatively stable.

It can be seen that the growth in health and education spending has accelerated more recently, especially since 1997. There are at least three potential explanations for this. The first is that the most recent period has been one of remarkable growth in Canada. In fact, the mean annual increase in constant dollar GDP per capita has been 9,3% in the last 9 years, compared to 5,07% in the

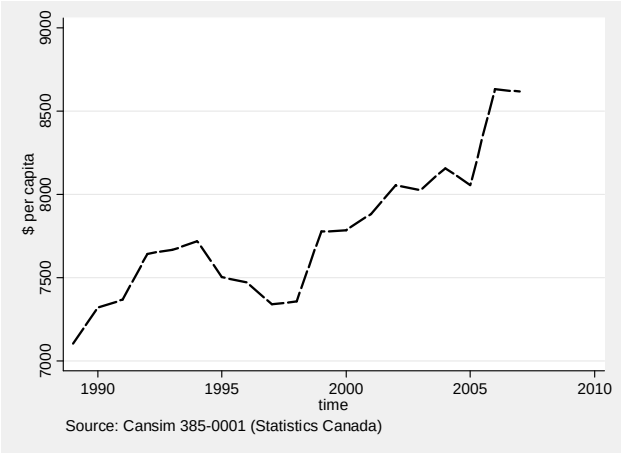

Figure 1: Canadian Public Spending (1989-2007)

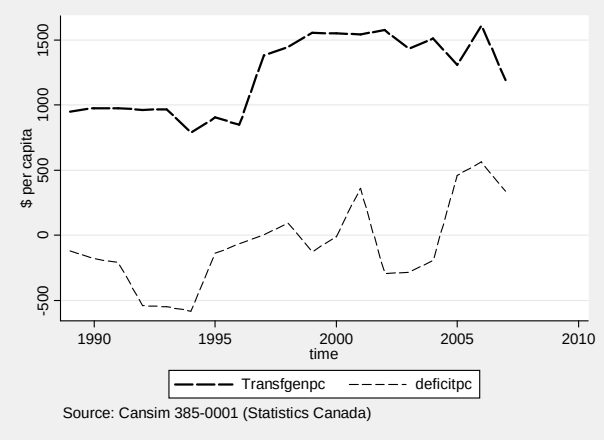

Figure 2: Canadian Public Finance Trends (1989-2007)

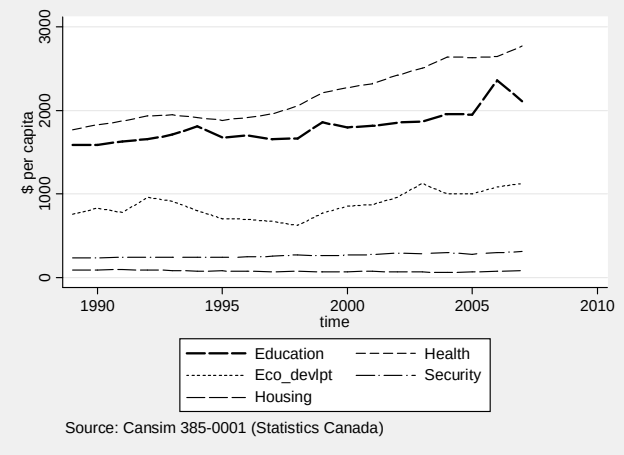

Figure 3: Canadian Public Expenditure Patterns (1989-2007)

previous nine years . The second concerns transfers from the federal to the provincial governments. These transfers were reduced in the 1990s and they have been substantially increased in the last few years. The third potential reason is the provincial deficit. Provincial deficits have been substantially curtailed during the period examined here. Lower deficits may make for more room to spend on basic services such as health and education.

Finally, total public spending has been increasing more or less linearly over time. The increase, however, has been less substantial than that of per capita GDP, with the consequence that spending has a proportion of GDP has actually slightly decreased. We have seen above that spending on health and education, which are the two most important provincial activities, have accelerated in the recent past. The fact that total spending has grown only moderately entails that spending on other matters has not increased at all, as we have observed for regional development, or may even have been cut in some instances.

Table 1a gives us a cross-sectional perspective. The table indicates mean per capita spending by province for the whole period. The view here is static, and complements the information provided in Figure 1. Perhaps the most striking pattern is that total spending is highest in the three smallest provinces (Prince Edward Island, Newfoundland, and Saskatchewan) and lowest in the largest (Ontario). This suggests the presence of scale economies in the delivery of public services. The difference is starkest in the case of regional development; per capita spending is six times higher in Saskatchewan than in Prince Edward Island. The difference may also reflect the fact that agriculture is much more heavily subsidized than the manufacturing sector. It is also interesting to note that total spending is noticeably higher in Quebec than in the other "large" provinces. The

Quebec government (and the National Assembly) sees itself as the defender of the Quebec "nation", and this leads to a wider array of programs in this province. Note, however, that the differences are rather small with respect to health and education. Quebec's distinctiveness emerges in other areas, such as culture, which are not considered in this study.

