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AN EMPIRICAL INVESTIGATION OF TAX COMPETITION BETWEEN CANADIAN PROVINCES

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An Empirical Investigation of Tax Competition between Canadian Provinces[†]

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Abstract

This paper employs data on the effective tax rates on the marginal production cost (ETRMCs) as defined by McKenzie, Mintz and Scharf (1997) in the study of tax competition. The ETRMC is the effective excise tax rate imposed on the cost of producing a marginal unit of output. Using a dataset of ETRMCs for 21 industries between 1970 and 1997 tax reaction functions are estimated for the largest six Canadian provinces, and they provide evidence of both horizontal and vertical tax competition. However, some of the reaction functions are negatively sloped and generally the hypothesis of a race to the bottom in effective taxes on marginal costs in Canada is not supported.

JEL Classification: H25, H32, H7

Keywords: tax competition; corporate taxes, effective tax rate on marginal cost

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1. INTRODUCTION

In April 1994, Gerhard Schröder, the German Chancellor, declared that it was unacceptable "that Germany, as the EU's biggest net payer, finances unfair tax competition against itself". This sentiment reflects a view common in Europe and within the OECD countries that tax competition is a harmful practice that should be prevented through international coordination of tax policies. Similar concerns have been expressed by France, which has accused the new EU members of “tax dumping”.

But does tax competition really exist? And, if so, is it a problem?

Tax competition can be defined as the strategic use of tax policy by governments that compete to attract mobile tax bases. The increased mobility of capital has led numerous researchers to predict a race to the bottom in capital taxes. This is generally perceived to be undesirable in that it leads to a decline in government revenues and therefore the supply of public goods below the point where the marginal social benefit equals the marginal cost.

Indeed, the World in general and Europe in particular have witnessed a substantial decrease in the statutory corporate tax rates over the last four decades. Moreover the tax-cutting fever seems to have accelerated during the last few years, especially when taking into account the twelve new members of EU.

Ireland was the first to drop its corporate tax rates to 12.5% from a low 24% between 2000 and 2003. In fact for a long period of time Ireland has promoted the lowest tax rates in the European Union and this is believed to be one of the reasons for its transformation from one of the poorest EU countries into the Celtic Tiger. Other EU countries have followed: between 2000 and 2005, the combined national and local statutory tax rate on corporate income dropped form 35% to 31.5% in the Netherlands, from 40.2% to 34% in Belgium, from 37.8% to 34.3% in France, from 41.2% to 37.2% in Italy, from 52% to 38.3% in Germany.

The tax cuts are even more impressive in the former communist countries of Central and Eastern Europe. In the recent years Poland cut its corporate income tax from 27% to 19%; Hungary reduced its corporate tax rate from an already low 18% to 16% and the top personal income tax from 41.5% to 38%; Moldova reduced its corporate income tax and top personal income tax from 25% to 20% and 22%, respectively; Latvia reduced its corporate tax rate to 19%. Several countries have introduced a flat tax rate on business and personal income. Estonia, the Baltic Tiger, was the first to implement a flat tax rate of 26% in the mid 1990s and plans to reduce it to 20% in 2007; Russia followed with a 13% flat tax rate; Slovakia replaced the old tax code with a top tax rate of 38% by a flat 19%; Romania followed in 2005 with a flat tax rate of 16%.

Although the most impressive changes in taxes happened in Europe, KPMG has found in a recent corporate tax survey that of 69 surveyed countries, only three (Chile, Hong Kong and Peru) have increased their taxes between 2003 and 2004, while rumours exist that even China is contemplating the possibility of introducing a flat tax rate.

However, the reduction of the statutory tax rates is not sufficient to confirm the race-to-the-bottom hypothesis. Tax bases are equally important, and while tax rates have declined lately, tax bases have generally broadened. One of the conclusions of a 1999 study of effective corporate tax rates in Europe by PriceWaterhouseCoopers is that "Where statutory rates vary from 28% to 45%, effective rates vary from 0 to 88%: effective rates are a function of statutory rates but obviously not a very predictable or transparent one."[1] What should be considered therefore when examining the tax competition phenomenon are the effective tax rates, which reflect all the characteristics of the tax system in a country.

The objective of this paper is to investigate the nature of tax competition in Canada by estimating tax reaction functions for the largest six Canadian provinces using a unique data set of effective tax rates on the marginal production cost. Canada provides a

[1] That the highest effective corporate tax rates in the EU were, according to the PWC report, those of Germany and France may have something to do with their virulence against tax competition.

convenient laboratory for a study of tax competition. The tax systems in the ten provinces are more similar than in the OECD or EU countries (the usual suspects in the study of tax competition), and with common exchange rate, monetary policy, and institutional features there are fewer variables that need to be controlled for. Yet the Canadian provinces have a high degree of autonomy in setting their tax policy that provides the necessary variability in data.

The remaining sections of the paper are organized as follows: Sections 2 and 3, respectively, review some of the theories of tax competition and the empirical evidence in this area. Section 4 provides some details on the construction of the effective tax rates on marginal cost and the reasons why this type of data is suitable for the study of tax competition. Section 5 describes the econometric specification of the tax competition model and the main econometric problems associated with this estimation. Section 6 presents the results obtained for the six Canadian provinces included in this study, while the final section concludes.

2. THEORIES OF TAX COMPETITION

There are two major views on tax competition. The first, and most common, is that tax competition is 'bad' or 'harmful' in that it leads to inefficiently low taxes and provision of public goods.[2] As firms can relocate to jurisdictions with a lower tax burden, local governments are forced to cut taxes, which results in a downward spiral in taxes and public services, the so-called 'race to the bottom'.

This view has been voiced by Oates (1972) and modelled by Zodrow and Mieszkowski (1984) (the ZM model henceforth) in what has become the benchmark model of tax competition. In the ZM model taxes are used to finance a productive public good which

[2] There is no rule that lower taxes imply lower public goods provision. A commentary on the Internet (http://hispanicpundit.com/archives/2005/03/24/big-changes-in-europe/) puts it simply: "[C]ountries have quickly realized that a larger percent of nothing is much less than a smaller percent of something." In fact, in many countries of Central and Eastern Europe, including Estonia, Russia, and Romania smaller taxes have been followed by an increased collection of tax revenues. This may be to a large extent the result of increased fiscal discipline of firms, for which, as taxes become smaller, the benefit of tax evasion may no longer justify the cost. This is an aspect of tax competition that the theory generally fails to account for.

is assumed to increase the marginal product of capital for private firms. The authors argue that the elasticity of the demand for capital with respect to the capital tax rate is always negative, since the marginal public good valuation (MPGV) [3] is always lower than the marginal cost of the public good. Due to the negative elasticity of the demand for capital with respect to the capital tax rate, the competitive equilibrium level of the capital tax rate is lower than the efficient level. Hence the result of tax competition is a race to the bottom in taxes, inefficient since, with all governments cutting their taxes, the ultimate distribution of capital among countries remains unaltered, while taxes are suboptimal, resulting in an underprovision of public goods.

The predictions of this and similar models have become so popular that for many tax competition, the race to the bottom in taxes and the underprovision of public goods have become synonyms. However if the MPGV is large enough (larger than the marginal cost of the public good) an increase in the provision of the public good makes capital more productive so that firms actually prefer to pay higher taxes.[4] Therefore, to attract more capital, local governments will engage in a race to the top in tax rates and tax competition results in larger than efficient tax rates and public good levels. Thus tax competition still exists and is 'bad', i.e. distortionary, although it leads to an overprovision of public goods.

This qualification was introduced in the original ZM model by Wooders, Zissimos and Dhillon (2001). They assume that the MPGV is monotonically decreasing in the level of capital, starting by being larger than its marginal cost for low levels of capital and ending up below the marginal cost for large levels of capital. With this simple change tax competition can result in a whole spectrum of outcomes that depend on the initial level of capital in each jurisdiction. Competitive tax levels and public good provision can be either too high (race to the top), too low (race to the bottom), or even equal to their efficient level when the MPGV equates the marginal cost of providing the public good.

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[3] The MPGV is defined as the increase in the marginal product of capital due to a marginal increase in the level of public good.

[4] An alternative view of this possibility is that governments, rather than competing in taxes, compete in government expenditures, for example offering a better infrastructure or better services meant to attract firms.

Both the race to the top and the race to the bottom views require that jurisdictions display positively sloped tax reaction functions with respect to each other. In other words, a necessary condition to have a "race" in taxes, in any direction, is for the tax rates of competing jurisdictions to be strategic complements.

However there are theoretical models in which negatively sloped tax reaction functions are equally plausible. Mintz and Tulkens (1985) develop a model of commodity tax competition between regions in which an origin-based tax is levied on the same commodity in all regions. The tax revenues are used to finance a welfare-enhancing public good. They show that "while nonincreasingness of the reaction function cannot be shown to hold as general property, the latter does follow when a sufficient degree of inelasticity of the demand for the public good prevails" (p. 154). The intuition is the following: if consumers in region *i* have a demand for the public good that is sufficiently inelastic, an increase in taxes in region *j*, by increasing the tax base in region *i*, will allow the latter to decrease its taxes.

A similar result is obtained by Brueckner and Saavedra (2001) in a model of property (business and residential) tax competition. An increase in a region's tax rate will increase the representative consumer's utility by increasing the amount of the public good, but it will hurt the consumer by reducing the private good. The first effect is increasing and the second is decreasing when the tax rate in the rival region is increasing. If the marginal utility of the public good is low enough, the second effect dominates, so the best response of government *i* to the increased tax rate in region *j* is a reduction in its tax rate.

Generally, whether tax competition leads to taxes that are too high or too low, and whether this is good or bad depends on the way taxes are modeled, and in particular the choice (and mobility) of the tax base and the destination of public expenditures.

Tax revenues can be used to finance four broad types of expenditures: a public good consumed by individuals, a productive public good that enhances firms' productivity, transfers to individuals, or rents collected by politicians. In the first case, the competitive level of taxes is below the efficient level. If taxes are used for productive purposes we are in the realm of the ZM and related models mentioned above, where any outcome regarding the competitive level of the tax rates is possible.

Wildasin (2000) argues that when capital is mobile, even imperfectly so, and capital taxes are used to finance transfers to local residents, tax competition leads to lower than efficient tax rates, public revenues and transfers. His model also applies to skilled labour and concludes that, as neither capital nor skilled labour are perfectly mobile, the optimal tax rate on both will be non-zero even in the presence of tax competition, but will be smaller than the optimal tax rate when both factors are completely immobile. For capital, the optimal tax rate in one jurisdiction is a decreasing function of the capital mobility and the share of capital owned by residents.

Janeba and Schjeldrup (2002) model taxes as a source of public good provision and rents for politicians. Tax competition is again distortionary as it leads to a decline in taxes. While the direct result is a reduction in the level of public good lowering the welfare of individual voters, it also reduces the waste of public funds, which is beneficial for voters. Under certain conditions tax competition may improve voters' welfare, and this is more likely for presidential than parliamentary regimes. This may explain why tax competition is viewed as harmful in Europe, where governments suggest a harmonization of taxes on capital, while it is considered beneficial in the US.

