The Impact on Investment of Replacing a Retail Sales Tax by a Value-Added Tax: Evidence from Canadian Experience[1]

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March 25, 2009

Abstract

Over a decade ago, several Canadian provinces replaced their retail sales taxes by value-added taxes.   This paper estimates the effects of this tax substitution on business investment in the reforming provinces. Consistent with theory, we find that the reform led to significant increases in machinery and equipment investment, in the short run at least. This evidence suggests that a similar reform in a US state with similar retail sales taxes may also be expected to result in increases, possibly substantial, in capital stocks.

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1. Introduction

Sales and gross receipts taxes are the largest source of own tax revenues in US states and account for about one fourth of state general revenues. While most states impose traditional retail sales taxes though with widely varying rates, bases and yields (Mikesell 2006), recent reform efforts have been pulling in two very different directions – towards taxation of gross business receipts on the one hand, or of value added on the other hand. Thus, in 2005, Ohio introduced a low rate gross receipts tax in addition to its existing retail sales tax; in 2007, Illinois considered replacing its sales tax by a gross receipts tax (Giertz 2007).[2] On the other hand, in 2007, in 2007 Georgia considered both replacing its property tax by an expanded sales tax (Winters 2007) and also the possibility of replacing its sales tax by some form of value-added tax (Wheeler and Monham 2007).
Likewise, Michigan continues to experiment with forms of value added taxation as it pursues its own unique and interesting path with respect to state taxation.[3]

The conventional wisdom among public finance economists is that value added taxes are superior to either retail sales taxes or gross receipts taxes that raise the same revenue, and several authors have proposed state-level VATs.[4] For example, RSTs usually have narrow consumption bases (which distort relative prices of marketed goods) and are susceptible to tax evasion. Both RSTs and gross receipts taxes tend to cascade through the value added chain, which distorts the relative prices of business inputs, particularly capital goods.

This paper goes beyond conventional wisdom by providing quantitative estimates of the effects on business investment of converting state RSTs to VATs based on the experience with such reforms in some (but not all) Canadian provinces. To do so, we examine the actual impacts of reform in the four Canadian provinces that have already adopted value added bases (the "harmonizing provinces"),[5] comparing their experience to what happened in the same period in provinces which retained their RSTs. In effect, we treat the asymmetric nature of past sales tax reform in Canada as analogous to a "natural experiment" that allows us to control for contemporaneous changes in the

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[2] Washington has long had a gross receipts tax in addition to a sales tax (Mikesell 2007). Uniquely, Delaware has had only a gross receipts tax since it was first introduced in 1913.

[3] Michigan introduced a new "modified gross receipts tax" in January 2008, replacing the Single Business Tax, a sort of VAT levied on an addition basis on production (Bird 2003). The new tax operates like an approximation to a destination based consumption VAT, as McIntyre and Pomp (2008) show.

[4] It is important to note that the "VAT-type tax" -- called a BVT or business value tax-- suggested as a possible local "benefit" tax on business in Bird (2003) and the "VAT" discussed as a possible replacement for state retail sales taxes in Bird (2007) are different in several important respects. In particular, as a (low rate) business benefit tax the BVT is explicitly levied on the basis of production in the taxing jurisdiction; in contrast, the VAT discussed in the second paper mentioned, as well as in the present paper, is by design imposed levied only on consumption by local residents.

[5] The four are Newfoundland and Labrador, Nova Scotia and new Brunswick, which introduced the Harmonized Sales Tax (HST) on the same base as the federal GST in 1997, and Quebec, which during the 1990s gradually introduced the Quebec Sales Tax (QST), a value added tax with a base now quite similar to the GST.

economic environment that would otherwise confound the analysis. This permits better inferences about cause and effect than previous studies, which have not considered a similar "control group" for such a major tax substitution.

At present, five Canadian provinces operate retail sales tax (RST) systems, which are collected separately and on a very different basis from the federal Goods and Services Tax (GST), a value added tax on consumption; four other provinces, in contrast, levy value added taxes which are largely integrated with the federal GST (Bird, Mintz and Wilson 2006).

In the simplest terms, the policy implications of our analysis may be summarized as follows. Examination of detailed revenue data for RSTs shows that effective tax rates on business inputs including capital goods are remarkably high – indeed, about 43% of current RST revenues in Canada are estimated to come from taxing business inputs. The situation is not very different in the United States, where Ring (1999) estimated the 'producer's share' of RST state tax revenues to be 41%. Eliminating such taxes by substituting a VAT for the RST would have substantial effects on business investment. By our estimates, annual machinery and equipment investment in harmonizing provinces rose 12.2 per cent above trend levels in the years following the 1997 sales tax reform. Given the high taxes on capital inputs in the remaining RST provinces, it seems reasonable to expect a similarly large short-run effect of reform on investment if these jurisdictions similarly substituted a VAT for their RSTs. In principle, similar results might perhaps be expected in US states that did the same thing, although of course the absence of a national VAT in the United States makes the context for state VAT reform quite different in some respects -- an issue that we do not discuss further in this paper.[6]

The necessary implication of high taxes on business inputs under RSTs is that, if reform were to be revenue neutral, then the tax burdens levied directly on personal expenditures of consumers would rise substantially. For example, analysis of effective tax rates in the Canadian case shows that, if RST provinces adopted a VAT base similar to that used in the federal GST, the tax rate could remain similar but the base would be broadened to include purchases of new homes and some other additional goods and services.

