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# The Economic Incidence of Replacing a Retail Sales Tax with a Value-Added Tax: Evidence from Canadian Experience

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Il y a une dizaine d'années, plusieurs provinces canadiennes ont remplacé la taxe de vente au détail par une taxe sur la valeur ajoutée. Dans cet article, nous analysons l'effet que ce changement a eu sur les prix à la consommation dans les provinces concernées. En accord avec la théorie dans ce domaine, nous observons que l'effet entraîné par les changements de taux a été reporté sur les consommateurs dans la plupart des secteurs de l'économie. Au bout du compte, l'impact sur les prix nets à la consommation n'a pas été important, quoique peut-être un peu dégressif.

**Mots clés :** incidence fiscale, taxe de vente, taxe sur la valeur ajoutée

A decade ago, several Canadian provinces replaced the retail sales taxes with value-added taxes. This paper estimates the effects of this tax substitution on consumer prices in the reforming provinces. Consistent with theory, we find that the resulting effective tax-rate changes were shifted forward to consumers in most sectors of the economy. The overall effect on tax-inclusive consumer prices was small, albeit perhaps somewhat regressive.

**Keywords:** tax incidence, sales tax, value-added tax

Recent developments in federal-provincial relations in Canada have renewed interest in the possibility of reforming provincial sales-tax systems. At present, five provinces operate retail sales-tax (RST) systems. Retail sales taxes are col-

lected separately and on a very different basis from the federal Goods and Services Tax (GST), which is a value-added tax (VAT) on consumption. Four other provinces, in contrast, levy value-added taxes that are largely integrated with the federal GST.

Many economists perceive substantial advantages in replacing RSTs with VATs, chiefly related to the taxes imposed on business inputs under RSTs. Taxes on business inputs cascade through the value-added chain, causing potentially important distortions in business decisions and losses in productivity.<sup>1</sup> More than 43 percent of aggregate RST revenues are estimated to come from taxing business inputs.<sup>2</sup> Given the high taxes imposed on business inputs under RSTs, for a shift to VATs to be revenue neutral, the taxes levied directly on personal expenditures of consumers would have to rise substantially through the broadening of the tax base—for example, to include purchases of new homes and, to a lesser extent, some other goods and services not previously taxed directly under RSTs. This shift in burdens from businesses to consumers is sometimes regarded as having undesirable distributional—and political—consequences and has apparently constituted a major obstacle to the reform of the sales tax in the remaining RST provinces.

Economists frequently assert that all taxes are ultimately paid by people and not by businesses. The question, however, is to what extent shifts in statutory burdens are reflected in shifts in true economic incidence. The answer depends on the extent to which existing RST input taxes are shifted forward to consumers (through higher prices), or backward to factors of production (through lower wages for example). The housing sector illustrates the issue: in the province of Ontario, for example, the results of substituting a VAT for the present RST would be an increase of roughly \$1.8 billion annually in new taxes on housing. However, at the same time, as a result of the tax reform the taxes imposed on residential and non-residential construction in the province would be reduced by about \$1.6 billion (Smart and Bird 2008). The final distributional implications of such a reform thus depend crucially on the extent to which these reduced taxes on construction inputs are either shifted forward to consumers in the form of lower housing prices and residential rents or shifted backward to owners of

labour, capital, and land used in the production of housing services.

In the present paper we explore this question and attempt to provide quantitative estimates of the likely distributional impacts of converting provincial RSTs to value-added taxes. To do so, we examine the actual impacts of reform in three Canadian provinces that have already adopted the same value-added tax base as the federal GST,<sup>3</sup> comparing their experience to what happened in the same period in the five provinces that have retained the RST system. In effect, we treat the asymmetric nature of sales-tax reform in Canada as analogous to a “natural experiment” that allows us to control 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.

In brief, the results show that 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 leads to approximately a 1 percent increase (or sometimes a bit more) in the price paid by consumers.