Table 1a: Public expenditures per capita (mean) by province, 1989-2007 (constant 2002 $)

Provinces	Total	Health	Education	Security	Eco Devlpt
Newfoundland and Labrador	8714.8	2297.0	2219.4	347.9	200.0
Prince Edward Island	7994.1	1973.2	1954.9	244.1	92.9
Nova Scotia	7242.7	2223.7	1787.9	252.6	266.9
New Brunswick	7860.3	2264.3	1841.8	213.3	215.2
Quebec	8287.1	2060.2	1842.1	277.2	2360.3
Ontario	6728.7	2221.7	1455.5	253.9	1516.6
Manitoba	7760.3	2189.8	1538.5	282.8	378.7
Saskatchewan	8082.8	2169.7	1538.9	299.8	816.6
Alberta	7593.7	2094.7	2006.1	217.8	1589.1
British Columbia	7357.2	2357.3	1851.3	261.9	1272.4

Note : Data come from CANSIM 385-0001, Statistics Canada.

4 Data

We test the existence of strategic interactions among health[1], education[2], regional development[3], and total expenditures. Each of these categories corresponds to provincial competencies without strong intervention from the federal level. From these data, we construct four dependant variables which have been transformed to be declared in terms of 2002 constant Canadian dollars. These four categories of public expenditures are calculated per capita and are log transformed to be able to interpret estimates as elasticities.

Among independant variables, we combine public finance data in order to control the province's ability to spend or not. For that, we include the level of public deficit at the previous fiscal year.

[1] According to Statistics Canada, provincial health expenditures include expenditures made to ensure that necessary health services are available to all citizens. Residential care facilities and other health and social services institutions providing medical care and professional nursing supervision are considered as institutions providing health services while those providing room and board with no or limited medical care and nursing supervision are considered as institutions providing social services. Also included are expenditures of hospitals, ancillary enterprises, i.e., entities that exist to furnish goods and services to patients, staff and others (food services, parking, etc.).

[2] Includes the costs of developing, improving and operating educational systems and the provision of specific education services. Also included are expenditures of universities. ancillary enterprises, i.e., entities providing goods and services to students, staff and others (bookstores, food services, residences, parking). It is subdivided into the following four sub-functions: Elementary and secondary education, Post-secondary education, Special retraining services and other education.

[3] Covers expenditures related to community and region development affairs and services. These include expenditures on planning and zoning and on community and regional development.

As Statistics Canada provides a same series for the surplus/deficit of provincial finances, we only keep the negative value for accounting the public deficit that we expressed in terms of provincial GDP. Indeed, it was not possible to keep a negative value for a log transformed variable. Finaly, it is expected that a strong public deficit prevents an increase of public spending. The second public finance dimension is linked to the Canadian federal system and concerns the transfer payments from the centre to the provinces[4]. As an extra revenue, transfers are likely to increase the ability for spending. But the decision to spend can be too explained by the increasing needs of a wealthier province (Wagner law) or by some ideological motives (partisan political business cycle).

5 Econometric Procedure

The main aim of this paper is to test the existence of spending interactions between Canadian provinces. We then have to consider spatial dependence in a panel data framework. In line with the earlier literature (see e.g. Devereux et al. 2002; Solé Ollé, 2006; Dreher, 2006), we assume that a province's policy reaction function can be written down as follows:

$$Exp_{i,t} = R_i(Exp_{j,t}, X_{i,t}), \tag{1}$$

where $Exp_{i,t}$ as the vector of public expenditures in a province i at time t. $Exp_{j,t}$ is the vector of public spending in the set of the other provinces j ($j \neq i$) at time t, and $X_{i,t}$ is the vector of the socio-economic characteristics of province i at time t. We replace vector $Exp_{j,t}$ by a weighted average such as $\sum_{j \neq i} w_{ij} Exp_{j,t}$, which implies that every province responds in the same way to the weighted average expenditures. The equation then becomes:

$$Exp_{i,t} = \alpha_{i,t} + \rho W Exp_{j,t} + \beta X_{i,t} + \varepsilon_{i,t}, \tag{2}$$

An a priori set of interactions has to be defined and then tested (Anselin, 1988). While a variety of weighting schemes may be explored to allow different patterns of spatial interaction, a scheme that assigns weights based on Euclidean distance or contiguity is commonly used in the relevant empirical literature. The explanation is twofold. In tax competition literature, jurisdictions are likely to take into account capital flight to the neighboring communities induced by an increase in its own tax rate. In the yardstick competition literature, residents consider neighboring jurisdictions - on which they are likely to get better information - as a yardstick to compare the performance of their incumbent.

