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

I. INTRODUCTION

Sales and gross receipts taxes are the largest source of own tax revenues in U.S. states and account for about one-fourth of state general revenues (Mikesell 2006). While most states impose traditional retail sales taxes, though with widely varying rates, bases and yields, 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, and in 2007 Illinois considered replacing its sales tax with a gross receipts tax (Giertz 2007).1 These taxes have broad bases including significant business-to-business transactions and hence distort the relative prices of business inputs, particularly capital goods (Pogue, 2007; Testa and Mattoon, 2007). On the other hand, in 2007 Georgia considered both replacing its property tax with an expanded sales tax (Winters, 2007) and also the possibility of replacing its sales tax with some form of value-added tax (VAT) (Wheeler and Monham, 2007). Most interestingly, as Michigan continues to pursue its own unique and interesting path with respect to state taxation, it has recently, without saying so, in effect adopted a form of

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1 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.
VAT that comes close in some respects to that we discuss in this paper.\textsuperscript{2}

The conventional wisdom among public finance economists is that VATs are superior to either retail sales taxes (RSTs) or gross receipts taxes (GRTs) that raise the same revenue. For example, RSTs usually have narrow consumption bases (which distort relative prices of marketed goods) and are more susceptible to tax evasion, while GRTs have very broad bases that encourage substantial tax cascading through the value added chain, which distorts the relative prices of business inputs, particularly capital goods.

This paper supports the VAT approach by providing quantitative estimates of the effects on business investment of converting state RSTs to destination-type 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”),\textsuperscript{3} comparing their experience to what happened in the same period in provinces that 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 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 VAT on consumption. Four other provinces, in contrast, levy VATs that 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 percent 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) estimates the “producer’s share” of RST state tax revenues to be 41 percent. 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 percent 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 U.S. 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

\textsuperscript{2} 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. The new tax more closely approximates a destination-based consumption VAT, as McIntyre and Pomp (2009) show.

\textsuperscript{3} 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 VAT with a base now quite similar to the GST. In March 2009, Canada’s largest province, Ontario, announced its intention to move in July 2010 to a provincial VAT base essentially the same as the federal GST base. The new tax will, like the existing HST, be administered by the federal government along with the GST.
different in some respects—an issue that we do not discuss further in this paper.\footnote{For further discussion of this point, see Bird, Mintz and Wilson (2006) and Bird and Gendron (2009).}

The necessary implication of high taxes on business inputs under RSTs is that, if a VAT 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 direct tax 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 labor, 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 1 percent increase in costs induced by taxes led to approximately a 1 percent increase (or perhaps more) in the price paid by consumers.\footnote{Besley and Rosen (1999) found somewhat similar results in an earlier study of U.S. state sales tax incidence; see also Poterba (1996).} Since these results are consistent with the notion that 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 II describes the sales tax systems of the Canadian provinces and discusses the economic problems associated with the RST as well as those with the GRTs recently discussed and introduced in some U.S. states. Section III 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 IV. Section V concludes.

II. SYSTEMS OF SALES TAXATION

The Canadian federation offers a useful laboratory for studying alternative sales tax regimes. Five Canadian provinces currently operate RSTs, while four others have adopted VATs that 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 1991 with the Quebec Sales Tax (QST), a modified VAT 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 percent in all three provinces, replacing the previous RST system that levied effective rates of 11 to 12 percent. Traditional RSTs remain in the provinces of Prince Edward Island, Ontario, Manitoba, Saskatchewan, and British Columbia.

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

- RSTs tax many purchases of intermediate inputs by businesses, but unlike the GST have no provision for rebating tax paid on inputs.
- Many services, even those consumed as final demand and purchased at the “retail” level, are exempted from taxation under the RSTs. The treatment of services is complicated under the GST, with many service sectors receiving tax exempt status, while international transportation services are in fact zero-rated. 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.
- 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. However, it taxes purchases of new houses, albeit at a reduced rate especially for properties valued at less than $450,000.

A. Problems with RSTs and GRTs

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 tax.
The Impact on Investment of Replacing a Retail Sales Tax with a Value-Added Tax

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.

RSTs imposed 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 theorem 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 whenever the tax authority has access to both an unlimited set of taxes on consumer demands that are set optimally, and to direct taxes on pure profits earned in production that are used to fully expropriate all such profits. While these conditions are of course not fully satisfied in the real world, there is nonetheless a presumption that input taxes—which distort production decisions while resulting in changes in prices that are equivalent to some input-exempting consumption tax system—should be avoided whenever possible (Keen 2007).

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), RSTs imposed 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 IV below.

A broader based alternative to state RSTs proposed by some commentators is the Gross Receipts Tax (GRT). The simplest form of GRT is of course the antiquated turnover tax, which taxes all sales by all businesses. Even the modified GRTs recently enacted or discussed in several U.S. states include significant business-to-business transactions in the tax base, hence encouraging substantial tax cascading through the value added chain and distorting the relative prices of business inputs, particularly capital goods.