This shift in burdens from business to consumers is typically regarded as a major obstacle to implementing such a reform. For economists, however, all taxes are ultimately paid by some people, somewhere – and never by "business" as such. The economic incidence of a tax shift from an RST to a VAT depends on the extent to which business tax burdens under the RST are shifted forward to consumers or shifted backward to factors of production like labour, capital, and land through changes in prices and wages that result from the tax. In a complementary paper (Smart and Bird 2009) we find that in the Canadian case the pattern of relative price changes among broad consumer expenditure categories was quite similar to the pattern of relative changes in taxes and business costs induced by the reform: each one per cent increase in costs induced by taxes leads to approximately a one per cent increase (or perhaps more) in the price paid by consumers. Since these results are consistent with the notion that

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[6] For further discussion of this point, see Bird, Mintz and Wilson (2006) as well as Bird and Gendron (2007).

taxes are fully shifted forward in most sectors, the implication is that the change in statutory burdens associated with the tax reform does not result in large distributional effects. We therefore ignore this issue in the balance of the present paper.

The rest of the paper is organized as follows. Section 2 describes the sales tax systems of the Canadian provinces and discusses the economic problems associated with the RSTs. Section 3 presents an accounting analysis of the changes in revenues and statutory tax burdens resulting from a hypothetical reform in which RST provinces adopted the federal GST base, while keeping statutory tax rates at current levels. Estimates of the effect of the 1997 HST tax reform on investment are presented in Section 4. Section 5 concludes.

2. Systems of sales taxation

The Canadian federation offers at present a useful laboratory for studying alternative sales tax regimes. Five Canadian provinces currently operate RSTs, while four others have adopted VATs which are largely integrated with the federal VAT (the GST or, formally, the GST/HST, as explained later). The 10th province, Alberta, benefiting from its energy revenues, levies no general taxes on consumption. Provincial sales tax reform began in 1992 with the Quebec Sales Tax (QST), a modified value added tax system that initially accorded only limited input tax credits to firms. Input tax credits under the QST were gradually expanded, however, and by 1995 the base of the QST was largely harmonized with the federal GST. Bird, Mintz and Wilson (2006) provide a detailed description of the differences between the two tax bases. Further reform followed in 1997 with the introduction of the Harmonized Sales Tax (HST) in Newfoundland and Labrador, Nova Scotia, and New Brunswick. The base of the HST is essentially the same as that of the federal GST, collection of the federal and provincial taxes is unified, and the provincial portion of the rate is 8 per cent in all three provinces, replacing the previous RST system that levied effective rates of 11.7 to 12 per cent. Traditional RSTs remain in the provinces of Prince Edward Island, Ontario, Manitoba, Saskatchewan, and British Columbia.

As in most US states, Canadian provincial RSTs are levied on purchases of goods (and some services) which take place at retail points of sale. In contrast, the federal GST/HST is an invoice-and-credit value added tax, which taxes sales of most goods and services by registered traders, while according full credit (offset) for taxes paid on registered traders purchases of taxable goods.[7] In practice, the chief differences between the GST and RST bases are:

- RSTs tax many purchases of intermediate inputs by businesses, while having no provision for rebating tax paid on inputs, as in a value-added tax system.
- Many services, even those consumed as final demand and purchased at the "retail" level, are exempted from taxation under the RSTs. The treatment of

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[7] Since the federal sales tax, the GST, and the three provincial VATs levied as the "Harmonized Sales Tax" have a fully integrated base and are administered together, the correct name of the combined federal-provincial VAT is the GST/HST.

services is complicated under the GST, with many service sectors receiving tax exempt status, while international transportation services are in fact zero-rated.[8] Moreover, the input tax rebates paid under the GST to exempt suppliers in the Municipal, Academic, Schools, and Hospitals (MASH) sector make these services much closer to zero-rated (i.e. tax free) under the GST.[9]

- Consumption of housing services is exempt under the RSTs: payments of rent are untaxed, and purchases of owner-occupied housing are untaxed as well. The GST also exempts market rents and implicit rents to owner-occupied housing, but it taxes purchases of new houses, albeit at a reduced rate, especially for properties valued at less than $450,000.[10]

2.1 Problems with RSTs

There are a number of potential deadweight economic costs associated with RSTs. First, RSTs invariably result in substantial changes in the relative prices of marketed commodities both because they exempt many types of consumption, chiefly services and intangibles, from taxation and because they subject many purchases of inputs to tax. The resulting changes in relative after-tax prices of various goods and services are likely to lead to large departures from tax neutrality, as some sectors of the economy are artificially favored at the expense of others.

Second, RSTs impose taxes on business inputs. Indeed, as already mentioned, a significant share of provincial "retail" sales tax revenues in Canada actually come from taxing business inputs. The failure to exempt business inputs has the potential to distort business decisions about which inputs to purchase and whether inputs are purchased in markets or produced in-house. Furthermore, business input taxes are typically passed on to consumers in the form of higher producer prices of some but not all commodities, resulting in further departures from uniform taxation of final demand.

RST taxes on business inputs appear to some commentators to be of uncertain welfare impact, since an equal-revenue tax that exempted business inputs would necessarily impose higher effective tax rates on final demands – apparently contravening the standard dictum that taxes should be "low-rate, broad-base". However, the Diamond—Mirrlees production efficiency lemma establishes fairly general conditions under which input taxes should not be used as part of an optimal tax system. Diamond and Mirrlees showed that optimal tax systems keep the economy at its full production potential

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[8] For supplies that are tax exempt under the GST, no tax is charged on the sale, but no input tax credits may be claimed for taxable inputs that went into its production. For zero-rated supplies, in contrast, no tax is charged but input tax credits may be claimed, so that the transaction is entirely tax free.

[9] For example, universities get a rebate of 67% of the GST that they pay to suppliers.