[4] We use the concept of "general purpose transfers" which are broken down by level of government from which the transfers originate. Transfers from the federal government are compiled as general purpose capital transfers from the federal government, statutory subsidies, shares of federal taxes on preferred share dividends and on the income of certain public utilities, tax revenue guarantees, equalization, the Canada Health and Social Transfer, reciprocal taxation and stabilization.

Following the relevant empirical literature, we have firstly chosen a common geographical definition of neighborhood (see Case, Rosen and Hines, 1993, for as discussion on weight matrices).

The first way of considering weights is based on a contiguity matrix, where the value 1 is assigned if two provinces share the same border and zero otherwise. The second way of weighing is based on the euclidean distance between provinces. This scheme is given by the weight matrix W^d and imposes a smooth distance decay, with weights w_{ij} given by $1/d_{ij}$ where d_{ij} is the Euclidian distance between provinces' capitals i and j for $j \neq i$.

Secondly, to deal with the case where competition occurs between states with similar economic or demographic characteristics, we construct a weighting matrix based on the inverse of the distance between population or GDP per capita, where each element is constructed as follow:
$w_i^P = \frac{1}{|P_i = P_j|}$ with $P = \{Pop_i, pcPIB_i\}$

We then assign a higher weight to provinces j that are close to province i on a demographic or economic criterion. Note that following previous studies like Case, Rosen and Hines (1993), we used matrices based on the average of a variables over time. Finally, we define a political weight matrix W^{Pol} based on the partisan affiliation of provincial government. The value 1 is assigned when both incumbents of province i and province j have the same partisan affiliation, zero otherwise. As the weight matrix has to remain the same during the whole period in order to estimate a coefficient of spatial correlation, we have computed a mean indicator of political affiliation for each province. As provinces are politically distributed on a continuum of three political parties (Conservative, Liberal and Left), we assign a value of 1 to Conservative and -1 to Left-wing parties. Overall the period, we derive a score which represents the average political profil of the province. With a score of -0.68 the Saskatchewan is strongly left-oriented between 1989 and 2007.

All weight matrices are standardized so that the elements in each row sum to one.

There are two econometric issues raised by the presence of the dependent variable in the right-hand side of equation (2). First, if provinces do react to each others' spending choices, then neighbours' spending decisions are endogenous and correlated with the error term (ε). OLS (ordinary least squares) yields a biased estimate of parameter ρ (Anselin, 1988). Basically, two approaches exist for getting consistent estimates of the spatial parameter ρ in equation (2). The first approach is based on an instrumental variables (IV) – two-stage least squares (2SLS) method. It consists in finding variables that are correlated with neighbours' spending fiscal choices but uncorrelated with the error term. The IV approach suggests the use of the weighted average of neighbours' exogenous or control variables, (WX), as instruments (Kelejian and Robinson, 1993; Kelejian and Prucha, 1998). Empirical studies that use the IV approach to estimate spatial coefficients are Ladd (1992), Kelejian and Robinson (1993), Brett and Pinkse (2000), Heyndels and Vuchelen (1998), Figlio, Kolpin, and Reid (1999), Buettner (2001), and Revelli (2001). The second method is based on maximum likelihood (ML). Under this method, a non-linear reduced form for equation1 is com-

puted by inverting the system. A non-linear optimization routine is then used to estimate the spatial coefficient ρ. Like the IV method, the ML approach also yields consistent estimates of the parameters of the equation (Brueckner, 2003). Several papers use the maximum likelihood approach: e.g. Case, Rosen, and Hines (1993); Besley and Case (1995a); Brueckner (1998) and Brueckner and Saavedra (2001). Revelli (2003) shows results from both IV and ML estimation techniques.

Secondly, if neighbors' provinces are subject to correlated shocks, we may find a correlation between jurisdictions' spending choices. The omission of explanatory variables that are spatially dependent may generate spatial dependence in the error term, which is given by the following equation:

$$\varepsilon_{i,t} = \lambda W \varepsilon_{i,t} + \upsilon_{i,t}. \tag{3}$$

When spatial error dependence is ignored, estimation of equation (2) can provide false evidence of strategic interaction. To deal with this problem, one possible approach is to use ML to estimate equation (1), taking into account the error structure in equation (3). This method, which is implemented by Case, Rosen, and Hines (1993), is computationally challenging (Brueckner, 2003). This is not a problem anymore when using the IV method, which yields consistent estimations even with spatial error dependence (Kelejian and Prucha, 1998). A second approach is to use the robust tests of Anselin et al. (1996). Based on OLS estimates of equation (1), these tests are not contaminated by uncorrected spatial error dependence and can properly detect the presence of spatial lag dependence. This approach is notably used by Brueckner (1998), Saavedra (2000), and Brueckner and Saavedra (2001).