This last model is an example of the more recent literature unveiling the potentially beneficial outcomes of tax competition, most notably the alleviation of the agency problem arising from the miss-alignment between politicians' and general public's objectives. In this context, tax competition reduces the 'market power' of politicians acting as rent-seekers.

The view that tax competition is beneficial or efficiency-enhancing goes back to the Tiebout (1956) model in which individuals choose among jurisdictions as they choose among firms providing private goods. The whole class of Tiebout-type models share the view that the competition among governments is similar to the competition in the private sector and therefore has desirable efficiency properties. As population is heterogeneous and groups with similar tastes tend to congregate, local governments will 'specialize' in taxes-public services 'packages' suitable for their public.

The main arguments against the Tiebout view is that governments provide goods and services for which competitive markets do not operate well, and thus reintroducing competition between governments is likely to result in market failures.

An additional perspective on the benefits of tax competition stems from the Leviathan literature in which tax competition forces oversized governments to improve the welfare of their residents by reducing the size of the public sector. Attempts to counteract tax competition will decrease the incentive for governments to offer better programs at the same cost or the same programs at lower costs/taxes.

Tax competition between jurisdictions within a federal country raises other issues. One can distinguish two forms of tax competition that may occur within a federation. Similar to the tax competition between different countries, there is the so-called horizontal tax competition that may occur between the jurisdictions, with all the characteristics discussed already. In addition, the existence of hierarchically nested levels of government gives rise to the vertical tax competition between the national and sub-national governments. Unlike in the case of the horizontal tax competition, in the vertical case the competing governments are not trying to divert the tax base from each other. However by taxing the same base their tax policies become dependant of one another.

While, as seen in the previous section, there is no consensus regarding the effect of the horizontal tax competition on the level of taxes, the prevailing view is that it leads to tax rates that are too low. The opposite is true for the vertical tax competition, which is generally believed to result in taxes that are too high. The intuition is that governments fail to take into account the fact that an increase in their tax rate, by shrinking the common tax base, affects the ability of the other (superior or inferior) government to collect tax revenues, thus generating negative externalities. However, as reviewed by Wilson (1999) this inefficiency can be mitigated if the national government is benevolent and is able to move first, thus being able to influence the behavior of the sub-national governments.

3. EMPIRICAL EVIDENCE OF TAX COMPETITION

There are two main themes in the empirical tax competition literature. One body of literature estimates the effect of factor mobility on the level and structure of the tax rates. A second approach deals with the strategic interaction among governments playing the tax competition game, and estimates tax reaction functions. This paper falls under the second category.

Regarding the effect of factor mobility of taxes, Bretschger and Hettich (2001) analyze a panel of 14 OECD economies between 1967-96 and find evidence for both the efficiency hypothesis (that globalization affects the tax mix by increasing labour taxes relative to capital), and the compensation hypothesis (that globalization impacts positively the amount of social care). For a panel of 14 EU countries for the period 1980-2000 Krogstrup (2004) finds evidence of a negative effect of increased capital mobility on corporate tax burden. The effect is smaller the greater the size of an economy and the stronger the agglomeration effects, which may explain why the decline in taxes is hard to qualify as a race to the bottom. Similar results are reported by Winner (2005) for a panel of 23 OECD countries, which finds evidence that capital mobility puts a negative pressure on capital tax burden and a positive pressure on labour taxes, more so for small countries and beginning with the mid 1980's.

In the tax reaction functions literature, Goodspeed (2000) finds evidence of horizontal and vertical tax competition in income taxes for a group of 13 OECD countries over 1975-84. Altshuler and Goodspeed (2002) use tax data for 17 European countries for the period 1968-96 and also find evidence of positively sloped reaction functions in capital taxes. They also find evidence that European countries display a positive and significant elasticity of capital taxes with respect to those in the US after 1986, the year of a major tax reform in the US, but not before. This corresponds to a game where the European countries, on the top of being Nash competitors among themselves, also act as followers to the US, which is the Stackelberg leader.

Devereux, Lockwood and Redoano (2001) find evidence of positively sloped tax reaction functions in corporate statutory tax rates, effective average tax rates and less evidence of competition in effective marginal tax rates on capital for a panel of 21 OECD countries between 1983 and 1999. Thus they conclude that governments generally compete in attracting firms rather than encourage existing firms to invest more. Moreover, they find evidence of concavity in the tax reaction functions, which supports the idea that the larger the tax rate in a country compared to its neighbours, the stronger the country will react to tax cuts in the neighbouring countries.

Stewart and Web (2003) use descriptive and cointegration analysis and find no evidence of a race to the bottom in taxes within the OECD, and little evidence of a harmonization of the tax burden.

Brueckner (2003) overviews the empirical studies on the existence of a strategic interaction between governments and the main econometric issues associated with these studies. Griffith and Klemm (2004) review some stylized facts of the evolution of capital taxes over the past few decades and the empirical evidence on tax competition. They conclude that while the basic models mostly fail to account for all the stylized facts, more advanced models (like those that allow firms to earn positive rents) are consistent with these facts.

All the empirical tax competition studies above are applications to groups of relatively homogenous countries. However, if we draw a parallel with the trade literature and believe that borders are important, tax competition is more likely to occur between jurisdictions in a federation than between countries. Helliwell and McKitrick (1999) use data on 27 regions (17 OECD countries and the 10 Canadian provinces) and find evidence that, while the national savings retention coefficient is significantly different from zero, the provincial one is not. Their results confirm that "national borders clearly divert flows of savings to domestic investment, but provincial borders have no such effect" (p. 1165-1166). Thus, they conclude that "provincial borders are not barriers to capital movement in the way that a national border is" (p. 1171).

Moreover, from the empirical point of view, when working with jurisdictions within a country rather than groups of countries, the common exchange rate, monetary policy, institutional features, etc. reduce the number of exogenous shocks that may blur the evidence of tax competition.

Case, Rosen and Hines (1992) use data on the continental United States during 1970-1985 and find evidence of interdependence of states' expenditures, where a dollar increase in the spending by a state's neighbours increasing its own spending by about 70 cents. In addition, taking into account this interdependence significantly alters the estimated impact on spending of conventional determinants, like federal grants.

On the taxation side, Brueckner and Saavedra (2001) test the existence of strategic property-tax competition (business and residential) using data on 70 cities in the Boston metropolitan area. They estimate the model before and after the implementation of Proposition $2\frac{1}{2}$, a property-tax limitation measure. They find evidence of strategic tax competition in both types of taxes before the Proposition $2\frac{1}{2}$ was implemented, and only in business property taxes after, which is consistent with the assumption that business investment relocates more rapidly than the residential investment in response to tax differentials.

In the realm of capital tax competition Hérnandez-Murillo (2003) finds evidence of such strategic interaction among U.S. states, where the elasticity of the average tax rate of neighboring states is found to be comparable to the elasticity of local economic variables such as real per capita income.

Canada is perhaps a better candidate for the empirical study of tax competition than other federations. Compared to Switzerland with 26 cantons, Canada has a smaller number of larger jurisdictions. The U.S. states are generally larger than the Canadian provinces (in terms of population), but also more heterogeneous, and in some cases they are constrained to not accumulate debt, thus their possibility to lower taxes is limited.

In the Canadian context, Robson and Poschmann (2001) view the equalization payments, the federal-provincial shared cost programs, and the social union framework agreement as responses to tax competition or generally to the presumption that provinces cannot provide attractive tax packages on their own. However, as they observe, opinions on tax competition seem to be "stronger than evidence".

Among the studies on Canadian tax competition, Mintz and Smart (2004) emphasize that, while the possibility for multijurisdictional firms to shift their income across jurisdictions may impose a downward pressure on statutory tax rates and corporate tax credits, income shifting also makes real investment less responsive to tax rates. They find that the elasticity of taxable income with respect to the tax rates is twice as large for "income shifting" firms than other, comparable ones, which suggests that firms' responses to taxes are rather financial than real. On the other hand, Beaulieu, McKenzie and Wen (2004) find evidence that the number of manufacturing establishments in Canadian provinces is responsive to the effective tax rate on marginal costs.

There are two empirical studies of tax reaction functions in Canada. Brett and Pinkse (2000) find evidence of positively sloped tax reaction functions in business property tax rates set by municipalities in British Columbia. However they argue that the joint investigation of the determinants of the tax base and tax rates does not support the hypothesis that the positively sloped tax reaction functions arise from competition over the tax base.

Hayashi and Boadway (2001) estimate vertical and horizontal tax reaction functions between the Canadian federal government, the provincial governments of Ontario, Quebec and the aggregate of the remaining eight provinces. They test both a Nash and a Stackelberg system with the federal government acting as a leader. Their findings might suggest a certain hierarchy in the tax setting, with Ontario possibly acting as a Stackelberg leader, being followed by the federal government which reacts to Ontario only, Quebec which reacts to both Ontario and the federal government, and the other eight provinces which take into account all the previous actors.

An issue that arises from their study, which is very common in the tax competition literature, is that the average tax rates they analyze are calculated as the ratio of corporate tax revenues to some aggregate level of income, corporate profits or GDP. In particular, Hayashi and Boadway use business tax rates calculated as the ratio of corporate income tax revenues to corporate profits. The problem with such measures of average tax rates is that, since the tax base cannot be observed and is approximated by some aggregate measure, the tax rate can change not only due to policy changes, but also when the true tax base changes relative to the aggregate measure used as a proxy due to different economic factors such as inflation, economic growth, etc. This raises the issue of the appropriate way to measure the tax variable; this will be addressed in detail below.

A second issue in the Hayashi and Boadway approach, again common in the empirical tax competition literature, is their aggregation of the eight smaller Canadian provinces into a single average business tax rate, which does not represent any of these provinces in particular. If the slopes of the tax reaction functions of the federal/Ontario/Quebec taxes to these provinces (or viceversa) have different signs, they will counteract through aggregation and the degree of tax competition will therefore be underestimated. For example, if Ontario reacts negatively to changes in taxes in Alberta, and positively to changes in taxes in the Atlantic Provinces, the model may conclude that, on average, Ontario does not react at all to taxes in the aggregate eight provinces.

Thus the intensity of capital tax competition in Canada may be better captured by using appropriate measures of the effective marginal tax rates faced by firms, and by considering each province separately.

This paper thus estimates tax reaction functions between the six largest Canadian provinces- British Columbia (BC), Alberta (AB), Saskatchewan (SK), Manitoba (MA), Ontario (ON) and Quebec (QC)- using the effective tax rate on marginal cost as a measure for the effective tax rate. This approach to measuring effective taxes is due to McKenzie et al. (1997) and starts from the observation that there are numerous taxes that affect firms and which do not fall on capital, such that taxes on capital, by themselves, are not sufficient to explain the location and investment decision of firms. Taxes that can also play a role are sales taxes, personal income taxes and payroll taxes, import and export duties, etc. As some of these taxes are different across the Canadian provinces (and even more so across the OECD countries), they may influence the existence, the pattern and the degree of tax competition between provinces/countries.