[10] There is a 36 per cent rebate (implying an effective GST rate of about 4.5 per cent when the standard rate was 7 per cent) for new houses valued at less than $350,000, with the marginal rebate progressively decreasing to zero for house values over $450,000. There is a similar system under the QST, but the starting and ending points are much lower ($200,000 and $225,000, respectively). Following a two-stage reduction of the federal GST to 5% between 2006 and 2008, some of the details of the rebate system have changed but its structure remains the same. There have been no significant changes in provincial sales taxes over this period.

whenever the tax authority has access to an unlimited set of taxes on consumer demands, and to direct taxes on pure profits earned in production. A fortiori, these conditions imply that input taxes – which distort production decisions while resulting in changes in prices that are equivalent to some input-exempting consumption tax system – should not be used.

Third, and most important for this paper, RSTs tax business capital inputs in significant proportion. To the extent that productivity improvements tend to be embodied in capital goods (De Long and Summers, 1992) RST taxes on investment goods may have even more far-reaching adverse consequences than other business input taxes. We return to the investment effects of RSTs in Section 4 below.

2.2 Can business inputs be exempted under RSTs?

In practice, significant efforts are made to exempt business inputs from tax under RSTs. As observed by Bird (2007), there are two ways to achieve this. First, the definition of "taxable sale" in most RST jurisdiction excludes "sales for resale". While it is not always clear what this term means,m the usual interpretation excludes from tax goods that are physically incoporporated in other goods then sold for final consumption – e.g. wood used to build a wooden desk. There are however many bordelrine items and the tax treatment varies widely under RSTs from state to state (Due and Mikesell, 1994).

Secondly, some products, notably machinery and equipment, may be specifically exempt from tax when sold to certain purchasers. The scope and nature of RST exemptions vary considerably among jurisdictions, but they are generally administered by requiring the purchaser to provide the seller with an official certificate of exemption – which identifies the purchaser as a registered vendor under the RST. Some systems require similar certificates for purchases of industrial equipment and even in a few cases for tax-free purchases of agricultural inputs – even though farmers are seldom if ever registered for sales tax purposes.

The purpose of such certificates is to facilitate control of evasion by providing a more complete "paper trail" for sales tax auditors. The efficacy of the system depends entirely on the quantity and quality of sales tax audit. Perhaps because of these difficulties, no state RST comes close to excluding all business inputs from taxation.

In contrast, under invoice-and-credit VATs, such as the GST in Canada, transactions between registered sellers and buyers are not exempted, but input taxes paid by registered buyers may be credited against tax owed on later sales. As a result, in contrast to RSTs, the system is inherently somewhat self-policing, as registered buyers have no incentive to evade tax on the transaction, and buyers and sellers have conflicting incentives when it comes to mistating the value of the transaction on invoices for tax purposes.

3. Fiscal consequences of sales tax reform

The preceding discussion suggests that reforming RSTs to eliminate business input taxes could have potentially large consequences for government revenues and for the

distribution of tax burdens between business and consumers, and among sectors of the economy. How important might such impacts be? To illustrate, we report estimates of the change in tax revenues and statutory tax burdens that would result if the remaining five RST provinces in Canada were to replace their tax bases with the federal GST base, while keeping statutory tax rates fixed at current levels. [11]

The estimates of revenue impacts reported in Table 1 are based on actual revenues of the GST and each province's RST in 2002, with effective tax rate estimates based on a detailed reading of the tax codes being used to attribute revenues to various sectors of the economy using weights from the 2002 provincial input-output tables. Underlying these calculations are very detailed estimates of the statutory tax burdens of the existing RST and GST tax systems in 2002. [12]

To estimate the effects of reform, suppose that provinces move to the GST base, including the same exemptions and rebates for the municipal, academic, schools, and hospitals (MASH) sector and for financial services, [13] and zero-rating of basic foods and exports (including interprovincial exports, as in the QST) [14]. For the 2002 data, the GST statutory rate was 7 per cent (although it has since been reduced to 5 per cent), while the RST rate was 8 per cent in Ontario, 10.7 in Prince Edward Island, and 7 per cent in the other provinces. The estimated statutory tax burdens (revenues collected) are therefore just eight-sevenths of GST revenues in Ontario, and so on proportionally for the other provinces. [15] Table 1 presents estimates us of the change in statutory tax burdens from different sectors of the economy under such a reform.

In summary, Table 1 shows:

(i) As expected, statutory burdens on business would decline substantially with harmonization to the GST base. The revenue changes are largest for current inputs, including construction inputs, but reductions in capital taxes are also substantial. Indeed, unreported detailed calculations indicate that revenues from taxing machinery and equipment purchases under the RSTs are between 4 and 6 per cent of the corresponding estimates of private gross fixed capital formation from the 2002 national accounts, including 4.4 per cent in Ontario, the largest province.

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[11] In Prince Edward Island, where the RST base includes GST payments, the statutory tax rate would rise to keep the effective provincial rate constant.

[12] Thus the calculations do not incorporate effects of the various RST reforms implemented since 2002. For example, since British Columbia subsequently enhanced the exemptions for business inputs under their RST, the reduction in revenues derived from taxing business inputs would presumably be smaller than that reported in Table 1.

[13] Note that this does not mean that the GST treatment of these sectors is 'ideal': for an argument that it is not, see e.g. Bird and Gendron (2007).

[14] For more on the issue of implementing a subnational VAT with differential rates among provinces, see Smart and Bird (2007).

[15] Our approach assumes that exemptions and rebates for housing and the MASH sector would be the same in percentage terms as under the GST, so that effective tax rates under the hypothetical Ontario eight per cent provincial VAT (PVAT) would be eight sevenths of the corresponding GST effective rates.