To deal with these two econometric issues raised by the presence of the dependent variable in the right-hand side of equation (2), we use a very simple adjustment process that generates testable reaction functions as we suppose that the government in each country sets the tax as a myopic best response to the taxes in the previous period in other countries (Devereux et al., 2002) . This generates reaction functions as in equation (1), except that $Exp_{j,t}$ is replaced by $Exp_{j,t-1}$. However, as mentionned by Devereux et al. (2002), the disadvantage of this lagged specification is that it is not directly consistent with the theory since governments are assumed myopic in the sense that they do not anticipate any change in other provinces' spending choices.

Finally, following Devereux et al. (2002), Dreher (2006), Redoano (2007), Veiga and Veiga (2007), we include the lagged dependent variable $Exp_{i,t-1}$ in order to take the autoregressive component of the time series into account. The system of equations can be written as follows:

$$\begin{aligned} \log Exp_{i,t} &= \alpha_i + \gamma \log Exp_{i,t-1} + \rho W^{\gamma} \log Exp_{j,t-1} + \beta_0 \log Unemployment_{i,t} + \beta_1 \log Deficit_{i,t} & (4) \\ &\quad + \beta_2 \log Density_{i,t} + \beta_3 \log Transfer_{i,t} + \beta_4 \log Pop_{i,t} + \beta_5 \log Pop19_{i,t} + \varepsilon_{i,t} & (5) \end{aligned}$$

where:

$Exp_{i,t}$ is the per capita public expenditure of province i ($i \neq j$) on year t,

$Exp_{j,t}$ is the per capita public spending in the set of the other provinces j ($j \neq i$) at time $t-1$,

$Unemployment_{i,t}$ is the unemployment rate in province i in year t,

$Deficit_{i,t-1}$ is the public deficit in terms of GDP in province i in year $t-1$,

$UnRate_{i,t}$ is the annual rate of unemployment in province i in year t,

$Density_{i,t}$ is the population density of province i in year t,

$Transfer_{i,t}$ is the per capita federal (general) transfers from the central State to province i in year t,

$Pop19$ is the share of the population under 19 years old in province i in year t,

$Pop65$ is the share of the population above 65 years old in province i in year t.

When including the time-lagged dependent variable in the regression together with fixed effects, the GMM estimator developed by Arellano and Bond (1991) is more appropriate here (Devereux et al., 2002; Dreher, 2006; Redoano, 2007). The GMM estimator first-differences the estimating equation and uses lags of dependent variables from at least two periods earlier as well as lags of the right-hand side exogenous variables as instruments. The validity of the instruments used in the regressions is evaluated with two different statistics. The Sargan test (or overidentifying restriction test) examines the hypothesis that the instruments are not correlated with the residuals. The second test is proposed by Arellano and Bond (1991). This test examines the hypothesis that the residuals from the first-differenced estimating equation are not second-order correlated. Both statistics are necessary to confirm the validity of the instruments used.

However, as there is some persistence of expenditures, it may be appropriate to estimate system-GMM (Veiga and Veiga, 2007; Foucault et al., 2008). Basically, Blundell and Bond (1998) show that this extended GMM estimator is preferable to that of Arellano and Bond (1991) when the dependent variable and/or the independent variables are persistent. If the level of an explanatory variable is correlated with the fixed effects but its first-differences are not, lagged values of the first-differences can be used as instruments in the equation in levels (Arellano and Bover, 1995). Lagged differences of the dependent variable may also be valid instruments for the level equations. The Sargan test indicates whether the system-GMM is preferable to the GMM that only includes the first-differenced equations.

6 Results

Our estimation strategy is as follows. We first estimate equation (4) using OLS without taking into account the possible influence of the expenditures set by other jurisdictions ($\rho = 0$) and without taking into account the lagged value of our dependent variable ($\gamma = 0$). The estimations results are shown in table 16. Columns 1 to 4 show the OLS estimation results of the model without fixed effects and without spatial lag for five types of expenditures: health, education, economic development and overall public expenditures. We then run the appropriate spatial tests based on the Lagrange Multiplier, which indicate the presence of spatial lag dependence for some categories of expenditures but not the existence of spatial error dependence.[5] We also test the fixed effects spatial lag model against the spatial lag model without fixed effects using the usual Fisher's test. We keep the former as the Fisher's test leads us to reject the spatial lag model without spatial (or province) fixed effects (see F test in appendix). Finally, the Hausman test tests the null hypothesis that the coefficients estimated by the efficient random effects estimator are the same as the coefficients estimated by the consistent fixed effects estimator. As we obtain significant p-values for any spending category, we may reject the model with random effects.

Secondly, we estimate equation (4) taking into account the possible influence of the expenditures set by other jurisdictions ($\rho \neq 0$) and the lagged value of our dependent variable ($\gamma \neq 0$). Tables 12, 13, 14 and 15 show the estimation results of this dynamic model using every matric for each category of public spending. We include the lagged dependent variable, because provincial expenditures are likely to change only slowly over time. We estimate the extended GMM estimator[6] as suggested by Blundell and Bond (1998).