4. THE EFFECTIVE TAX RATE ON THE MARGINAL PRODUCTION COSTS

The majority of tax competition studies reviewed in the previous section study exclusively capital taxes. Where effective taxes are used, the marginal/average effective tax rate on capital reflects the taxation associated with the marginal/average unit of capital when an extra dollar of capital investment is undertaken.

McKenzie et al. (1997) argue that such measures fail to reflect the overall tax burden that companies face in different jurisdictions. They propose a different measure of effective taxes by defining the effective tax rate on marginal costs (ETRMC) as the increase in the marginal cost of production due to the imposition of different taxes on firm's inputs and outputs. Thus their model of tax aggregation starts from the production, rather than the investment decision of a firm and their measure of effective taxes accounts not just for taxes on capital, but for taxes on other factors of production (such as labour) that may influence the location decision of the firm.

The ETRMC is a function of the effective tax rates on the different inputs used by firms.

Thus the first step in constructing the ETRMC consists in calculating the effective tax rates on each input, which are then aggregated in the second stage based on the particular shape of the marginal cost function. This in turn depends on the functional form assumed for the production function of the firm.

Based on this approach Beaulieu, McKenzie, Vu, and Wen (2004) construct a data set of effective tax rates on marginal costs for 21 manufacturing industries[5] in the largest six Canadian provinces[6] for the period 1970-97. Contrary to the general belief that taxes in Canada have decreased over the last three decades, the ETRMCs have generally increased, despite declines in various statutory tax rates. As explained by the authors, this is mainly due to the increase in labour taxes, which are completely ignored in the traditional measures of effective average and marginal tax rates on capital.

The ETRMC data employed in this paper corresponds to a Cobb-Douglas production function. For this functional form, the provincial ETRMC (τ) in any industry is calculated as:

$$\tau = (1+\beta_{SB}\tau_{SB})^{A_{SB}}(1+\beta_{ME}\tau_{ME})^{A_{ME}}(1+\beta_P\tau_P+\beta_S\tau_S+\beta_{PI}\tau_{PI})^{A_L}-1 \quad (1)$$

The terms in the first two brackets correspond to the effective tax rate on capital where τ_{SB} and τ_{ME} represent the effective tax rates on Structures and Building (SB) and Machinery and Equipment (ME) respectively, the two types of capital considered in this calculation. The effective tax rate on labour is reflected by the terms in the last bracket, being a combination of the payroll tax rate τ_P sales tax rate τ_S and personal income tax rate τ_{PI}. The parameter β_i represents the tax shifting factor associated with each tax, or the amount by which an increase in any of these taxes will be transferred onto the user

[5] The industries are: Food (FO), Beverages (BE), Tobacco (TO), Rubber (RU), Plastic (PL), Leather (LE), Textile (TX), Clothing (CL), Wood (WO), Furniture (FU), Paper (PA), Printing and Publishing (PP), Primary Metal (PM), Metal Fabrication (MF), Machinery (MA), Transportation and Equipment (TE), Electrical (EL), Mineral (MI), Petroleum (PE), Chemical (CH), and Miscellaneous Manufacturing (MM).

[6] From East to West: Quebec (QC), Ontario (ON), Manitoba (MA), Saskatchewan (SK), Alberta (AB), and British Columbia.

cost of one input for a firm. Firms act as demanders in the market for inputs and the tax shifting factor β_i will depend on the relative elasticities of demand and supply in each input market. For SB and ME, β equals 1, i.e. an increase in any of the corresponding taxes is entirely borne by the firm. β_P is set to 0.5, while both β_S and β_{PI} equal 0.3. The A_i terms represent the input shares for SB, ME and labour, which are allowed to vary across industries.

Appendix A illustrates graphs representing the ETRMC in 6 of the 21 industry for the six provinces. The ETRMCs generally declined in the beginning of '70s, increased for the rest of '70s and '80s, and generally declined during '90s. The ETRMCs show a substantial variability across industries and provinces. While for the Clothing industry the ETRMCs in all provinces stayed below 16% throughout the 1970-97 period, for Beverages they increased above 30-35%. While Alberta displays the lowest ETRMCs in all industries, largely due to the absence of a provincial sales tax, the ETRMC's tend to be similar in the remaining five provinces.

There is however a feature of the ETRMC data that needs to be addressed before employing it for the study of Canadian tax competition. In their original form, the ETRMCs reflect the provisions of both the federal and the provincial tax systems. Using the raw data to estimate tax reaction functions between the six Canadian provinces may result in spurious evidence of tax competition when tax changes initiated by the federal government affect the effective tax rates in all provinces.

One way to solve this issue is to decompose the ETRMC into a provincial (τp) and a federal (τf) component. The provincial component is obtained by 'switching off' the federal elements in the capital tax (i.e. by setting the federal capital cost allowance rate to zero) and by considering only the payroll,[7] sale and personal income taxes raised at the

[7] Like the overall payroll taxes in the original ETRMC dataset, the federal and provincial components of payroll taxes for 1980-97 are taken from Lin (2001). The federal payroll taxes are the Unemployment Insurance premiums and the Canada/Quebec Pension Plan contributions, while the provincial payroll taxes are the Workers Compensation

provincial level. The federal component is constructed similarly.

Figures 7 to 12 in Appendix B illustrate the overall ETRMC together with the provincial and the federal components in one particular industry for each of the six Canadian provinces. In all cases, the provincial ETRMC is lower than the federal ETRMC, and they both display an upward slopping trend.

The separation of the ETRMC into a federal and a provincial ETRMC creates the possibility of estimating not just horizontal tax reaction functions in provincial ETRMC for the six provinces, but also vertical tax reaction functions by looking at the interaction between the provincial and the federal ETRMC.

5. ESTIMATION

To estimate tax reaction functions among jurisdictions or countries, the effective tax rates in each jurisdiction are regressed against the effective taxes in all the other jurisdictions or some average across the competing jurisdictions.

As most empirical papers analyze tax competition among groups of more than ten countries or jurisdictions, the limited volume of data makes it virtually impossible to estimate tax reaction functions of each jurisdiction to each of the others. In this case it is typical to estimate a tax reaction function of each jurisdiction to some weighted or unweighted average capital tax rate in all the other jurisdictions. For the weighted average, the weights are given usually by some measure of the size of each jurisdiction, like GDP (to capture the possibility that each jurisdictions is more concerned to changes in taxes in the larger competing jurisdictions), by the reciprocal of the distance based on the gravity equation (to account for the possibility that each jurisdiction may be more interested in changes in the tax system that occur in the neighbouring jurisdictions), or by

premiums and the provincial healt/post-secundary education taxes levied by Quebec, Manitoba and Ontario. For 1970-1980, the data on the contributions to the Health services fund in Quebec is taken from Kesselman (1994).

some measure of the volume of trade between jurisdictions. Although some methods of averaging may be superior to others, they all constrain each jurisdiction to react to changes in the tax system in the others in a pre-defined manner. Moreover, as long as the theory allows for both positively and negatively sloped tax reaction functions, reactions in different directions would partly cancel each other when these slopes are averaged and thus the degree of tax competition is underestimated.

The data set employed in this paper has the advantage of spanning three dimensions- 28 years, 21 industries, and six provinces- with the number of competing jurisdictions relatively small compared to the other two dimensions. The resulting 588 observations on effective taxes in each province makes it possible to estimate tax reaction functions of each province to each of the other five provinces (thus a total of 30 tax competition coefficients), removing any *a priori* constraints on the relative importance for a jurisdiction of the effective taxes in any of the five competing provinces.

To capture the tax reaction function of any jurisdiction (*i*) to any of the remaining five provinces (-*i*), the equation to be estimated is:

$$\tau p_{i,j,t} = \sum \beta_{-i} \tau p_{-i,j,t} + \gamma \tau f_{i,j,t} + \mathbf{X}_{i,t}\boldsymbol{\delta} + \alpha_{i,j} + \lambda_{i,t} + u_{i,j,t} \quad (2)$$

where $\tau p_{i,j,t}$ represents the provincial ETRMC in province *i,* industry *j* at time *t*, $\tau p_{-i,j,t}$ represents the provincial ETRMCs in industry *j* in each of the five competing provinces $-i$, $\tau f_{i,j,t}$ is the federal component of ETRMC in industry *j* of province *i*, $\mathbf{X}_{i,t}$ is a vector of control variables for province *i*, $\alpha_{i,j}$ represents industry fixed effects (to control for the possibility that capital may be more or less mobile in some sectors than others), $\lambda_{i,t}$ are time specific effects and $u_{i,j,t}$ is the error term. Note that while we allow for a different intercept for each industry, the slope of the reaction functions is constrained to be the same across industries.

Equation (2) is estimated separately for each of the six provinces. Two issues regarding the specification and estimation procedure deserve further explanation.

5.1.Control variables

While the object of this study is the estimation of tax reaction functions, the tax rates in each province are not determined just by strategic responses to choices made by the other provinces. Other fiscal variables at the provincial and federal level may affect a province's tax policy. One potentially important factor in this regard is the size of the debt of the provincial governments. A large provincial debt may preclude the provincial government from cutting taxes in response to tax cuts in other provinces, or may even force the provincial government to increase taxes, although strategic interaction with the other governments may dictate otherwise. Thus for each province *i* the first two lags of the provincial net debt-to-GDP ratio NDY_i are included in the vector of provincial controls.[8, 9]

Business cycles as well as the economic conditions in each province and in Canada in general may also influence the provincial and federal tax policy, which is in turn reflected by the effective taxes in each province. The provincial and federal governments may try to boost the economy during recessions by reducing taxes, increasing government purchases or a combination of the two. Therefore the provincial unemployment rate u_i and the industrial capacity utilization rate *ICUR* are also included in the set of controls. Other control variables to account for changes in economic conditions at the national level that may affect taxes in all provinces are the real interest rate *r*, the inflation rate π

[8] The provincial net debt is defined as Excess of Financial Assets over Direct Liabilities minus Liabilities of Employee Pension Plans.

[9]Using the lagged rather than the contemporaneous value of NDY eliminates the possible endogeneity of this variable, and is encouraged by the fact that the NDY variables are highly persistent. The second lag is included to control for this persistency, and also because using the first two lags together represents the unconstrained version of including the lagged first difference of NDY.

and the Canadian-US dollar exchange rate *xr*. For Alberta and Saskatchewan, the two provinces collecting large oil and gas royalties, the price of oil *pwt* (Price of West Texas Intermediate Crude) is also included as control variable. The assumption is that an increase in the price of oil may increase the amount of royalties collected by the provincial governments and allow them to relax their fiscal policy, and thus it has a negative impact on provincial ETRMC.

A last group of controls is connected with the political conditions in each province. Kneebone and McKenzie (2001) use dummy variables to capture partisan and opportunistic effects on governments' fiscal choices and find them to have significant effects on changes in different fiscal variables. Therefore their variables are also considered in this study. A dummy variable is included to reflect the political orientation of the provincial government, whereby $DLEFT_i$[10] equals 1 if the provincial government in power during the first half of the fiscal year *t* is left-oriented.[11] Another control variable for each province *i* is $ELECT_i$, a dummy set to 1 for the fiscal year *t* if elections are held in the second half of fiscal year *t* or the first half of *t+1*. An additional control for the political conditions in each province is $LEFT_i$, which represents the share of left-wing seats in total seats within the provincial Legislatures. The expectation is that a stronger left wing at the provincial level may be associated with higher levels of taxes, even if the left is not in power.