(ii)   Effective tax rates on services would, perhaps surprisingly, change little: the reported increase in revenues from taxing services represent about 0.5 per cent of the corresponding base in Ontario, and 1.4 per cent in British Columbia. This reflects the rather low effective tax rates on services under the federal GST, as well as some base-broadening reforms in RST provinces that have made parts of the service sector subject to RST. Effective tax rates are low under the GST because of the tax-exempt status accorded many large services industries, including most of the finance, insurance and housing sectors, the health sector, and the MASH (quasi-governmental) sector.[16] Furthermore, as mentioned earlier, many of the sectors listed are accorded large rebates for input taxes under the GST – they are nearly zero-rated rather than tax-exempt – so that total taxes paid on outputs and use of these sectors are indeed small. At least in Canada, replacing provincial RSTs by VATs would thus result in a much smaller increase in taxes on consumer services than might perhaps have been expected a priori.

(iii)   Taxes on final demand in the housing sector would rise, primarily because the federal GST taxes sales of new houses (albeit at a reduced rate). However, since the construction industry also faces one of the highest effective tax rates on business inputs under RSTs, as evidenced by the large decline in input taxes in Table 1, the reforms would lead to reductions in construction costs that offset much of the new explicit taxes on housing, leaving changes in true economic tax burdens that are relatively small.[17]

(iv)   The net result of all this is that provincial revenues would change relatively little in aggregate: indeed, according to these estimates the reform would be nearly revenue neutral in most provinces.[18] Of course, such single year estimates may be a poor guide to future impacts, particularly given that RSTs rely so heavily on taxation of investment goods, one of the most volatile components of the economy. In addition, recall that the net revenue impacts in Table 1 assume that the RST provinces would adopt exactly the tax exemptions and rebates for various sectors that are available under the federal GST.[19] In fact, reforming provinces, if they wished to do, could in principle increase their revenues by reducing the rebates available to tax-exempt or favoured sectors.

4. Investment impacts of sales tax reform

A primary effect of reforming retail sales taxes in Canada and elsewhere would be to eliminate the resulting sales taxes on investment goods, and so perhaps to increase

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[16] Tax-exempt status implies these sectors do pay some tax under the GST, which is included in the business inputs section of the table and netted out from the much larger reduction in input taxes that results when provincial RSTs are removed.

[17] As a rough estimate, about half of RST taxes on construction inputs relate to residential buildings, and half to non-residential structures.

[18] The single exception is Manitoba, where revenues are estimated to decline by $151 million, or about $130 per capita in 2002. For more details on the effects in different RST provinces, see Smart (2007).

[19] This assumption is required given the available data on the GST, which presents revenues net of the effects of the existing exemptions and rebates.

capital stock in affected industries.   To the extent that productivity improvements tend to be embodied in capital goods (De Long and Summers, 1992) RST taxes on investment goods may have even more far-reaching adverse consequences than other business input taxes.

In principle, the effects of eliminating sales taxes on capital goods are no different than other tax reforms that reduce the marginal effective tax rate (METR) on capital. Chen and Mintz (2003) calculated that provincial RSTs add about five percentage points to the marginal effective tax rate on capital on average in Canada, with a much larger burden in Ontario. Chen, Mintz and Tarasov (2007) found that RSTs raise METRs by about one-third in the provinces that levy them. As well as the factor substitution effects hypothesized to result from lower METRs on capital, investment would in principle respond to scale effects resulting from the impact of the reform on business costs.

These problems with the RST base may be hidden from public view but are far from inconsequential. Baylor and Beauséjour (2004) report results of various simulated tax reforms from a dynamic, computable general equilibrium model of the Canadian economy. According to their estimates, the marginal cost of a dollar in revenue raised by provincial governments through sales taxes on capital is about $2.30, compared to a mere $1.13 for a VAT like the GST/HST.   Since, as reported below, a move from provincial RSTs to the GST base would reduce taxes on capital by about $1.5 billion at current rates of taxation, a very rough calculation suggests the potential long-run gains for the economy could be as high as $1.75 billion.[20]

The recent empirical literature points to a strong and robust link between taxes as measured by the METR and investment levels (see e.g. Hassett and Newmark 2008 and OECD 2008 for recent surveys). Most previous studies have however been concerned with features of the corporate income tax system rather than with the sales taxes on capital that are the focus of this paper. It is therefore particularly interesting to examine the evidence on the effects of the 1997 HST reform, to which we turn next.

To estimate the effect of such a change on investment and long-run capital stocks, we turn to a retrospective analysis of the effects of the introduction of the HST in three provinces in Atlantic Canada in 1997. While the previous RSTs of these harmonizing provinces were not identical, like the remaining provincial RSTs they imposed high

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[20] The Baylor-Beauséjour estimate is valid only for small tax changes, and the benefits to large scale reform may be somewhat smaller. Note that this calculation excludes the economic benefits of eliminating RST taxes on non-capital business inputs. On the other hand, Piggott and Whalley (2001) and Emran and Stiglitz (2005) have emphasized that value added taxation may encourage the expansion of a relatively inefficient informal sector providing services, to the extent that these producers are not subject to the tax or can more easily evade it than can other producers. As Keen (2007) notes, however, these formal results ignore the fact that real-world invoice-and-credit VAT systems tax production in the informal sector indirectly, by denying input credits to traders that evade tax on their sales. Moreover, the issue of service taxation appears to be of only secondary importance at least in the Canadian context: the estimates below show that the effective rate of taxation of consumption of services under the GST is about 2 per cent in aggregate, compared to about 1 per cent under the RSTs. While the aggregate figures mask greater variation for narrower commodity classifications, the differences are relatively small.

effective tax rates on some capital goods, with estimated average effective tax rate on machinery and equipment in 1996 ranging from 2.6 per cent in manufacturing to 10.4 per cent in Construction, and averaging about 4.95 per cent. (Estimates of pre-reform effective tax rates are discussed in more detail below and presented in Table 2.) The broad empirical strategy is therefore to examine changes in various measures of aggregate investment in the harmonizing provinces compared to the RST provinces in the years following the reform.