As both Pogue (2007) and Testa and Mattoon (2007) suggest, in the end the only sensible way to impose a GRT is by introducing some form of crediting for business-to-business transactions, thus turning it into something as close to an income-type VAT as possible. Here, we go further and suggest, as did Bird (2007), that states can and should consider carefully the possibility of going further and introducing a destination-type VAT —as indeed McIntyre and Pomp (2009) show Michigan has in effect just done under the name of a “modified gross receipts tax.”

It is important to note that the “income-type VAT” suggested by Pogue (2007) and Testa and Mattoon (2007)—a tax that was called a BVT or business value tax by Bird (2003)—and the “destination-type VAT” discussed here (and 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 provincial VATs currently imposed in four Canadian provinces, and to be introduced in 2010 in Ontario, are standard “consumption” VATs explicitly imposed only on consumption by local residents.

B. 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 various items that reflect “sales for resale.” While it is not always clear what these terms mean, the usual interpretation excludes from tax goods that are physically incorporated in other goods that are then sold for final consumption—e.g., wood used to build a desk or inventory sold at retail. There are however many borderline 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 provincial (or state) RST comes close to excluding all business inputs from taxation.

In contrast, under invoice-and-credit VATs, such as the federal GST and its provincial equivalents (the HST and the QST) 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 misstating the value of the transaction on invoices for tax purposes. Moreover, the existence of a “trail” of taxable invoices that constitute explicitly falsified documents in principle makes it easier to detect and prove fraud at the pre-retail level than it is to detect the simple non-reporting that is the most common form of RST fraud.

III. 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

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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.
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 percent (although it has since been reduced to 5 percent), while the RST rate was 8 percent in Ontario, 10.7 percent in Prince Edward Island, and 7 percent 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 of the change in statutory tax burdens for different sectors of the economy under such a reform.

Table 1
Revenue Consequences of Implementing Provincial VATs
($ Millions)

<table>
<thead>
<tr>
<th></th>
<th>Prince Edward Island</th>
<th>Ontario</th>
<th>Manitoba</th>
<th>Saskatchewan</th>
<th>British Columbia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consumers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goods</td>
<td>28</td>
<td>1,252</td>
<td>67</td>
<td>200</td>
<td>353</td>
</tr>
<tr>
<td>Services</td>
<td>11</td>
<td>754</td>
<td>70</td>
<td>115</td>
<td>722</td>
</tr>
<tr>
<td>Housing</td>
<td>16</td>
<td>1,816</td>
<td>73</td>
<td>52</td>
<td>549</td>
</tr>
<tr>
<td><strong>Business</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction inputs</td>
<td>–25</td>
<td>–1,553</td>
<td>–116</td>
<td>–130</td>
<td>–519</td>
</tr>
<tr>
<td>Other intermediate</td>
<td>–16</td>
<td>–1,516</td>
<td>–106</td>
<td>–119</td>
<td>–516</td>
</tr>
<tr>
<td>Capital</td>
<td>–12</td>
<td>–1,021</td>
<td>–125</td>
<td>–79</td>
<td>–351</td>
</tr>
<tr>
<td>Government</td>
<td>–4</td>
<td>147</td>
<td>–14</td>
<td>–24</td>
<td>–15</td>
</tr>
<tr>
<td>Total impact</td>
<td>–1</td>
<td>–121</td>
<td>–151</td>
<td>16</td>
<td>224</td>
</tr>
<tr>
<td>Total revenues 2002</td>
<td>179</td>
<td>14,419</td>
<td>1,123</td>
<td>858</td>
<td>3,984</td>
</tr>
<tr>
<td>Tax rate (%)</td>
<td>10.7</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
</tbody>
</table>


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 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 8 percent provincial VAT (PVAT) would be eight-sevenths of the corresponding GST effective rates. (As mentioned earlier, as of 2010 the Ontario 8 percent VAT will no longer be hypothetical, but real.)
In summary, Table 1 shows:

- 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 4–6 percent of the corresponding estimates of private gross fixed capital formation from the 2002 national accounts, including 4.4 percent in Ontario, the largest province.

- Effective tax rates on services would, perhaps surprisingly, change little: the reported increase in revenues from taxing services represents about 0.5 percent of the corresponding base in Ontario, and 1.4 percent 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. 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.

- 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.

- 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. 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

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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 See Bird and Gendron (2009) for a detailed discussion of the extensive GST “rebate” system in Canada.