The inclusion of these variables is motivated by the possibility that tax policy may be influenced in a certain direction by the political orientation of the government in charge during this period (the partisan effect) or by impending elections (the opportunistic effect).

[10] The provincial variable DLEFT corresponding to Alberta is not included in the results, since it takes the value zero for the entire period.

[11] As in Kneebone and McKenzie (2001), a left-wing government is considered to be one dominated by the Liberal Party, the New Democratic Party or Parti Québécois.

Finally, although most theoretical treatments of tax competition do not take place in a dynamic setting, it is very likely that governments do not adjust their tax rates abruptly, but rather try to follow a smooth adjustment process. If this is true, the provincial ETRMC in province *i* depends not only on the effective taxes in the rival provinces and the federal ETRMC, but also on its lagged value $\tau p_{i,j,t-1}$. The model is therefore estimated both in a static version (without the lagged dependant variable as regressor) and a dynamic version (with the lagged dependant variable as additional regressor).

The list of the effective tax rates and the control variables used, together with a short statistical summary, is reported in Appendix C, Table 1.

5.2. Estimation procedure

Since equation (2) is estimated separately for each of the six provinces, the provincial ETRMC variable for each province *i* appears in turn as a dependent variable (when the system is estimated for province *i*) and as an independent variable (when the system is estimated for each of the other five provinces –*i*). It is therefore obvious that there is an endogeneity problem associated with (2), since the ETRMCs in each province are influenced by, and in turn influence (at least theoretically) all the others. This endogeneity problem renders the OLS estimates inconsistent. The typical solution in the tax competition literature is to use an instrumental variables (IV)/ Two-Stage Least Squares (2SLS) estimation. [12]

The major issue that arises with any IV procedure is to find the right instruments for the endogenous right handside variables. For this paper there are five endogenous panel variables represented by the ETRMCs in the rival provinces, so the usually difficult problem of finding instruments is even more complicated by the need that these instruments span the 21 industries. One obvious candidate as instrument for each

[12] Regarding the federal effective taxes, I assume that the federal government acts as a Stackelberg leader in this model and announces its tax rates before the provinces make their choices. Thus the federal ETRMC can be treated as exogenous and included in the model with its current value.

provincial ETRMC is its lagged value. However, it is possible that the lagged values themselves are endogenous, which would render them unsuitable as instruments.

In fact, although the theory of tax competition treats taxes as the outcome of a game in which governments choose their taxes simultaneously, in practice fiscal policy takes time to design and implement and it is very likely that governments choose their tax variables based on the observed past choices of rival governments rather than the anticipated ones.

For these reasons, it is not the contemporaneous, but the lagged value of the provincial ETRMC in the rival jurisdictions that are included in equation (2).[13]

Regarding the estimation procedure, for the type of data with a fixed number of cross-sections observed over repeated periods of time OLS is problematic since it is typical to allow for temporally and spatially correlated errors as well as panel heteroskedasticity. One method to deal with this error structure is to use a generalized least squares (GLS) method (or feasible GLS), first described by Parks (1967). An alternative solution is to use OLS estimates but replace the OLS standard errors with panel-corrected standard errors (PCSE). Beck and Katz (1995) implement a Monte Carlo analysis to show that the GLS standard errors often underestimate the true variability of the coefficients by 50% or more, while the PCSE perform well for a variety of combinations of N (the number of cross-sections) and T (number of time periods). They also note that Parks' GLS technique is only usable when T is substantially larger than N.

In this paper, in addition to spatial correlation and heteroskedasticity the errors are also assumed to display serial correlation, and therefore the OLS estimation with PCSE is replaced by the Prais-Winsten estimation with PCSE (PW-PCSE). And since T is larger than N, although not substantially larger, the FGLS estimates are also reported.

[13] The fact that in the results to follow most of these lagged variables have estimated coefficients that are statistically significant does, in fact, testify against their suitability as instruments were the contemporaneous values of the ETRMCs used instead.

The introduction of the lagged dependant variable, however, complicates the estimation of the model, since the lagged dependant variable is correlated with the industry fixed effects. One possibility to correct for this effect is to use the Arellano and Bond (1991) GMM estimator. [14] Another possibility is to acknowledge that the bias of the fixed effects estimator increases with the number of cross sections and decreases with the number of time periods. [15] For this study, with 21 industries and 28 time periods, the bias is anticipated to be considerably smaller than for the typical panel data with a large number of cross sections and usually less than 10 time periods, so the FGLS and PW-PCSE estimates may still perform reasonably well in the presence of the lagged dependant variable.

Working with provinces within a single country and controlling for an array of macroeconomic variables ensures that most exogenous shocks that might result in spurious evidence of tax reaction functions are accounted for. The remaining shocks, if any, that might affect all the tax rates in a given year can be controlled for by introducing year fixed effects. However in this study, since the provincial control variables are common across all industries, their influence on the provincial ETRMC will be 'swallowed' by the time fixed effects. The model is thus estimated both with and without year fixed effects, but the preferred estimates are those obtained without year effects.

5.3. Results

Tables 2 to 7 in Appendix C show the estimation results for both the static and dynamic versions of the model, with and without year fixed effects. Columns (1) and (2) report the FGLS and, respectively, the PW-PCSE estimates of the static model without the year

[14] This estimator is consistent as long as the error term in the levels equation is not autocorrelated, which implies that the error term in the first-difference equation has negative first-order autocorrelation, and 0 second order autocorrelation. For all the provinces except Ontario the lagged dependant variable is instrumented by three lagged values. For Ontario, since the null hypothesis of no second order autocorrelation is rejected when three lags are used but not when two lags are used, the latter specification is preferred.

[15] Baltagi (2005) pp. 135-136.

fixed effects. Columns (3) to (5) estimate the dynamic model using the FGLS, PW-PCSE and AB-GMM methods, again without year fixed effects. Columns (6), (7) and (8) correspond to columns (2), (4) and (5), respectively, this time with year fixed effects.

For the reasons mentioned in the previous section the preferred sets of estimates are those from the regressions without year fixed effects. Of these, the FGLS and PW-PCSE estimates are very similar, the major difference among them being the size of the standard errors, which are much more conservative for the PW-PCSE estimates, as predicted by Beck and Katz (1995). The following discussion will therefore concentrate on the results obtained with PW-PCSE in columns (2) and (4) and their comparison with the AB-GMM estimates of the dynamic model in column (5).

For the province of Quebec, all the results in column (1) to (5) are very similar. For the static model, the PW-PCSE estimates in column (2) are positive for two out of the five competing provinces. Quebec displays positively sloped tax reaction functions with respect to Alberta and Saskatchewan, with coefficients equal to 0.7 and 0.51, respectively, in the static model, and 0.74 and 0.47 in the dynamic model. Thus, a percentage point increase in provincial ETRMC in Alberta or Saskatchewan is associated with an increase of effective taxes in Quebec by almost three quarters or, respectively, almost half of a percentage point.

The three negative tax competition coefficients in the static model in column (2) are all statistically insignificant, but two of them, with respect to Ontario and British Columbia, are significant in the dynamic version in column (4) and all three of them are significant in the AB-GMM estimation in column (5). It is noteworthy that Ontario and British Columbia are Canada's largest provinces aside from Quebec, and Ontario is also adjacent to Quebec. The magnitude of both the positive and the negative tax competition coefficients seems to be exacerbated by the introduction of the year effects in columns (6) to (8), and this is probably due to the fact that the tax competition coefficients also account for some of the effects of the provincial control variables that are lost in these regressions.

With regard to vertical tax competition, the coefficient of the federal ETRMC in Quebec is positive and significant at 1% in all eight specifications, indicating that an increase in the federal ETRMC is associated with an increase in provincial taxes in Quebec of 0.37 to 0.56 of a percentage point.

Ontario displays statistically significant tax reaction functions robust across all specifications only with respect to Alberta, with an estimated slope of around 0.3, and with respect to the federal government, with a slope around 0.35 in columns (2) and (4). The sign and significance of these coefficients are preserved as year effects are introduced, and the magnitude alters only slightly. Ontario's tax reaction function with respect to British Columbia appears also to be positively sloped with the GLS and GMM estimations in columns (1), (3) and (5), but it becomes statistically insignificant when considering PCSE, and it does turn negative as year effects are introduced. For the remaining provinces, the results are insignificant in the models without year effects, and only the introduction of year effects makes them significant, but also less plausible (especially the coefficient of more than 1 associated with taxes in Saskatchewan).

For Manitoba, the estimated slopes of the tax reaction functions are positive with respect to Alberta (around 0.45 in columns (2) and (4), significant at 5%) and negative with respect to Quebec (around -0.2, significant at 10% only) and Ontario (-0.5 in column (4), significant at 10%). Little can be said about the effect of its neighbour Saskatchewan's effective taxes on taxes in Manitoba, since the coefficient changes its sign and statistical significance as the estimation method changes. Regarding vertical tax competition, a percentage point increase in the federal effective taxes in Manitoba is associated with 0.4 to 0.5 of a percentage point increase in the provincial ETRMC.

Saskatchewan displays positively sloped tax reaction function with respect to taxes in Alberta, with a coefficient that is around 0.5-0.7. Regarding its other neighbour, Manitoba, the results are inconclusive. The coefficient is positive and significant in the static model, either without or with year effects, but becomes negative with both the GLS and PW-PCSE models as the model becomes dynamic and/or year effects are introduced. Like the provinces before, an increase in federal taxes is associated with an increase in effective tax rates in Saskatchewan, with a magnitude of approximately 0.5.

All the provinces considered so far display positively sloped tax reaction functions with respect to Alberta. The reciprocal is not true. There is some evidence of negative tax competition coefficients with respect to Quebec and Saskatchewan, but none of the PW-PCSE estimates are significant at 5%. If year effects are disregarded , Alberta does seem to display positively sloped tax reaction functions with respect to its Western neighbour, British Columbia, although the magnitude changes significantly from the static model (0.7) to the dynamic models (0.2). A similar distinction between the static and dynamic models exists for the estimated coefficient of taxes in Ontario: the coefficient of 0.4 in the static models becomes negative, around -0.15, in the dynamic models.

While Alberta does seem to care about federal taxes, like the other provinces, its reaction is the flattest: a percentage point increase in federal taxes is associated with only a 0.1-0.2 of a percentage point increase in taxes in Alberta.

For British Columbia the results are more homogenous. British Columbia does seem to react positively to changes in the tax rates in the closest two provinces, Alberta and Saskatchewan, although the magnitude of the coefficients declines slightly in the dynamic models compared to the static ones, from around 0.7 and 0.9, respectively, to 0.6 and 0.7. British Columbia's tax reaction function with respect to the largest Canadian provinces, Ontario and Quebec, are negatively sloped and quite steep in the case of Ontario, with magnitudes of (minus) 0.75 and more. This result may be explained by the fact that these are also the provinces located the furthest away from British Columbia, which seems to care much more about its neighbours. With respect to Manitoba the results are rather inconclusive, while the estimated slope of the vertical tax reaction function of British Columbia is close to 0.5, robust to all specifications.