Figure 1 shows total private investment per capita[21] in 1997 dollars for the 1986-2004 period, on average for Quebec, the HST provinces, and the five provinces that have retained their RSTs.[22]   Prior to the reform, investment per capita was considerably lower in the HST provinces than others, reflecting the traditionally lower levels of GDP per capita and of capital per unit of GDP in the Atlantic provinces. However, year-to-year variations in the HST and RST provinces tracked each other closely as both were affected by nationwide economic shocks. That pattern changes dramatically following the 1997 sales tax reform (the vertical line in Figure 1 is between 1996 and 1997) as investment per capita in the reforming provinces began to rise, particularly relative to investment in the provinces that retained their RSTs. Although the rise in relative investment appears to slow or even reverse after 1999, this is as expected, since a reduction in the effective tax rate on capital goods should lead to a permanent rise in capital per unit of output but not a permanent rise in investment flows.

A similar pattern appears with respect to investment per capita for Quebec, although the data in this case are more difficult to interpret. Since VAT was phased in gradually under the QST during the 1990s, there is no clear delineation between pre- and post-reform periods. In addition, the phase-in, if anticipated by firms, might have induced them to defer investment rather than increase it – consistent with the pattern displayed in the data. Lastly, many of the capital assets that tend to be taxed under RSTs are still not accorded full input tax credits under the QST either, at least for large firms (Bird, Mintz and Wilson 2006). It may therefore be that the QST lies "in between" a retail sales tax and a value added tax in terms of its effects on the cost of capital. For these reasons, we generally exclude the Quebec data from the empirical analysis, with one exception noted below.

Of course, the pattern displayed in Figure 1 is only suggestive of the possible impacts of sales tax reform, and many other factors may have caused the run-up in relative investment rates in HST provinces. For example, it may reflect a general rise in economic growth in the HST provinces, rather than investment per se; it may reflect long-term trends in the HST provinces unrelated to the reform; and it may reflect changes in the relative cost of capital there that have nothing to do with taxes.

To address some of these concerns in a simple way, we present in Table 2 estimates of the effects of HST reform on investment based on a reduced-form regression model. In each of the regressions, the logarithm of real investment per capita in each of the nine provinces is regressed on the logarithm of real provincial GDP per capita (to control for

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[21] The data are for business gross fixed capital formation, from the Provincial Economic Accounts prepared by Statistics Canada.
[22] Alberta, which does not levy a sales tax, is excluded.

provincial business cycle effects) and a dummy variable equal to one in years and provinces for which the HST was in place and equal to zero otherwise. All regressions also include estimated fixed effects for each year and separate estimated linear trends for each province, not reported in the table. That is, this approach allows for the possibility that investment was on average higher in Canada after 1997 for reasons unrelated to sales tax reform or that investment grew faster over the sample period in, say, Newfoundland and Labrador (a HST province) than in other provinces for reasons unrelated to sales tax reform.[23] That is, the estimating equation is

$$(1) \qquad \text{LOGINVPC}_{it} = \alpha_i^0 + \alpha_i\, t + \delta_t + \beta\ \text{HST}_{it} + \gamma \text{LOGGDPPC}_{it} + \varepsilon_{it}$$

where LOGINVPC is the logarithm of investment per capita in province *i* and year *t,* and HST is a categorical variable equal to one in the HST provinces in years after the reform and equal to zero otherwise. The key coefficient to be estimated is β, the difference-in-difference effect of the reform. For the estimates reported below, we calculate estimated standard errors of estimates that are robust to arbitrary heteroskedasticity and contemporaneous correlation among provinces within the HST and RST groupings.[24]

In the leftmost column of figures in Table 2, the dependent variable is real gross fixed capital formation per person, as in Figure 1. The estimated coefficient of 0.111 for HST dummy variable indicates that investment per capita rose 11.1 per cent higher above the trend in HST provinces in post-reform years, relative to RST provinces in post-reform years. The difference is significantly different from zero at the 95 per cent significance level.

The remaining three columns report estimates of the same regression equation, using narrower components of investment as the dependent variable. In the second column, the dependent variable is real business investment in machinery and equipment – the component most affected by the reform. The effect of HST reform on M&E investment is larger, at 16.7 per cent, than for the total, and significantly different from zero at the 95 per cent confidence level.   In the third column, the dependent variable is real business investment in non-residential buildings per capita; the HST impact here is larger than before but not significantly different from zero. This is not entirely unexpected, since the provincial RSTs that the HST replaced tend to tax M&E investment more heavily than investment in buildings. That being said, the point estimate is large. We return to this below.

The last column of Table 2 performs a further robustness check of the results, using real investment in residential buildings per capita as the dependent variable. HST reform should likely *not* have a positive effect on housing investment, since housing final demand is taxed under the GST/HST base, and the direct negative effect of the reform probably outweighed the indirect positive effect of the reduction in implicit taxes on residential construction. However, if the results so far simply reflect an improvement in

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[23] In particular, investment in Newfoundland has risen with the development in recent years of the offshore oil sector. This is addressed in part in the regressions by including provincial GDP per capita as a control variable; in addition, the qualitative results of the analysis are robust to excluding Newfoundland and Labrador entirely from the data set.

[24] The robust standard errors are calculated with the "cluster" option to Stata's regress command.

asset values and investment climate in the reforming provinces relative to the others, then the regression approach might suggest a positive effect of HST on housing as well. Since the results essentially show no change in housing investment in the HST provinces relative to the others in the years following the reform, the idea that the results reported so far reflect the sales tax reform rather than other contemporaneous factors is reinforced.