The following results can be put to the fore. As Tables 12 to 15 show, the lagged endogenous variable ($Exp_{i,t-1}$) is always significant and takes a positive sign in all specifications. As the coefficients on lagged public spending provide an estimate γ varying between and , the first point to note is the relatively high level of persistency in all public spending categories. As in Veiga and Veiga (2007) and in Foucault, Madies and Paty (2008), this result confirms both the consistency of the autoregressive specification in equation (1) and the hypothesis that provincial expenditures are likely to change slowly over time.

Let us now turn to the estimation results associated with the presence of spending interactions between Candian provinces. As suggested by Case et al. (1993), there is no reason to assume that patterns of expenditures interdependence are identical for all categories of public spending. We thus estimate the model in equation (4) for health, education, regional development and total spending.

[5] We compute for each weighing scheme the robust LM test statistics for spatial lag dependence and for spatial error dependence (see Anselin, Le Gallo and Jayet, 2007).

[6] The Sargan test indicates that the system-GMM is preferable to the GMM that only includes the first-differenced equations.

As for the weighting scheme based on Euclidean distance (W^d), we find a significant and a positive sign for the coefficient associated with the neighboring provinces' decisions in expenditures categories, excepted for economic and regional development spending. This implies the existence of spending interactions between neighboring provinces. Let us notice that this result of horizontal spending interactions in the Canadian case is close to those obtained in previous tests carried out in other countries and other forms of decentralized governments. (see Case et al., 1993; Figlio et al., 1999; Baicker, 2001; Redoano, 2007; Foucault et al., 2008). It means that provincial decision-makers react positively to what their neighbors do. The reason why such a result is not validated for regional development is unexpected. Indeed we expected that a province that increases its level of regional development spending will encourage neighboring provinces to mimick her. At the opposite, the existence of strategic interactions for education is unexpected but in the other side. A positive sign ($\rho > 0$) of education spending interaction reveals a strategic behavior of Canadian provinces when they allocate education goods. Such a result means that the threat for students to leave the province (i.e. to vote with feet) is more credible than expected for a share of the population, mainly in University education where citizens (students) are able to vote. The constrained mobility of pupils and parents seems to be sufficient to prevent provinces to be involved into education races. Nevertheless, the same assumption should be tested for only Unviersity education spending where a yardstick competition is expected.

Measured in terms of GDP, strategic interactions occur for four categories of spending out of five, economic and regional development being the exception. The theory of yardstick competition seems to fit very well in Canadian provinces which yield similar GDP. The last weighted matrix confirm the previous results by establishing that provinces which share the same dominant partisan attitudes react positively to each other and increase their public spending. This result challenges the recent empirical studies of partisan business cycles. It seems to be a better partisan measure of strategic behavior of local decision-makers than the inclusion of a dummy variable (left/right-wing party). Contrary to the result of Tellier (2006) where left provincial governments are systematically prone to increase public spending, we found that partisan effect occurs more significantly through a coordination (competition) process.

Control variables present the expected signs when they are significant. However a number of coeficients are not significantly different from zero. For instance, provinces are likely to increase public expenditures when their unemployment rate is growing. At the opposite, the lagged public deficit variable is not a powerful control and can not confirm the presence of fiscal constraints in high deficit provinces. Concerning the structure of the population, there is also significant relationships between the population and the size of province spending. Indeed, economies of scale emerge whatever the kind of expenditures and imply a negative sign for Pop. This result is consistent with the literature on the costs for providing public goods. Nevertheless, age of population yields some unexpected results for coefficients linked to $Pop19$ and $Pop65$. A negative sign seems to mean that

spending decreases when the proportion of youth are old increases. Concerning health spending, this result is surprising because we expect a fiscal effort of provincial government for this category of population. On the public finance side, when transfers are significant they are likely to increase public expenditures (mainly in education). Transfers from the federal government act as incentives to spend more. Another venue of research could consist in focusing on the exogeneity of federal transfers since they can be negotiated with the centre before each province vote her budget.

Canada presents another case to add to the literature on strategic fiscal interactions. The existence of horizontal interactions is confirmed for most of categories of public expenditures considered in this paper (regional and economic develoment being the exception). Basically, other series should be tested in the next future to strenghten this result. What is interesting is the good fitness of the model for education and health spending where yardstick competition seem to arise whatever the yardstick (or weighting scheme). What we have shown is that provincial governments adjust their decisions to their neighbors but also to those of other governments with which they tend to compare themselves because they share economic and political characteristics. The challenge is to sort out under which conditions and what types of interactions matters most or least.