Regarding the control variables, for all provinces except Quebec a larger provincial Net-Debt-to-GDP ratio carried forward from the previous year is associated with an increase in the provincial taxes. For the same provinces, the effect of the Net-Debt-to-GDP lagged two years is negative in all but one specification, and of magnitudes relatively similar to those of the lagged NDY. This may suggest that an increase in the Net-Debt-to-GDP ratio (loosely speaking, the budget deficit per dollar of GDP) lagged one period has a positive impact on provincial effective taxes.

There is support for the partisan effect in Ontario and to some extent Saskatchewan, where left-oriented governments in power are associated with higher effective taxes, but the opposite happens in British Columbia and Quebec. On the other hand, a stronger left wing in the provincial Legislature, reflected by the variable LEFT, is associated with higher levels of provincial taxes in all provinces except Saskatchewan and Alberta, although some coefficients are not statistically significant. The proximity of provincial elections as reflected by the ELECT variable is associated with a definite decline in taxes only in British Columbia, where effective taxes seem to decline by 0.3 of a percentage point, with some weak evidence for Ontario and Alberta as well.

For Saskatchewan and Alberta, as expected, the increase in the price of oil, the *pwt* variable, seems associated with a decline in taxes. While the result is not so striking for Saskatchewan, it is quite impressive for Alberta, where a $1 increase in the price of a barrel of oil is associated with more than 0.3 percentage point decline in the effective tax rates on marginal cost in the preferred specifications.

It is worth recalling that positive estimated slopes of the tax reaction functions support the idea that taxes in competing jurisdictions tend to move in the same direction, which is consistent with both the race to the top and the race to the bottom hypothesis. The only way to distinguish between the race to the top and the race to the bottom is to analyze the dynamics of the tax rates and, as shown in Appendix A and B, the ETRMCs and their federal and provincial components display an upward sloping trend. Thus, if there is any race in Canadian effective tax rates, it seems to be a race to the top.

As for the negative tax competition coefficients, they do not fit the original ZM model and its extensions, but they are one possible outcome in the tax competition models developed in Mintz and Tulkens (1985) and Brueckner and Saavedra (2001), although these models deal with commodity and property tax competition, respectively. Negatively sloped tax reaction function are also consistent with the Tiebout-type models that predict that local governments 'specialize' in taxes-public services bundles suitable for their public.

6. SUMMARY AND CONCLUSIONS

This paper is the first to employ data on the effective tax rates on marginal cost (ETRMC) as defined by McKenzie et al. (1997) to estimate tax reaction functions. The ETRMCs are constructed based on the production decision of the firm and reflect not just taxes on capital, but all taxes on firms' inputs and outputs that may influence their location decision. This measure of taxes has three desirable properties for the analysis of tax competition: they are *effective* taxes (as opposed to statutory), marginal (as opposed to average), and they reflect all the characteristics of the tax system in one jurisdiction that may be of interest for firms, not just taxes on capital.

A dataset of ETRMCs for the six largest Canadian provinces and 21 manufacturing industries spanning the 1970-1997 period is employed to study the pattern of tax competition in Canada. The estimated model has a static and a dynamic version, either with or without time effects. The estimated slopes of the tax reaction functions for the 30 pairs of provinces are relatively robust across the model specification and the estimation method.

The results are very supportive for the vertical tax competition, with all but two coefficients being positive and significant at the 1% significance level. However, the results are only partly consistent with the hypothesis of horizontal tax competition, in the sense that many of the tax competition coefficients are statistically insignificant.

The dynamics of effective taxes, both federal and provincial, for the period 1970-97 and the fact that many of the estimated slopes of the provincial tax reaction functions are negative rejects the hypothesis of a race to the bottom in taxes. Even the existence of positively sloped tax reaction functions between provinces is just a necessary, but by no means a sufficient condition for the race-to-the-bottom view, since it is also consistent with a race to the top in taxes, or even an oscillation of taxes in all provinces, as long as the movements are relatively synchronized.

However the fact that all provinces display positively sloped tax reaction function that are rather steep and highly significant with respect to Alberta, the province with the lowest provincial taxes in all industries, may be an indication of the fact that Canadian provinces are interested in decreasing their taxes or at least not increasing them too much. While we fail to observe a race to the bottom in taxes in Canada, it is possible that taxes would be much higher in the absence of tax competition, i.e. if inputs were not mobile and provincial governments did not have to take into account the decisions of rival governments.

There are some directions in which this empirical study can be furthered. Expanding the dataset beyond 1997 would add valuable information. The most dramatic changes in the statutory corporate income tax rates in Europe took place in the past ten years and it may be the case that the effective tax rates on marginal costs in Canada have also continued to decrease after 1997. Analyzing separately tax competition in effective tax rates on capital and labour, besides the effective taxes on marginal costs should reveal which of the two input taxes is the main driving force behind the ETRMCs and also whether the hypothesis that capital effective tax rates have decreased in the past few decades on the expense of labour taxes is confirmed for Canada.

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Appendix A. Effective Tax Rate on Marginal Cost, Selected Industries

Fig. 1. Beverage Industry

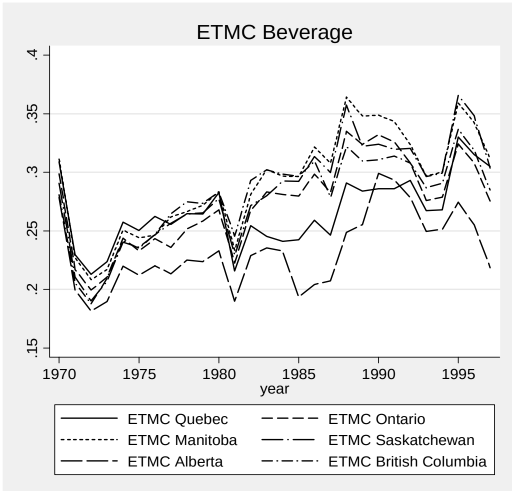


Fig. 2. Chemical Industry

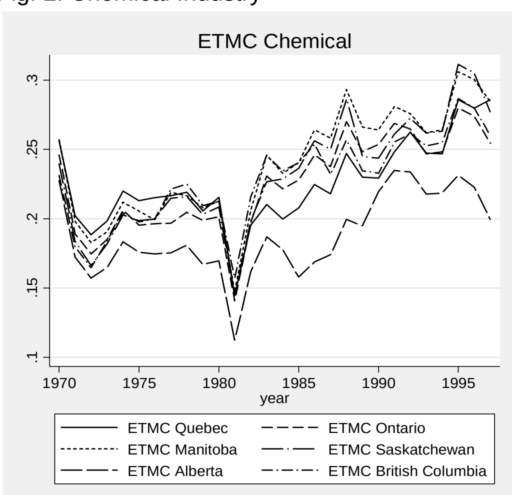


Fig. 3. Clothing Industry

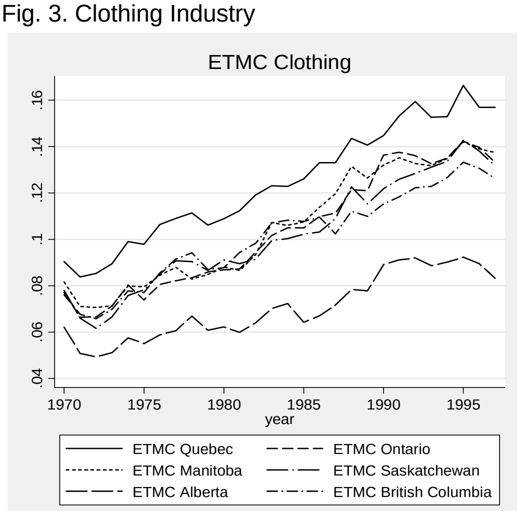


Fig. 4. Plastic Industry

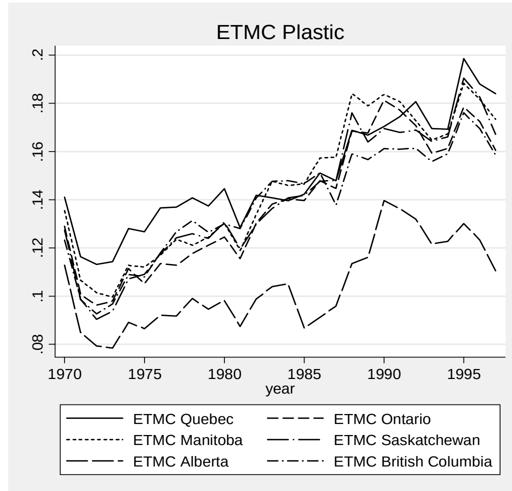


Fig. 5. Transportation Equipment Industry

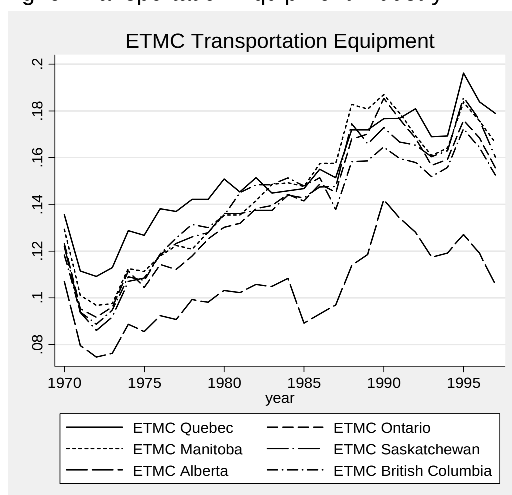
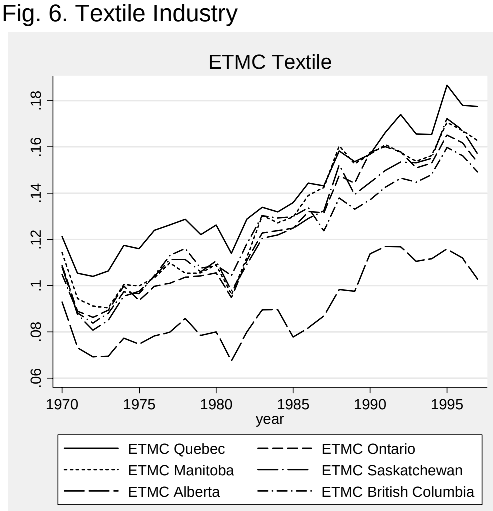