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

19 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).
that are available under the federal GST.20 In fact, reforming provinces, if they wished, could in principle increase their revenues by reducing the rebates available to tax-favored sectors.21

IV. INVESTMENT IMPACTS OF SALES TAX REFORM

A primary effect of reforming retail sales taxes in Canadian provinces and similar small open jurisdictions would be to eliminate the resulting sales taxes on investment goods, and so perhaps to increase capital stocks in the 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. While the empirical magnitude of the link between machinery investment and productivity is open to question for the United States as a whole (Auerbach, Hassett, and Oliner, 1994), the effect has been argued to be most important in a country like Canada with a high rate of foreign direct investment and a resulting potential for technology transfer through investment (Globerman, Ries, and Vertinsky, 1994)—conditions likely to be found in most small sub-national jurisdictions. 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 (2005) calculated that provincial RSTs add about 5 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. Reducing METRs on capital by eliminating the taxation of capital inputs under RSTs should stimulate investment, both due to the hypothesized factor substitution effects and 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.22

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

21 Indeed, all of the HST provinces at present provide lower rebates for some sectors than available under the GST; for details, see Bird and Gendron (2009).

22 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 RSTs 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 percent in aggregate, compared to about 1 percent under the RSTs. While the aggregate figures mask greater variation for narrower commodity classifications, the differences are relatively small.
The recent empirical literature points to a strong and robust link between taxes as measured by the METR and investment levels (see Hassett and Newmark (2008) and Organisation for Economic Co-operation and Development (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 effective tax rates on some capital goods, with estimated average effective tax rates on machinery and equipment in 1996 ranging from 2.6 percent in Manufacturing to 10.4 percent in Construction, and averaging about 4.95 percent. (Estimates of pre-reform effective tax rates are discussed in more detail below and presented in Table 2.)

The broad empirical strategy we follow here 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\(^{23}\) in 1997 dollars for the 1986-2004 period, on average for Quebec, the HST provinces, and the five provinces that have retained their RSTs\(^{24}\). Prior to the reform, investment per capita was relatively low in the HST provinces, 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 changed 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

<table>
<thead>
<tr>
<th>Table 2</th>
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<tr>
<td><strong>Estimates of the Investment Impact of HST Reform</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Total Investment</th>
<th>Machinery and Equipment</th>
<th>Non-residential Construction</th>
<th>Residential Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>HST</td>
<td>0.111**</td>
<td>0.167**</td>
<td>0.242</td>
<td>-0.003</td>
</tr>
<tr>
<td>Logarithm of GDP</td>
<td>1.06***</td>
<td>1.43***</td>
<td>1.00</td>
<td>0.83*</td>
</tr>
<tr>
<td>Observations</td>
<td>180</td>
<td>180</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.95</td>
<td>0.96</td>
<td>0.88</td>
<td>0.90</td>
</tr>
</tbody>
</table>

Notes: Asterisks denote significance at the 1% (**), 5% (**), and 10% (*) levels. All specifications include province-specific linear trends and year fixed effects, with coefficients not reported. Robust t statistics are in parentheses.

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23 The data are for business gross fixed capital formation, from the Provincial Economic Accounts prepared by Statistics Canada, available at www.statcan.ca.

24 Alberta, which does not levy a sales tax, is excluded.
lead to a permanent rise in capital per unit of output but not a permanent rise in net 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 VAT 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 increase in relative investment rates in the HST provinces. For example, these factors may include (1) a general rise in economic growth in the HST provinces, rather than investment per se, (2) long-term trends in the HST provinces unrelated to the reform, and (3) 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 provincial business cycle effects) and a dummy variable equal to one in years and in 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. That is, the estimating equation is

\[ \text{LOGINVPC}_i = \alpha_i + \alpha_i t + \beta_i \text{HST}_i + \gamma \text{LOGGDP}_i + \epsilon_{it} \]

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 \( \beta \), the difference-in-differences 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.

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 percent 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 percent significance level.

The remaining three columns of Table 2 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 (M&E)—the component most affected by the reform. The effect of HST reform on M&E investment is larger, at 16.7 percent, than for the total, and significantly different from zero at the 95 percent confidence level. In the third column, the dependent variable is real business investment in non-residential buildings per capita; the estimated HST impact in this case 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. Nonetheless, the point estimate is large. We discuss this further 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. The HST reforms likely should not have had 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

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25 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.

26 The robust standard errors are calculated with the “cluster” option under Stata’s regress command.
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 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 interpretation that the results reported thus far reflect the sales tax reform rather than other contemporaneous factors is strongly 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 to 10.4 percent 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 0.5–1.0 for user cost investment elasticities reported 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 estimates from our reduced-form approach are undeniably large. Of course, as noted earlier, larger investment elasticities than those for the United States as a whole would presumably be expected in small open economies like Canadian provinces (or, perhaps, the U.S. states?).