7 Appendices

Table 1: Summary statistics

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**N**
Province's size (1000kmš)	606293.1	471061.04	5660	1542056	190
Population	3006397.25	3512442	130077	12816545	190
Population under 19 (%)	0.26	0.03	0.17	0.34	190
Population over 65 (%)	0.13	0.01	0.09	0.15	190
Unemployment rate (%)	9.70	3.84	3.4	20.1	190
GDP	30580.14	7782.33	19165.27	63433.42	190
Fiscal Deficit	-76.95	571.75	-1770.84	2889.04	190
Transfers	1226.08	936.91	4.14	6371.31	190
Public Expenditure	7762.17	814.06	6018.55	12837.56	190
Education	1803.65	403.54	1186.87	5828.06	190
Eco Development	870.93	793.85	57	3342	190
Health	2185.2	372.6	1282.59	3171.22	190
Security	265.16	56.06	182.01	529.4	190

Table 2: Summary statistics Newfoundland and Labrador

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Public Expenditure	8714.808	1213.658	7560.399	12837.563
Education	2219.454	892.859	1847.657	5828.064
Eco Development	200.006	73.119	145	463.121
Health	2297.024	538.172	1579.785	3171.219
Security	347.983	69.819	270.442	529.404
deficitpc	-173.331	362.265	-746.945	613.318
transfgenpc	2753.431	1048.168	1830.056	6371.313
N		19		

Table 3: Summary statistics Prince Edward Island

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Public Expenditure	7994.017	615.588	7104.848	9202.671
Education	1954.973	275.276	1625.054	2759.613
Eco Development	92.947	22.78	57	132
Health	1973.251	494.751	1282.585	2800.212
Security	244.013	22.721	194.075	270.203
deficitpc	-216.141	422.682	-1174.537	321.351
transfgenpc	2123.987	393.728	1410.276	2723.94
N		19		

Table 4: Summary statistics Nova Scotia

Variable	Mean	Std. Dev.	Min.	Max.
Public Expenditure	7242.725	488.627	6702.719	8460.847
Education	1787.93	167.411	1574.233	2152.866
Eco Development	266.947	101.628	193	664
Health	2223.716	303.821	1836.464	2782.344
Security	252.696	39.746	202.979	359.316
deficitpc	-74.312	345.861	-691.961	814.542
transfgenpc	1699.737	423.181	1088.82	2395.483
N		19		

Table 5: Summary statistics New Brunswick

Variable	Mean	Std. Dev.	Min.	Max.
Public Expenditure	7860.333	398.539	7027.356	8553.76
Education	1841.803	126.61	1678.942	2112.01
Eco Development	215.263	27.481	163	283
Health	2264.366	272.583	1975.695	2808.575
Security	213.28	18.617	182.457	243.151
deficitpc	-89.14	192.066	-488.345	221.938
transfgenpc	1854.957	416.097	1272.594	2733.304
N		19		

Table 6: Summary statistics Quebec

Variable	Mean	Std. Dev.	Min.	Max.
Public Expenditure	8287.016	541.397	7329.153	9410.453
Education	1842.088	82.085	1635.401	1950.25
Eco Development	2360.316	564.388	1705	3342
Health	2060.204	262.525	1691.056	2521.682
Security	277.227	20.883	246.517	335.381
deficitpc	-381.632	277.275	-795.472	246.816
transfgenpc	842.198	178.176	603.893	1098.255
N		19		

Table 7: Summary statistics Ontario

Variable	Mean	Std. Dev.	Min.	Max.
Public Expenditure	6728.699	316.628	6126.244	7210.22
Education	1455.472	166.299	1186.874	1795.727
Eco Development	1516.632	354.593	876	2193
Health	2221.701	230.357	1885.151	2710.566
Security	253.913	13.916	221.065	277.716
deficitpc	-337.54	337.769	-947.221	107.119
transfgenpc	259.075	223.416	4.3	659.723
N		19		

Table 8: Summary statistics Manitoba

Variable	Mean	Std. Dev.	Min.	Max.
Public Expenditure	7760.302	329.885	7310.659	8441.826
Education	1538.51	113.908	1432.909	1751.783
Eco Development	378.789	119.57	195	572
Health	2189.854	409.182	1699.354	2955.531
Security	282.87	62.66	211.191	435.135
deficitpc	-2.17	219.419	-386.965	440.893
transfgenpc	1412.985	331.234	864.440	1852.865
N		19		

Table 9: Summary statistics Saskatchewan

Variable	Mean	Std. Dev.	Min.	Max.
Public Expenditure	8082.796	547.349	7258.409	8999.838
Education	1538.957	195.687	1356.697	1986.547
Eco Development	816.737	335.939	360	1625
Health	2169.736	405.632	1684.424	2988.318
Security	299.801	69.663	226.008	433.803
deficitpc	-2.689	585.228	-1012.57	1122.537
transfgenpc	717.209	238.008	291.118	1163.774
N		19		