Fig. 6. Textile Industry



Appendix B. Effective Tax rate on Marginal Cost, Total, Federal and Provincial

Fig. 7. Effective Tax Rates Quebec

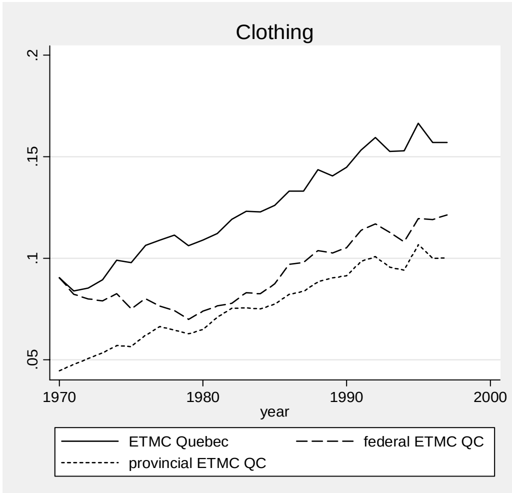


Fig. 10. Effective Tax Rates Saskatchewan

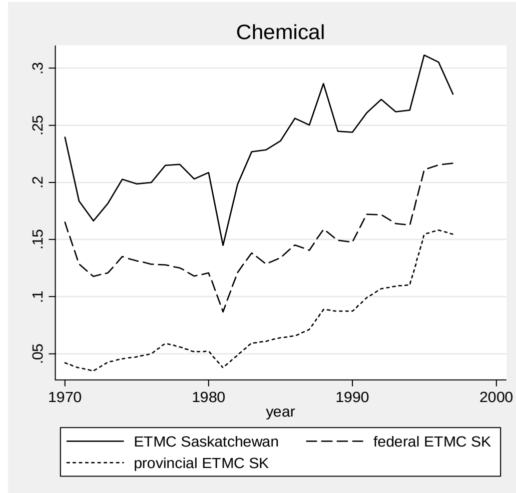


Fig. 8. Effective Tax Rates Ontario

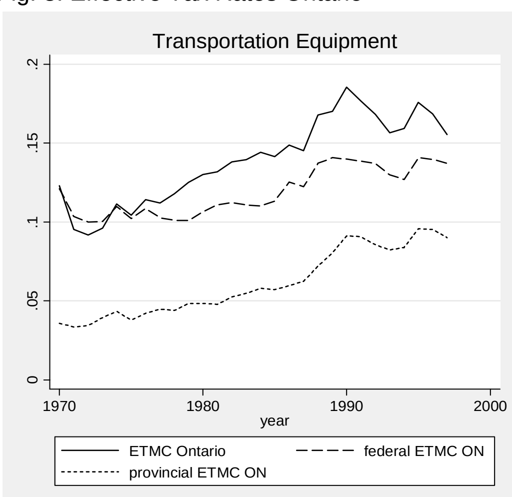


Fig. 11. Effective Tax Rates Alberta

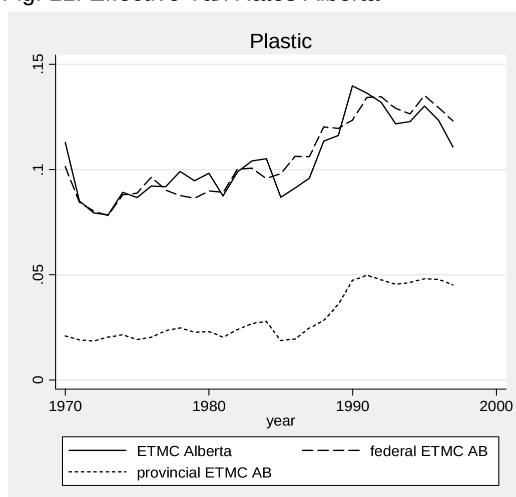


Fig. 9. Effective Tax Rates Manitoba

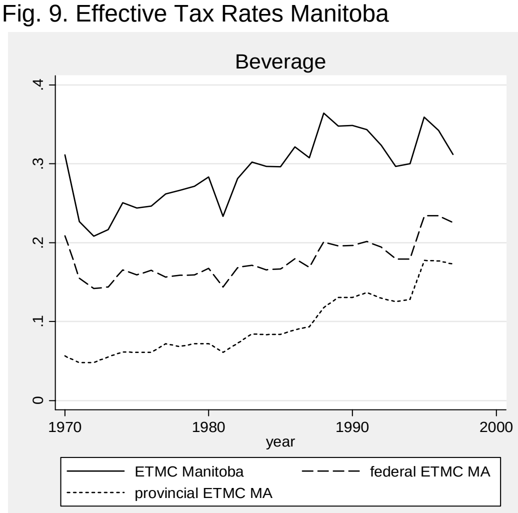
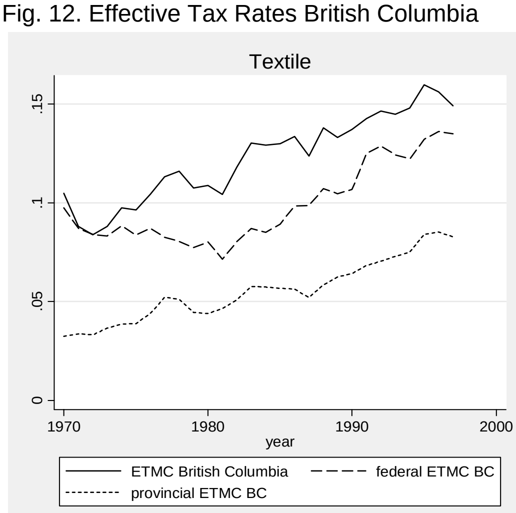


Fig. 12. Effective Tax Rates British Columbia



Appendix C. Data and Estimation Results

TABLE 1. Variable names and description

Variable	Description	Mean	Std. Dev.	Min	Max
dleft_ab	provincial government Left oriented Alberta	0.000	0.000	0	0
dleft_bc	provincial government Left oriented British Columbia	0.286	0.452	0	1
dleft_ma	provincial government Left oriented Manitoba	0.536	0.499	0	1
dleft_on	provincial government Left oriented Ontario	0.250	0.433	0	1
dleft_qc	provincial government Left oriented Quebec	0.964	0.186	0	1
dleft_sk	provincial government Left oriented Saskatchewan	0.643	0.480	0	1
elect_ab	pre-election year Alberta	0.286	0.452	0	1
elect_bc	pre-election year British Columbia	0.250	0.433	0	1
elect_ma	pre-election year Manitoba	0.250	0.433	0	1
elect_on	pre-election year Ontario	0.286	0.452	0	1
elect_qc	pre-election year Quebec	0.250	0.433	0	1
elect_sk	pre-election year Saskatchewan	0.250	0.433	0	1
left_ab	% Left seats in Alberta Legislature	13.4%	14.8%	1.3%	38.6%
left_bc	% Left seats in British Columbia Legislature	50.7%	22.2%	30.9%	90.7%
left_ma	% Left seats in Manitoba Legislature	53.7%	7.4%	42.1%	63.2%
left_on	% Left seats in Ontario Legislature	57.3%	19.6%	33.3%	87.7%
left_qc	% Left seats in Quebec Legislature	91.7%	12.6%	46.3%	100.0%
left_sk	% Left seats in Saskatchewan Legislature	67.2%	31.7%	14.1%	100.0%
ndy_ab	(Net) Debt-to-GDP ratio Alberta	-10.2%	9.5%	-23.9%	5.2%
ndy_bc	(Net) Debt-to-GDP ratio British Columbia	-1.6%	4.9%	-8.9%	5.3%
ndy_ma	(Net) Debt-to-GDP ratio Manitoba	14.2%	10.0%	-0.1%	30.2%
ndy_on	(Net) Debt-to-GDP ratio Ontario	11.8%	6.5%	3.8%	27.9%
ndy_qc	(Net) Debt-to-GDP ratio Quebec	21.6%	4.8%	14.0%	32.0%
ndy_sk	(Net) Debt-to-GDP ratio Saskatchewan	6.7%	15.9%	-8.1%	37.9%
t_ab	effective tax rate on marginal cost (ETMC) Alberta	10.6%	5.1%	-3.0%	29.9%
t_bc	effective tax rate on marginal cost (ETMC) British Columbia	14.0%	5.7%	-1.9%	33.7%
t_ma	effective tax rate on marginal cost (ETMC) Manitoba	14.6%	6.2%	-2.2%	36.4%
t_on	effective tax rate on marginal cost (ETMC) Ontario	14.1%	5.7%	-1.4%	33.5%
t_qc	effective tax rate on marginal cost (ETMC) Quebec	15.5%	4.8%	2.1%	33.0%
t_sk	effective tax rate on marginal cost (ETMC) Saskatchewan	14.2%	6.0%	-1.6%	36.6%
tf_ab	federal ETMC Alberta	10.8%	3.2%	1.5%	21.0%
tf_bc	federal ETMC British Columbia	10.8%	3.3%	0.9%	22.3%
tf_ma	federal ETMC Manitoba	10.4%	3.4%	0.8%	23.4%
tf_on	federal ETMC Ontario	12.0%	3.0%	2.3%	22.5%
tf_qc	federal ETMC Quebec	11.1%	3.3%	1.2%	24.6%
tf_sk	federal ETMC Saskatchewan	10.2%	3.6%	0.8%	24.4%

TABLE 1. Variable names and description *(cont.)*

Variable	Description	Mean	Std. Dev.	Min	Max
tp_ab	provincial ETMC Alberta	3.1%	1.6%	0.2%	10.1%
tp_bc	provincial ETMC British Columbia	5.9%	2.1%	2.0%	15.7%
tp_ma	provincial ETMC Manitoba	6.2%	2.5%	1.4%	17.8%
tp_on	provincial ETMC Ontario	6.2%	2.4%	2.0%	15.3%
tp_qc	provincial ETMC Quebec	7.8%	2.3%	4.2%	18.1%
tp_sk	provincial ETMC Saskatchewan	5.9%	2.5%	1.9%	18.6%
uab	unemployment rate Alberta (fiscal year)	6.8%	2.4%	3.6%	11.2%
ubc	unemployment rate British Columbia (fiscal year)	9.3%	2.5%	5.3%	15.0%
uma	unemployment rate Manitoba (fiscal year)	6.8%	1.7%	3.2%	9.7%
uon	unemployment rate Ontario (fiscal year)	7.1%	2.1%	3.4%	10.9%
uqc	unemployment rate Quebec (fiscal year)	10.3%	2.3%	6.1%	14.7%
usk	unemployment rate Saskatchewan (fiscal year)	5.8%	1.8%	2.7%	8.4%
i	nominal interest rate	8.5%	3.4%	3.2%	17.8%
icur	industrial capacity utilization rate	80.4	4.1	67.2	87.3
pi	inflation rate	5.6%	3.5%	0.6%	12.1%
r	real interest rate	2.8%	3.4%	-4.2%	7.5%
xr	nominal exchange rate CAD/USD	1.18	0.13	0.98	1.38
pwt	price of west texas intermediate crude (thousands CAD)	0.023	0.012	0.003	0.045