The estimated increase in aggregate investment is fairly large in proportion to the magnitude of the sales tax change. As reported in Table 3 and discussed below, the effective sales tax rate on capital purchases ranged among industries from 2.6 percentage points to 10.4 percentage points in the HST provinces prior to the reform, with an investment-weighted average tax rate of 5.0 percentage points. Since the user cost of capital is simply proportional to one plus the effective sales tax rate, the estimated impact of the HST reform implies an elasticity of investment with respect to the user cost of capital of 2.4 – outside the typical range of 0.5 to 1.0 user cost elasticities in the studies surveyed by Hassett and Newmark (2008). Of course, it is difficult to compare user cost elasticities estimated from different studies and using different tax reforms. As pointed out by Chirinko (1993), the elasticity cannot be regarded as a structural parameter of production or investment adjustment cost functions, and its identification in empirical studies depends heavily on the assumption of static expectations about tax rates. Nevertheless, the estimate from our reduced-form approach are undeniably large.

Aggregate investment data may include a number of confounding effects of economic changes in the Atlantic provinces that were roughly coincident with the HST reform, and which are therefore not adequately handled by the difference-in-difference strategy. Most notably, offshore oil and gas projects in Newfoundland and Nova Scotia likely boosted investment in that sector for reasons unrelated to sales tax reform, and the introduction of the Atlantic Investment Tax Credit may have had similar effects in manufacturing and processing industries.[25]

To deal with some of these questions, we turn to investment data disaggregated to the two-digit industry level from Statistics Canada's Capital and Repair Expenditures (CRE) survey. Unlike the Provincial Economic Accounts (PEA) data used in the Table 2 estimates, the Capital Expenditures data are available on a consistent basis only for the 1992-2005 period, and only nominal values of investment expenditures are recorded. The data are deflated by province-specific implicit price indexes for gross fixed capital formation derived from the PEA data.

Table 3 presents the average annual investment levels per capita for each of the six industry groupings examined, the two-digit industries for Agriculture, Mining, Construction, and Finance and Insurance, and for two broader aggregates of Wholesale and Retail Trade and Transportation and for Other Services.[26] The first column shows

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[25] The Atlantic Investment Tax Credit (AITC) applicable to investment in the three HST provinces (as well as in Prince Edward Island, an RST province, and in the Gaspé region of Québec) is 10% of most capital expenditures in manufacturing and other industries.

[26] Other Services includes all other two-digit industries except Public Administration, Education Services, and Health Care and Social Assistance, where investment decisions are likely to reflect factors other than taxes; these sectors are therefore excluded altogether from the analysis.

the population-weighted averages of provincial total investment per capita in each industry, an indication of the relative importance of each in the aggregates.

The remaining two columns report the effective tax rate on capital goods induced by the pre-reform RSTs in the harmonizing provinces. These tax rates were estimated by Statistics Canada on the basis of the 1996 provincial Input-Output tables and a detailed reading of the tax laws of each of the three provinces, and are calculated to include the direct effect of taxes paid on capital inputs as well as the indirect effects of the higher costs in capital goods-producing industries, assuming full forward shifting of the taxes (Smart and Bird 2009).[27] The effective tax rates were then aggregated to the level of the industry categories in Table 3, using province-specific fixed weights from the 1998 provincial Input-Output tables. These calculations allow us to estimate the "tax shock" of the 1997 reform—the extent to which producer prices plus sales taxes changed on average in the HST provinces—for each of the major expenditure categories.

The data show that the highest effective tax rates were imposed on machinery and equipment investment in the Construction sector at a 10.4 per cent average effective rate and that rates vary widely among sectors, to a low of 2.6 per cent in manufacturing. Estimated effective tax rates on buildings are above four per cent in most sectors, which of course reflects not the direct imposition of retail sales taxes on business purchases of structures, but rather the RSTs on construction inputs that are deemed to be "embedded" in their producer prices. For structures, the lowest effective rate is in Mining, which presumably reflects the large share of imported capital goods in use in that sector.

Table 4 reports further difference-in-difference estimates of the effect of HST reform, based on these data. In the interests of brevity, only the coefficients on the dummy variable for the HST reform are reported. All regressions include controls for log real GDP per capita and year fixed effects and province-specific linear time trends, as before. The first row is the "baseline" specification corresponding most closely to the results for the PEA data; in it, the investment data are for the aggregate of all industries excluding Public Administration. The estimated coefficients in this row are similar to but smaller than those in Table 2, which may reflect the shorter sample period or differences in definitions, with only the estimated 7.1% increase for the machinery and equipment category being significantly different from zero.

Since many producers in these sectors are effectively tax-exempt under the HST, effective tax rates on investment were in any case largely unaffected by the reform.

[27]The estimates, which were kindly provided by Ziad Ghanem of Statistics Canada, reflect the extent to which input taxes have increased the unit cost of commodities, the extent to which those cost increases have further increased the cost of commodities, and so on. Algebraically, let $A = (a_{ij})$ denote the matrix of expenditure shares of each reproducible commodity j in the production of commodity $i,$ derived from the 1998 input-output tables, and let τ_t denote the vector of ad valorem input tax rates for all commodities in year t. Taking a first order approximation to the cost functions of all sectors and employing Shephard's lemma yields a formula for the year t vector of indirect tax rates

$$INDTAX_t = (I - A)^{-1} A\tau_t$$

that is the basis for the estimates in the data.

To address the possibility that the results are confounded by unrelated changes in oil and gas capital investments, we next exclude Mining sector investment from the total, and find that machinery and equipment investment in the harmonizing provinces rose 12.2 per cent above trend, though the point estimate for buildings is now essentially zero. For the reasons discussed above, this is our preferred estimate of the aggregate effect of HST reform. As a further robustness check, results in the third row are for the baseline specification including the Quebec observations, treating them as part of the treatment group beginning in 1995, the year that widespread input tax credits were available under the QST. Once again, a significant positive effect remains for machinery and equipment. The final row reports broadly similar results for a "pure" difference-in-difference specification, which excludes the province-specific time trends.