Table 10: Summary statistics Alberta

Variable	Mean	Std. Dev.	Min.	Max.
Public Expenditure	7593.74	649.441	6533.58	8567.620
Education	2006.008	303.545	1614.64	2618.858
Eco Development	1589.158	498.276	782	2426
Health	2094.727	313.212	1646.498	2712.975
Security	217.851	23.991	182.007	274.16
deficitpc	602.634	1177.468	-994.095	2889.043
transfgenpc	260.459	186.118	16.098	636.13
N		19		

Table 11: Summary statistics British Columbia

Variable	Mean	Std. Dev.	Min.	Max.
Public Expenditure	7357.265	667.718	6018.554	9296.442
Education	1851.325	288.6	1302.523	2787.7
Eco Development	1272.474	269.092	763	1757
Health	2357.375	278.88	1934.717	2910.429
Security	261.954	26.816	214.404	310.61
deficitpc	-95.194	546.212	-1770.844	848.782
transfgenpc	336.717	297.818	4.139	798.359
N		19		

Table 12: GMM estimation results / yardstick competition test (2)

	(1a)	(1b)	(1c)	(1d)
Dependent var.	Health exp.			
Estimation method	GMM	GMM	GMM	GMM
Weighted scheme	W^d	W^{pop}	W^{GDP}	W^{Pol}
$Exp_{i,t-1}$	0.673*** (0.068)	0.707*** (0.029)	0.767*** (0.047)	0.766*** (0.037)
$WExp_{j,t-1}$	0.315*** (0.099)	0.26*** (0.085)	0.201*** (0.089)	0.204** (0.079)
Unemployment	0.013 (0.037)	0.011 (0.044)	0.000 (0.036)	0.009 (0.043)
Deficit_{t-1}	-0.003 (0.002)	-0.003 (0.003)	-0.003 (0.002)	-0.004 (0.003)
Pop19	-0.181 (0.139)	-0.189 (0.176)	-0.193 (0.151)	-0.161 (0.177)
Pop65	-0.001 (0.246)	-0.037 (0.279)	-0.137 (0.215)	-0.026 (0.273)
Transfer	-0.001 (0.014)	0.001 (0.016)	0.005 (0.014)	0.001 (0.016)
Density	-0.013*** (0.003)	-0.011*** (0.003)	-0.010*** (0.002)	-0.008** (0.003)
Intercept	0.096 (0.272)	0.168 (0.363)	1.176 (0.327)	0.146 (0.365)
Arellano Bond test (p-value)	0.802	0.752	0.540	0.743
Sargan test (p-value)	0.007	0.04	0.002	0.01
Observations (10 x 18)	180	180	180	180

Estimated using xtabond in Stata 9.2. All variables are log-transformed except for dummies. Robust standard errors in parentheses. ***, **, * denote significance at 99%, 95%, and 90% levels, respectively.

Table 13: GMM estimation4 results / yardstick competition test (2)

	(2a)	(2b)	(2c)	(2d)
Dependent var.	Education Exp.			
Estimation method	GMM	GMM	GMM	GMM
Weighted scheme	W^d	W^{pop}	W^{GDP}	W^{Pol}
$Exp_{i,t-1}$	0.255* (0.136)	0.976 (0.188)	0.182 (0.208)	0.323* (0.171)
$WExp_{j,t-1}$	0.818*** (0.186)	1.001*** (0.311)	0.889** (0.295)	0.642** (0.22)
Unemployment	0.102 (0.066)	0.095 (0.079)	0.065 (0.067)	0.076 (0.069)
Deficit_{t-1}	0.001 (0.002)	0.000 (0.003)	0.001 (0.003)	0.002 (0.003)
Pop19	-0.636** (0.248)	-0.599*** (0.176)	-1.105** (0.383)	-0.779** (0.308)
Pop65	-2.056*** (0.607)	-2.163*** (0.486)	-2.665** (0.876)	-2.25*** (0.608)
Transfer	0.036*** (0.012)	0.037*** (0.007)	0.031** (0.01)	0.048** (0.018)
Density	-0.000 (0.019)	-0.010 (0.022)	-0.016 (0.024)	-0.020 (0.021)
Intercept	-0.017 (0.436)	-0.006 (0.632)	0.257 (0.494)	0.40 (0.526)
Arellano Bond test (p-value)	0.363	0.530	0.389	0.383
Sargan test (p-value)	0.086	0.580	0.174	0.096
Observations (20 x 90)	180	180	180	180

Estimated using xtabond in Stata 9.2. All variables are log-transformed except for dummies. Robust standard errors in parentheses. ***, **, * denote significance at 99%, 95%, and 90% levels, respectively.