TABLE 2. Coefficient estimates for Quebec

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation method[a]	**FGLS**	**PW-PCSE**	**FGLS**	**PW-PCSE**	**AB-GMM**	**PW-PCSE**	**PW-PCSE**	**AB-GMM**
L.tp_qc			0.632***	0.633***	0.631***		0.685***	0.660***
			(0.009)	(0.103)	(0.052)		(0.100)	(0.028)
L.tp_on	-0.246***	-0.253	-0.498***	-0.495**	-0.559***	-1.145	-1.165*	-1.249***
	(0.026)	(0.197)	(0.018)	(0.181)	(0.126)	(0.741)	(0.453)	(0.157)
L.tp_ma	-0.001	-0.050	-0.113**	-0.137	-0.190***	0.257	-0.353	-0.225
	(0.053)	(0.208)	(0.040)	(0.219)	(0.025)	(0.984)	(0.617)	(0.229)
L.tp_sk	0.464***	0.505*	0.458***	0.467*	0.409***	1.513**	1.448***	1.311***
	(0.044)	(0.238)	(0.029)	(0.216)	(0.075)	(0.584)	(0.379)	(0.083)
L.tp_ab	0.636***	0.699***	0.724***	0.743***	0.664***	0.933***	0.861***	0.803***
	(0.024)	(0.192)	(0.013)	(0.143)	(0.038)	(0.255)	(0.161)	(0.044)
L.tp_bc	-0.371***	-0.385	-0.528***	-0.523*	-0.414***	-1.324*	-0.957**	-0.846***
	(0.034)	(0.269)	(0.022)	(0.275)	(0.074)	(0.577)	(0.351)	(0.064)
tf_qc	0.547***	0.558***	0.492***	0.500***	0.531***	0.422***	0.365***	0.379***
	(0.006)	(0.072)	(0.003)	(0.067)	(0.061)	(0.077)	(0.054)	(0.062)
L.ndy_qc	0.070***	0.076	-0.026***	-0.017	-0.022			
	(0.015)	(0.049)	(0.007)	(0.058)	(0.014)			
L2.ndy_qc	0.006	0.001	0.027***	0.010	0.006			
	(0.012)	(0.043)	(0.007)	(0.047)	(0.011)			
uqc	0.131***	0.133	0.053***	0.057	0.046***			
	(0.023)	(0.082)	(0.008)	(0.089)	(0.014)			
elect_qc	0.000	-0.000	0.000	0.000	-0.000	-0.007**	-0.017*	0.017***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.003)	(0.008)	(0.001)
dleft_qc		-0.047*		-0.062**				
		(0.022)		(0.024)				
left_qc	0.023***	0.027**	0.016***	0.019*	0.015***			
	(0.003)	(0.010)	(0.001)	(0.011)	(0.002)			
rho	0.283	0.283	-0.056	-0.056		0.333	-0.079	
Industry effects	YES	YES	YES	YES	NO	YES	YES	NO
Time effects	NO	NO	NO	NO	NO	YES	YES	YES
Number of observations	546	546	546	546	525	546	546	546
Industries	21	21	21	21	21	21	21	21
R^2		0.933		0.973		0.964	0.992	
AR(1)[b]					-2.77 (0.006)			-2.45 (0.014)
AR(2)[b]					-1.53 (0.126)			-1.76 (0.078)

Notes: Standard errors in parentheses. *, **, and ***, respectively, indicate statistical significance at the 0.10, 0.05, and 0.01 levels.
[a]FGLS= feasible GLS estimation; PW-PCSE= Prais-Winsten estimation with panel-corrected standard errors; AB-GMM= Arellano and Bond (1991) GMM estimation (all variables first differenced).
[b]Arellano-Bond *z* statistic (P value). H_0: no autocorrelation.

TABLE 3. Coefficient estimates for Ontario

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation method[a]	FGLS	PW-PCSE	FGLS	PW-PCSE	AB-GMM	PW-PCSE	PW-PCSE	AB-GMM
L.tp_on			0.175***	0.179	-0.177*		-0.599*	-1.010***
			(0.016)	(0.153)	(0.072)		(0.331)	(0.115)
L.tp_qc	-0.003	-0.005	-0.028***	-0.031	-0.058	-0.182*	-0.199**	-0.270***
	(0.002)	(0.072)	(0.004)	(0.072)	(0.039)	(0.077)	(0.075)	(0.029)
L.tp_ma	0.158***	0.162	0.032	0.026	0.043	-0.441	0.063	0.348*
	(0.018)	(0.151)	(0.021)	(0.198)	(0.060)	(0.365)	(0.445)	(0.172)
L.tp_sk	0.008	0.020	0.046*	0.060	0.080	1.165***	1.084***	1.191***
	(0.020)	(0.173)	(0.021)	(0.176)	(0.087)	(0.277)	(0.275)	(0.057)
L.tp_ab	0.297***	0.310***	0.260***	0.272**	0.384***	0.543***	0.567***	0.605***
	(0.008)	(0.090)	(0.008)	(0.093)	(0.041)	(0.118)	(0.115)	(0.013)
L.tp_bc	0.257***	0.243	0.261***	0.252	0.324***	-0.586*	-0.598*	-0.688***
	(0.019)	(0.166)	(0.018)	(0.165)	(0.064)	(0.278)	(0.267)	(0.070)
tf_on	0.358***	0.358***	0.333***	0.334***	0.438***	0.375***	0.391***	0.392***
	(0.003)	(0.047)	(0.003)	(0.048)	(0.054)	(0.037)	(0.036)	(0.032)
L.ndy_on	0.128***	0.142**	0.125***	0.144**	0.138***			
	(0.018)	(0.055)	(0.014)	(0.055)	(0.014)			
L2.ndy_on	-0.075***	-0.092	-0.079***	-0.102*	-0.136***			
	(0.018)	(0.061)	(0.014)	(0.061)	(0.019)			
uon	-0.222***	-0.238***	-0.246***	-0.263***	-0.247***			
	(0.017)	(0.066)	(0.014)	(0.069)	(0.015)			
elect_on	-0.000	-0.001	-0.001**	-0.001	-0.000	0.007*	0.014**	0.007***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.004)	(0.005)	(0.001)
dleft_on	0.008***	0.008***	0.007***	0.007**	0.005***	0.000	-0.008	0.005***
	(0.001)	(0.002)	(0.000)	(0.002)	(0.001)	(0.004)	(0.005)	(0.001)
left_on	0.000	0.002	0.003**	0.003	-0.002			
	(0.001)	(0.004)	(0.001)	(0.004)	(0.002)			
rho	-0.051	-0.051	-0.067	-0.067		0.162	0.180	
Industry effects	YES	YES	YES	YES	NO	YES	YES	NO
Time effects	NO	NO	NO	NO	NO	YES	YES	YES
Number of observations	546	546	546	546	525	546	546	546
Industries	21	21	21	21	21	21	21	21
R^2		0.987		0.988		0.995	0.995	
AR(1)[b]					-3.71 (0.000)			-2.35 (0.019)
AR(2)[b]					-0.59 (0.558)			-2.61 (0.009)

Notes: Standard errors in parentheses. *, **, and ***, respectively, indicate statistical significance at the 0.10, 0.05, and 0.01 levels.
[a]FGLS= feasible GLS estimation; PW-PCSE= Prais-Winsten estimation with panel-corrected standard errors; AB-GMM= Arellano and Bond (1991) GMM estimation (all variables first differenced).
[b]Arellano-Bond *z* statistic (P value). H_0: no autocorrelation.

TABLE 4. Coefficient estimates for Manitoba

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation method[a]	FGLS	PW-PCSE	FGLS	PW-PCSE	AB-GMM	PW-PCSE	PW-PCSE	AB-GMM
L.tp_ma			1.114***	1.136***	0.773***		0.202	0.417
			(0.041)	(0.296)	(0.026)		(0.610)	(0.299)
L.tp_qc	-0.204***	-0.227*	-0.180***	-0.191*	-0.135***	-0.237*	-0.242*	-0.306***
	(0.010)	(0.128)	(0.009)	(0.107)	(0.034)	(0.104)	(0.104)	(0.040)
L.tp_on	-0.104**	-0.067	-0.520***	-0.523*	-0.158**	-1.106**	-1.212**	-1.596***
	(0.034)	(0.249)	(0.031)	(0.241)	(0.049)	(0.361)	(0.452)	(0.191)
L.tp_sk	0.384***	0.338	-0.059	-0.085	-0.114	1.445***	1.375***	1.544***
	(0.038)	(0.221)	(0.037)	(0.244)	(0.153)	(0.260)	(0.374)	(0.097)
L.tp_ab	0.408***	0.450**	0.438***	0.456**	0.366***	0.808***	0.803***	0.854***
	(0.016)	(0.167)	(0.013)	(0.142)	(0.049)	(0.156)	(0.158)	(0.013)
L.tp_bc	0.125**	0.133	-0.168***	-0.163	0.003	-0.474	-0.525	-0.628***
	(0.046)	(0.317)	(0.037)	(0.276)	(0.150)	(0.353)	(0.367)	(0.151)
tf_ma	0.371***	0.376***	0.388***	0.393***	0.402***	0.497***	0.497***	0.490***
	(0.006)	(0.071)	(0.006)	(0.063)	(0.041)	(0.051)	(0.051)	(0.046)
L.ndy_ma	0.125***	0.122**	0.124***	0.126***	0.154***			
	(0.015)	(0.040)	(0.014)	(0.035)	(0.011)			
L2.ndy_ma	-0.004	0.009	-0.086***	-0.083	-0.056***			
	(0.015)	(0.054)	(0.013)	(0.054)	(0.012)			
uma	-0.141***	-0.134	-0.196***	-0.186*	-0.218***			
	(0.041)	(0.122)	(0.036)	(0.107)	(0.018)			
elect_ma	0.001	0.001	0.001*	0.001	0.001***	-0.029***	-0.010	0.012***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.000)	(0.005)	(0.007)	(0.001)
dleft_ma	0.007***	0.008	-0.005**	-0.005	-0.004***	0.006	0.006	0.013***
	(0.002)	(0.005)	(0.002)	(0.006)	(0.001)	(0.005)	(0.005)	(0.001)
left_ma	0.004	0.004	0.032***	0.030	0.033***			
	(0.009)	(0.026)	(0.008)	(0.025)	(0.005)			
rho	0.093	0.093	-0.066	-0.066		0.194	0.187	
Industry effects	YES	YES	YES	YES	NO	YES	YES	NO
Time effects	NO	NO	NO	NO	NO	YES	YES	YES
Number of observations	546	546	546	546	525	546	546	546
Industries	21	21	21	21	21	21	21	21
R^2		0.969		0.981		0.992	0.992	
AR(1)[b]					-3.79 (0.000)			-2.39 (0.017)
AR(2)[b]					0.07 (0.943)			-1.97 (0.049)

Notes: Standard errors in parentheses. *, **, and ***, respectively, indicate statistical significance at the 0.10, 0.05, and 0.01 levels.
[a]FGLS= feasible GLS estimation; PW-PCSE= Prais-Winsten estimation with panel-corrected standard errors; AB-GMM= Arellano and Bond (1991) GMM estimation (all variables first differenced).
[b]Arellano-Bond *z* statistic (P value). H_0: no autocorrelation.