Table 5 addresses the influence of contemporaneous changes in corporate tax systems, which may in principle confound our estimates of the impact of HST reform. To do so, we obtained estimates of the Hall-Jorgensen user cost of capital (UCC) by industry, province, and year for the 1993-2004 period from the federal Department of Finance[28] for each of our broad industry groups except Mining.[29] The user cost estimates are based on fixed assumptions about the financial structure and financial costs of representative firms, and reflect detailed data on the asset mix of the different industries and the statutory tax rates, capital cost allowances, and investment tax credits in the federal and provincial income tax laws.

To control for such effects, we perform difference-in-difference regressions for each industry group separately and include the log of the estimated user cost of capital as an additional control variable. Thus the estimating equation becomes:

$$(1') \qquad \text{LOGINVPC}_{it} = \alpha_i^0 + \alpha_i\, t + \delta_t + \beta\ \text{HST}_{it} + \eta\ UCC_{it} + \gamma \text{LOGGDPPC}_{it} + \varepsilon_{it}$$

UCC is the computed user cost of cost of capital for the relevant industry, province, and year, based on federal and provincial corporate income tax considerations alone – that is, excluding the effect of input sales taxes.

The user cost data exclude two years, 1992 and 2005, covered by the investment data. To keep the sample unchanged when the UCC is included, the 1993 UCCs are imputed for the 1992 values, and the 2004 UCCs for the 2005 values. This imputation notwithstanding, the investment data at the two-digit industry level is missing for some industries, provinces, and years for reasons of confidentiality. This problem is especially pronounced among the reforming provinces, where industrial concentration is presumably higher since they are relatively small. As a consequence, the two-digit industry panels are unbalanced, and the regression sample years and provinces differ from sector to sector in the rows and columns of Table 5. For this reason, caution must be exercised in comparing estimates for different sectors and asset groups.

Table 5 again reports only the estimated coefficient for the HST reform variable and suppresses the others for brevity. The unreported coefficient estimates for the UCC

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[28] For detail on the user cost methodology, see Department of Finance (2005).
[29] Corporate taxation in the Mining sector is particularly complicated.

variable are typically very large (implausibly so) and occasionally of the wrong sign; nonetheless, in most cases they are insignificantly different from zero. This result likely reflects the stability of the user cost over the sample period, which makes the variables roughly collinear with the unobserved province effects. There is thus insufficient within-province variation in user costs to allow us to distinguish the effects of this factor on investment from other, unobserved factors that may explain the persistent differences in per capita investment levels among the provinces. In any case, the inclusion of UCC has only a negligible impact on the estimated effect of the HST reform in all sectors other than Manufacturing. In Manufacturing, the estimated effect of the HST reform is a 20.3 per cent increase in machinery and equipment investment when the UCC is excluded from the regression, but a mere 2.3 per cent when it is included.

Indeed, in most of the six sectors shown in Table 5, the estimated effect of HST reform on machinery and equipment investment is small and insignificant. In Agriculture, Fishing, and Forestry, however, machinery investment rose about 26 per cent above the trend level following the reform, when the separate impact of UCC changes is controlled for. In the Trade and Transportation sector, investment is estimated to have declined significantly following the reform. Aside from Manufacturing, where the estimate reflects the contemporaneous changes in corporate taxes, the smallest point estimate is for the Finance and Insurance sector. Finance and Insurance is the industry with the smallest change in effective tax rates following the HST reform, since a substantial portion of the sector is treated as exempt from the GST/HST and therefore does not receive input credits for taxes paid on its inputs.

The estimates for investment in buildings, reported in the second column of the table, are more widely dispersed, and indeed some of the estimates seem implausibly large. The estimate for Manufacturing is a 79 per cent increase. The estimates are significantly positive in four sectors and significantly negative in one. While our data do not allow us to investigate further the source of these large point estimates, it is clear that caution is warranted in attributing the estimated effects to the HST reform.

5. Conclusion

Examination of detailed revenue data for those Canadian provinces that still have RSTs shows that effective tax rates on business inputs including capital goods are remarkably high. Eliminating such taxes by replacing RSTs by VATs would have substantial effects on business investment. The preferred estimate derived in the preceding section indicates that annual machinery and equipment investment in the provinces that have already replaced RSTs by VATs rose 12.2 per cent above trend levels in the years following the 1997 sales tax reform. Given the high taxes on capital inputs in the remaining provinces, it seems reasonable to expect a similarly large short-run effect of reform on investment in the RST provinces as well.

Since the structure of the RST is in Canadian provinces is very similar to that in many US states, a priori one might perhaps expect to see similar effects from a similar tax substitution there although of course the details would vary from state to state depending on the structure of their economies and their RSTs. Smart and Bird (2008) show that at

least in the case of Canada the net distributional effect of the tax substitution was very small. Bird (2007) argues that the administrative complexities of replacing the present highly imperfect RSTs by workable -- though certainly not perfect-- VATs are also much less than many appear to think. While both the distributional and administrative aspects of such an important tax change obviously require much closer examination in the context of specific states (and indeed the US in general), the surprisingly strong impact on investment demonstrated in the present paper suggests that the possibility of substituting a VAT for state RSTs appears to warrant much closer examination than it has so far received in the United States.[30]

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[30] One potentially important complicating factor in a number of states, as McLure (2005) notes, may be the presence of local sales taxes that 'piggy-back' on state RSTs. This issue is not discussed in the present paper.

Table 1: Revenue consequences of implementing provincial VATs

	Prince Edward Island	Ontario	Manitoba	Saskatchewan	British Columbia
			- $ millions -		
Estimated change in statutory tax burdens on:					
Consumers					
- Goods	+28	+1252	+67	+200	+353
- Services	+11	+754	+70	+115	+722
- Housing	+16	+1816	+73	+52	+549
Business					
- Construction inputs	-25	-1553	-116	-130	-519
- Other intermediate	-16	-1516	-106	-119	-516
- Capital	-12	-1021	-125	-79	-351
Government	-4	+147	-14	-24	-15
Total Impact	-1	-121	-151	+16	+224
2002 Total Revenues	179	14419	1123	858	3984
Tax rate	10.7%	8%	7%	7%	7%

Source: 2002 Input-Output tables and Department of Finance calculations.