Table 14: GMM estimation results / yardstick competition test (2)

	(3a)	(3b)	(3c)	(4d)
Dependent var.	Eco. development Exp.			
Estimation method	GMM	GMM	GMM	GMM
Weighted scheme	W^d	W^{pop}	W^{GDP}	W^{Pol}
$Exp_{i,t-1}$	0.764*** (0.101)	0.716*** (0.114)	0.598*** (0.164)	0.686*** (0.125)
$WExp_{j,t-1}$	0.113 (0.098)	0.375* (0.178)	0.689 (0.412)	0.507* (0.259)
Unemployment	-0.324* (0.159)	-0.28 (0.17)	-0.051 (0.256)	-0.517** (0.195)
Deficit_{t-1}	-0.047 (0.043)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)
Pop19	-0.905 (0.651)	0.524 (0.795)	-2.478 (1.485)	0.194 (0.653)
Pop65	-1.943 (1.806)	-1.526 (2.168)	-6.058* (3.287)	-4.604* (2,161)
Transfer	0.078* (0.039)	-0.035 (0.027)	-0.042 (0.041)	0.020 (0.02)
Density	-0.047 (0.043)	-0.073 (0.054)	0.113 (0.114)	0.113 (0.08)
Intercept	1.406 (0.926)	1.55 (1.079)	0.747 (0.966)	0.723 (0.873)
Arellano Bond test (p-value)	0.130	0.169	0.095	0.170
Sargan test (p-value)	0.049	0.186	0.626	0.352
Observations (20 x 90)	180	180	180	180

Estimated using xtabond in Stata 9.2. All variables are log-transformed except for dummies. Robust standard errors in parentheses. ***, **, * denote significance at 99%, 95%, and 90% levels, respectively.

Table 15: GMM estimation results / yardstick competition test (2)

	(5a)	(5b)	(5c)	(5d)
Dependent var.	Total Expenditure			
Estimation method	GMM	GMM	GMM	GMM
Weighted scheme	W^d	W^{pop}	W^{GDP}	W^{Pol}
$Exp_{i,t-1}$	0.379** (0.166)	0.449* (0.211)	0.594*** (0.187)	0.543*** (0.188)
$WExp_{j,t-1}$	0.782*** (0.180)	0.588** (0.240)	0.502* (0.246)	0.613** (0.226)
Unemployment	0.073*** (0.022)	0.039 (0.023)	0.034 (0.026)	0.071** (0.025)
Deficit_{t-1}	-0.000* (0.001)	0.001 (0.002)	0.000 (0.002)	-0.001 (0.001)
Pop19	-0.037 (0.089)	-0.046 (0.079)	0.000 (0.065)	0.005 (0.07)
Pop65	0.051 (0.315)	-0.004 (0.310)	-0.081 (0.266)	-0.106 (0.305)
Transfer	0.017* (0.008)	0.014* (0.002)	0.013 (0.008)	0.014 (0.009)
Density	-0.02*** (0.008)	-0.031** (0.013)	-0.019* (0.009)	-0.025** (0.009)
Intercept	-0.725** (0.34)	-0.189 (0.394)	-0.423 (0.43)	-0.682 (0.407)
Arellano Bond test (p-value)	0.735	0.782	0.510	0.540
Sargan test (p-value)	0.245	0.107	0.120	0.277
Observations (20 x 90)	180	180	180	180

Estimated using xtabond in Stata 9.2. All variables are log-transformed except for dummies. Robust standard errors in parentheses. ***, **, * denote significance at 99%, 95%, and 90% levels, respectively.

Table 16: OLS estimation results

	(1a)	(1b)	(1c)	(1d)
Dependent var.	Total	Education	Regional Devlpt	Health
Estimation method	OLS	OLS	OLS	OLS
GDP	0.137*** (0.032)	0.326*** (0.049)	0.826*** (0.181)	0.423*** (0.044)
Deficit_{t-1}	-0.00** (0.000)	0.000 (0.000)	-0.00 (0.000)	0.000 (0.00)
Left	0.016** (0.007)	0.020* (0.01)	0.120*** (0.039)	0.011 (0.009)
Pop19	-.413*** (0.086)	-1.504*** (0.131)	0.675 (0.484)	-0.145*** (0.117)
Pop65	-0.036 (0.221)	-3.083*** (0.334)	1.236 (0.437)	0.523* (0.301)
Population	-.022** (0.007)	-0.088*** (0.009)	0.653*** (0.036)	-0.024*** (0.008)
Transfer	0.029*** (0.005)	0.045** (0.008)	0.039 (0.029)	0.034*** (0.007)
Density	-0.034*** (0.006)	0.004 (0.009)	-0.063* (0.036)	-0.015* (0.008)
Intercept	3.58*** (0.148)	2.984*** (0.224)	5.005*** (0.828)	1.734*** (0.201)
Adj. R^2	0.462	0.612	0.493	0.86
F	20.28***	36.36***	22.75***	138.47***
Observations	180	180	180	180

Estimated using OLS in Stata 9.2. All variables are log-transformed except for dummies. Robust standard errors in parentheses. ***, **, * denote significance at 99%, 95%, and 90% levels, respectively.

Notes

8 References

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