TABLE 5. Coefficient estimates for Saskatchewan

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation method[a]	**FGLS**	**PW-PCSE**	**FGLS**	**PW-PCSE**	**AB-GMM**	**PW-PCSE**	**PW-PCSE**	**AB-GMM**
L.tp_sk			1.533***	1.558***	1.366***		1.962***	2.104***
			(0.032)	(0.264)	(0.121)		(0.404)	(0.106)
L.tp_qc	-0.026***	-0.021	-0.179***	-0.189*	-0.275***	-0.167	-0.326**	-0.380***
	(0.006)	(0.115)	(0.008)	(0.081)	(0.034)	(0.166)	(0.107)	(0.040)
L.tp_on	-0.916***	-0.995***	-1.098***	-1.104***	-1.415***	-1.408*	-1.530**	-1.802***
	(0.021)	(0.277)	(0.026)	(0.236)	(0.137)	(0.612)	(0.486)	(0.198)
L.tp_ma	0.750***	0.763***	-0.184***	-0.180	0.178**	1.271*	-0.297	-0.194
	(0.027)	(0.228)	(0.036)	(0.262)	(0.066)	(0.587)	(0.660)	(0.311)
L.tp_ab	0.480***	0.500***	0.692***	0.717***	0.861***	0.498*	0.896***	0.938***
	(0.013)	(0.145)	(0.015)	(0.121)	(0.038)	(0.210)	(0.171)	(0.019)
L.tp_bc	0.371***	0.443*	-0.229***	-0.257	-0.335***	0.215	-0.365	-0.414*
	(0.038)	(0.222)	(0.028)	(0.225)	(0.062)	(0.528)	(0.388)	(0.175)
tf_sk	0.497***	0.501***	0.475***	0.474***	0.532***	0.520***	0.489***	0.490***
	(0.004)	(0.070)	(0.003)	(0.054)	(0.049)	(0.066)	(0.055)	(0.047)
L.ndy_sk	0.096***	0.108***	0.130***	0.141***	0.102***			
	(0.004)	(0.032)	(0.006)	(0.030)	(0.005)			
L2.ndy_sk	-0.052***	-0.063**	-0.061***	-0.072**	-0.071***			
	(0.004)	(0.024)	(0.006)	(0.023)	(0.004)			
usk	-0.249***	-0.270*	-0.222***	-0.259*	-0.190***			
	(0.018)	(0.141)	(0.029)	(0.132)	(0.030)			
elect_sk	0.000	-0.000	0.002***	0.002	0.002*	0.007	-0.014*	0.003*
	(0.000)	(0.002)	(0.000)	(0.002)	(0.001)	(0.012)	(0.007)	(0.002)
dleft_sk	0.004***	0.004	0.007***	0.006	0.009***	0.009	-0.026***	-0.021***
	(0.001)	(0.007)	(0.002)	(0.007)	(0.001)	(0.009)	(0.006)	(0.002)
left_sk	-0.018***	-0.019	-0.044***	-0.044***	-0.040***			
	(0.002)	(0.013)	(0.003)	(0.013)	(0.004)			
pwt	-0.060**	-0.079	-0.102**	-0.123	-0.200***			
	(0.018)	(0.163)	(0.031)	(0.156)	(0.040)			
rho	0.106	0.106	-0.143	-0.143		0.433	0.082	
Industry effects	YES	YES	YES	YES	NO	YES	YES	NO
Time effects	NO	NO	NO	NO	NO	YES	YES	YES
Number of observations	546	546	546	546	525	546	546	546
Industries	21	21	21	21	21	21	21	21
R^2		0.972		0.988		0.974	0.992	
AR(1)[b]					-3.90 (0.000)			-2.42 (0.016)
AR(2)[b]					-0.99 (0.321)			1.46 (0.145)

Notes: Standard errors in parentheses. *, **, and ***, respectively, indicate statistical significance at the 0.10, 0.05, and 0.01 levels.
[a]FGLS= feasible GLS estimation; PW-PCSE= Prais-Winsten estimation with panel-corrected standard errors; AB-GMM= Arellano and Bond (1991) GMM estimation (all variables first differenced).
[b]Arellano-Bond *z* statistic (P value). H_0: no autocorrelation.

TABLE 6. Coefficient estimates for Alberta

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation method[a]	**FGLS**	**PW-PCSE**	**FGLS**	**PW-PCSE**	**AB-GMM**	**PW-PCSE**	**PW-PCSE**	**AB-GMM**
L.tp_ab			0.765***	0.768***	0.779***		1.017***	1.139***
			(0.012)	(0.104)	(0.028)		(0.151)	(0.057)
L.tp_qc	-0.103***	-0.103	-0.074***	-0.078	-0.087***	-0.064	-0.175*	-0.232***
	(0.003)	(0.119)	(0.005)	(0.079)	(0.024)	(0.164)	(0.102)	(0.038)
L.tp_on	0.396***	0.394*	-0.150***	-0.162	-0.153***	0.032	-0.218	-0.461
	(0.012)	(0.218)	(0.018)	(0.197)	(0.030)	(0.609)	(0.431)	(0.290)
L.tp_ma	0.193***	0.215	0.341***	0.365*	0.432***	1.406*	0.887	0.817***
	(0.020)	(0.203)	(0.026)	(0.163)	(0.049)	(0.780)	(0.563)	(0.190)
L.tp_sk	-0.408***	-0.427*	-0.211***	-0.237	-0.312***	-1.028*	0.009	0.305**
	(0.017)	(0.225)	(0.022)	(0.174)	(0.026)	(0.450)	(0.351)	(0.099)
L.tp_bc	0.666***	0.667***	0.209***	0.234	0.131*	0.289	-0.787*	-0.910***
	(0.015)	(0.167)	(0.022)	(0.147)	(0.059)	(0.468)	(0.356)	(0.126)
tf_ab	0.112***	0.112*	0.158***	0.167***	0.116***	0.136*	0.210***	0.213***
	(0.002)	(0.057)	(0.003)	(0.046)	(0.012)	(0.064)	(0.049)	(0.009)
L.ndy_ab	0.087***	0.076**	0.057***	0.048*	0.066***			
	(0.007)	(0.024)	(0.008)	(0.021)	(0.010)			
L2.ndy_ab	-0.084***	-0.069**	-0.066***	-0.058**	-0.071***			
	(0.007)	(0.024)	(0.008)	(0.020)	(0.007)			
uab	-0.164***	-0.147**	-0.114***	-0.130**	-0.192***			
	(0.014)	(0.056)	(0.015)	(0.047)	(0.020)			
elect_ab	-0.001***	-0.001	0.000	-0.000	-0.001***	-0.012	-0.001	-0.019***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.011)	(0.008)	(0.001)
left_ab	-0.008***	-0.008	0.003	0.003	-0.034***			
	(0.002)	(0.016)	(0.003)	(0.013)	(0.006)			
pwt	-0.355***	-0.348*	-0.278***	-0.340**	-0.606***			
	(0.028)	(0.150)	(0.035)	(0.129)	(0.082)			
rho	0.279	0.279	0.041	0.041		0.463	0.234	
Industry effects	YES	YES	YES	YES	NO	YES	YES	NO
Time effects	NO	NO	NO	NO	NO	YES	YES	YES
Number of observations	546	546	546	546	525	546	546	546
Industries	21	21	21	21	21	21	21	21
R^2		0.924		0.971		0.937	0.979	
AR(1)[b]					-3.92 (0.000)			-2.54 (0.011)
AR(2)[b]					-1.08 (0.281)			-2.16 (0.031)

Notes: Standard errors in parentheses. *, **, and ***, respectively, indicate statistical significance at the 0.10, 0.05, and 0.01 levels.
[a]FGLS= feasible GLS estimation; PW-PCSE= Prais-Winsten estimation with panel-corrected standard errors; AB-GMM= Arellano and Bond (1991) GMM estimation (all variables first differenced).
[b]Arellano-Bond *z* statistic (P value). H_0: no autocorrelation.

TABLE 7. Coefficient estimates for British Columbia

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation method[a]	**FGLS**	**PW-PCSE**	**FGLS**	**PW-PCSE**	**AB-GMM**	**PW-PCSE**	**PW-PCSE**	**AB-GMM**
L.tp_bc			0.348***	0.361*	0.356***		-0.036	-0.005
			(0.029)	(0.153)	(0.059)		(0.269)	(0.130)
L.tp_qc	-0.133***	-0.138*	-0.123***	-0.134*	-0.143***	-0.215**	-0.218**	-0.275***
	(0.005)	(0.074)	(0.007)	(0.074)	(0.021)	(0.070)	(0.073)	(0.028)
L.tp_on	-0.722***	-0.721***	-0.754***	-0.752***	-0.928***	-1.263***	-1.267***	-1.590***
	(0.014)	(0.145)	(0.017)	(0.134)	(0.078)	(0.342)	(0.338)	(0.168)
L.tp_ma	-0.158***	-0.175	-0.071**	-0.103	0.009	-0.125	-0.102	0.065
	(0.027)	(0.166)	(0.025)	(0.151)	(0.022)	(0.434)	(0.452)	(0.208)
L.tp_sk	0.908***	0.932***	0.631***	0.656***	0.669***	1.236***	1.245***	1.309***
	(0.023)	(0.128)	(0.029)	(0.166)	(0.062)	(0.274)	(0.281)	(0.062)
L.tp_ab	0.671***	0.678***	0.549***	0.573***	0.562***	0.803***	0.810***	0.826***
	(0.011)	(0.098)	(0.014)	(0.103)	(0.043)	(0.106)	(0.118)	(0.020)
tf_bc	0.466***	0.467***	0.467***	0.470***	0.453***	0.408***	0.410***	0.413***
	(0.003)	(0.052)	(0.004)	(0.050)	(0.035)	(0.037)	(0.039)	(0.013)
L.ndy_bc	0.115***	0.121*	0.121***	0.125**	0.084***			
	(0.012)	(0.050)	(0.012)	(0.044)	(0.024)			
L2.ndy_bc	-0.045***	-0.035	-0.031*	-0.021	-0.016**			
	(0.013)	(0.055)	(0.013)	(0.049)	(0.005)			
ubc	0.076***	0.072	0.037***	0.037	0.052***			
	(0.011)	(0.047)	(0.011)	(0.043)	(0.011)			
elect_bc	-0.003***	-0.003**	-0.003***	-0.003**	-0.003***	-0.017**	-0.017**	0.003***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.006)	(0.006)	(0.000)
dleft_bc	-0.002***	-0.003	-0.002***	-0.003*	-0.003***	-0.018***	-0.018***	-0.015***
	(0.001)	(0.002)	(0.000)	(0.002)	(0.001)	(0.003)	(0.004)	(0.002)
left_bc	0.004***	0.004	0.005***	0.005	0.005***			
	(0.001)	(0.004)	(0.001)	(0.003)	(0.001)			
rho	0.132	0.132	0.152	0.152		0.079	0.079	
Number of observations	546	546	546	546	525	546	546	546
Industries	21	21	21	21	21	21	21	21
R^2		0.979		0.980		0.994	0.994	
AR(1)[b]					-2.74 (0.006)			-2.44 (0.015)
AR(2)[b]					-1.28 (0.200)			-2.31 (0.021)

Notes: Standard errors in parentheses. *, **, and ***, respectively, indicate statistical significance at the 0.10, 0.05, and 0.01 levels.
[a]FGLS= feasible GLS estimation; PW-PCSE= Prais-Winsten estimation with panel-corrected standard errors; AB-GMM= Arellano and Bond (1991) GMM estimation (all variables first differenced).
[b]Arellano-Bond *z* statistic (P value). H_0: no autocorrelation.