Table 2: Estimates of the investment impact of HST reform

	Total Investment	Machinery and equipment	Non-residental construction	Residential construction
HST	0.111**	0.167**	0.242	-0.003
	[2.41]	[3.35]	[1.52]	[-0.08]
logarithm of GDP	1.06***	1.43***	1.00	0.83*
	[3.68]	[4.71]	[1.33]	[2.00]
Observations	180	180	180	180
R-squared	0.95	0.96	0.88	0.90

Notes: All specifications include province-specific linear trends and year fixed effects, coefficients not repor
  Robust t statistics in brackets.
* significant at 10% level; ** significant at 5% level; *** significant at 1% level.

Table 3: Summary statistics
Investment and effective sales tax rates by industry
Capital and Repair Expenditures data

| | Average provincial investment per capita | Pre-reform effective tax rate on investment in HST provinces: | |
		Machinery	Buildings
	- 1992 $ per year -	- per cent -	
Agriculture	35.6	5.6	4.2
Mining and oil & gas	699.2	3.9	2.6
Construction	94.4	10.4	4.9
Manufacturing	603.5	2.6	4.6
Trade and transportation	192.1	8.9	4.4
Finance and insurance	367.1	6.1	4.1
Other services	121.0	8.6	4.0

Notes: The figures reported are population-weighted averages of provincial per capita investment data, and of the estimated effective tax rates on investment under sales taxes in HST provinces prior to the reform. These do not correspond to national averages because some provincial observations are missing due to confidentiality restrictions.

Source: Statistics Canada

Table 4: Further estimates of the investment impact of HST reform
Capital and Repair Expenditures data

	Total Investment	Machinery and equipment	Non-residental construction
Baseline	0.1	.071*	0.1
	[1.68]	[1.86]	[0.81]
Excluding mining sector	0.01	.121**	-0.02
	[0.19]	[2.48]	[-0.49]
Including Quebec	0.01	.055*	-0.04
	[0.32]	[1.82]	[-0.55]
Excluding provincial trends	.066**	.064**	0.06
	[2.40]	[2.08]	[1.26]

Notes: Estimates based on aggregated data from the Capital and Repair Expenditures sur

Robust t statistics in brackets. The baseline sample is 135 observations.

* significant at 10% level; ** significant at 5% level; *** significant at 1% level.

Table 5: Estimates by sector
Capital and Repair Expenditures data

	Machinery	Buildings
Agriculture	0.261 **	0.443 **
	[2.51]	[2.76]
Construction	0.114	0.135 *
	[1.64]	[2.01]
Manufacturing	0.023	0.794 **
	[0.15]	[2.03]
Trade and transportation	-0.242 ***	-0.492 ***
	[-3.46]	[-2.87]
Finance and insurance	0.057	0.601 **
	[0.80]	[2.18]
Other services	0.064	-0.022
	[0.52]	[-0.18]

Notes: All specifications include controls for provincial log GDP per capita and the user cost of capital based on provincial and federal corporate tax measures, as well as controls for unobserved province-specific linear trends, year, and province-industry fixed effects, coefficients of which are not reported.
* significant at 10% level; ** significant at 5% level; *** significant at 1% level.

Figure 1: Gross investment per capita in HST and RST provinces
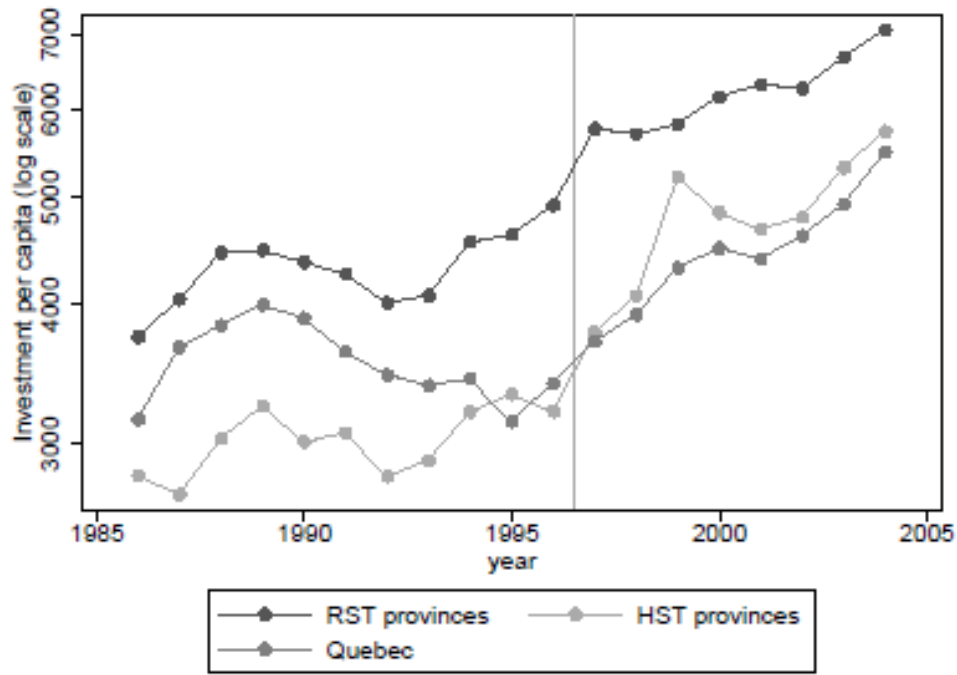
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