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-differences 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

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Summary Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment and Effective Sales Tax Rates by Industry (Capital and Repair Expenditures Data)</td>
<td>Pre-reform Effective Tax Rate on Investment in HST Provinces (%)</td>
</tr>
<tr>
<td>Average Provincial Investment Per Capita (1992 $ per year)</td>
<td>Machinery</td>
</tr>
<tr>
<td>Agriculture</td>
<td>35.6</td>
</tr>
<tr>
<td>Mining and oil and gas</td>
<td>699.2</td>
</tr>
<tr>
<td>Construction</td>
<td>94.4</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>603.5</td>
</tr>
<tr>
<td>Trade and transportation</td>
<td>192.1</td>
</tr>
<tr>
<td>Finance and insurance</td>
<td>367.1</td>
</tr>
<tr>
<td>Other services</td>
<td>121.0</td>
</tr>
</tbody>
</table>

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.


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had similar effects in manufacturing and processing industries.\textsuperscript{27}

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.\textsuperscript{28} Unlike the Provincial Economic Accounts (PEA) data used to generate the estimates in Table 2, 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.\textsuperscript{29} The first column shows 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).\textsuperscript{30} 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 percent average effective rate, and that rates vary widely among sectors, with a low of 2.6 percent in Manufacturing. Estimated effective tax rates on buildings are above 4 percent 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

\textsuperscript{27} 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 percent of most capital expenditures in manufacturing and other industries.

\textsuperscript{28} The data are available at www.statcan.ca.

\textsuperscript{29} 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. 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.

\textsuperscript{30} 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 $\tau_t$ 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.
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-differences estimates of the effect of the HST reforms, 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 the logarithm of 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 percent increase for the machinery and equipment category being significantly different from zero.

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 12.1 percent 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-differences 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 Finance31 for each of our

<table>
<thead>
<tr>
<th></th>
<th>Total Investment</th>
<th>Machinery and Equipment</th>
<th>Non-residential Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>0.100 (1.68)</td>
<td>0.071* (1.86)</td>
<td>0.100 (0.81)</td>
</tr>
<tr>
<td>Excluding mining sector</td>
<td>0.010 (0.19)</td>
<td>0.121** (2.48)</td>
<td>-0.020 (-0.49)</td>
</tr>
<tr>
<td>Including Quebec</td>
<td>0.010 (0.32)</td>
<td>0.055* (1.82)</td>
<td>-0.040 (-0.55)</td>
</tr>
<tr>
<td>Excluding provincial trends</td>
<td>0.066** (2.40)</td>
<td>0.064** (2.08)</td>
<td>0.060 (1.26)</td>
</tr>
</tbody>
</table>

Notes: Asterisks denote significance at the 1% (**), 5% (**), and 10% (*) levels. Estimates are based on aggregated data from the Capital and Repair Expenditures Survey. Robust t statistics are in parentheses. The baseline sample is 135 observations.

31 For detail on the user cost methodology, see Department of Finance (2005).
broad industry groups except Mining.\textsuperscript{32} 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-differences 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:

\begin{equation}
(1') \text{LOGINVPC}_a = \alpha_0 + \alpha_t + \delta_i + \beta \text{HST}_a + \eta \text{UCC}_a + \gamma \text{LOGGDPPC}_a + \epsilon_a
\end{equation}

where UCC is the computed user 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 are 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

\begin{table}[ht]
\centering
\begin{tabular}{lcc}
\hline
   & Machinery & Buildings \\
\hline
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) \\
\hline
\end{tabular}
\caption{Estimates by Sector (Capital and Repair Expenditures Data)}
\end{table}

Notes: Asterisks denote significance at the 1% (**), 5% (*), and 10% (*) levels. 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.

\textsuperscript{32} Corporate taxation in the Mining sector is particularly complicated.
and suppresses the others for brevity. The unreported coefficient estimates for the UCC 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 percent increase in machinery and equipment investment when the UCC is excluded from the regression, but a mere 2.3 percent 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 percent above the trend level following the reform, when controls for the separate impact of UCC changes are included. 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 percent 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.

V. 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. Economic theory predicts that eliminating such taxes by replacing RSTs with VATs would have substantial effects on business investment. Consistent with this theory, 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 percent 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 in Canadian provinces is very similar to that in many U.S. states, a priori one might expect to see similar effects from a similar tax substitution by a U.S. state, although of course the details would vary from state to state depending on the structure of their economies and their RSTs. Smart and Bird (2009) 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 in the U.S. 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.33

ACKNOWLEDGMENTS

We would like to thank Ziad Ghanem of Statistics Canada for access to and assistance with data, and the participants at the John Deutsch Institute 2006 conference on “Harmonizing the RSTs and GST in Canada: Arguments and Issues” for advice and encouragement. We are also grateful to the editor and two anonymous referees for helpful comments that have improved the paper. An earlier version of much of this paper appeared in Smart (2007).

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33 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 examined in the present paper, but is discussed by Bird and Gendron (2009).
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