Actually, overall consumer prices in the three HST (harmonized sales tax) provinces fell with the 1997 reform, although prices rose somewhat for purchases of shelter, clothing, and footwear, which would tend to make the reform in itself slightly regressive. The pattern of reform-induced tax changes would presumably be somewhat different if harmonization were extended to the remaining RST provinces, since their economic structures and current sales-tax systems differ to some extent from those that were replaced in the 1997 reform we examine here. Nonetheless, our principal result—that sales taxes are fully shifted forward (or even “overshifted”) in most sectors, so that the change in

statutory burdens that occurs when a province moves from an RST to a VAT would not result in large distributional effects—seems likely to be as valid today in provinces such as Ontario or British Columbia as the evidence we discuss here suggests that it was a decade ago in the three eastern HST provinces.<sup>4</sup>

## PROVINCIAL SALES TAXATION IN CANADA

As mentioned above, five Canadian provinces currently operate RST systems, while four others have adopted value-added taxes that are largely integrated with the federal GST. The tenth province, Alberta, levies no direct 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 de-

tailed description of the differences between the two tax bases. Further reform followed in 1997 with the introduction of the Harmonized Sales Tax in Newfoundland and Labrador, Nova Scotia, and New Brunswick. The base of the HST is essentially the same as that of the federal GST,<sup>5</sup> collection of the federal and provincial taxes is unified, and the provincial portion of the rate is 8 percent in all three provinces.<sup>6</sup> The new HST replaced their previous RSTs, which had levied effective rates of 11.77 to 12.84 percent.<sup>7</sup> Traditional RSTs remain in the provinces of Prince Edward Island, Ontario, Manitoba, Saskatchewan, and British Columbia, levied at statutory rates of between 5 and 10.5 percent.<sup>8</sup> In all provinces, owing to exemptions from taxation, the effective tax rates are well below statutory rates (see Table 1).

Provincial RSTs are levied on essentially all purchases of goods (and some services) at retail points of sale. In contrast, the GST/HST is an invoice-and-credit value-added tax that taxes sales of most goods

TABLE 1  
Average Effective Tax Rates by Expenditure Category, 1996

	<i>Direct Taxes on Sales (%)</i>		<i>Indirect Taxes on Production (%)</i>	
	<i>RST Provinces</i>	<i>HST Provinces</i>	<i>RST Provinces</i>	<i>HST Provinces</i>
All items	2.7	4.3	0.5	0.5
Food	0.7	1.5	0.5	0.5
Shelter	0.1	0.7	0.4	0.5
Household operations and furnishings	3.5	4.9	0.7	0.7
Clothing and footwear	4.8	6.1	0.5	0.4
Transportation	4.0	7.6	0.5	0.3
Health and personal care	1.5	3.0	0.9	0.8
Recreation, education, and reading	4.8	7.0	0.6	0.7
Alcohol and tobacco products	6.9	8.4	0.2	0.2

Note: RST = retail sales tax. HST = harmonized sales tax. Effective tax rates on sales (DIRTAX) and on production costs (INDTAX), by Consumer Price Index expenditure category. Unweighted averages of individual provincial rates.

Source: Authors' calculations.

and services by registered traders while according full credit (offset) for taxes paid on registered traders' purchases of taxable goods. In practice, the chief differences between the GST and RST bases are as follows:

- 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. Indeed, as discussed later, a remarkable proportion of provincial "retail" sales tax revenues actually come from taxing business 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.<sup>9</sup> 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: that is, payments of rent are untaxed, and purchases of owner-occupied housing are untaxed as well. The GST also exempts market rents and implicit rents on owner-occupied housing, but it taxes purchases of new houses, albeit at a reduced rate, especially for properties valued at less than \$450,000.<sup>10</sup>

In practice, 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

favoured at the expense of others. Different firms and sectors of the economy rely on purchases of inputs subject to RST to different degrees, resulting in unequal increases in costs of production and prices, and so in further departures from neutrality, efficiency in production, and international competitiveness.

A move by the provinces from their current RST bases to any true value-added tax base would appear, owing to these differences in bases, to have potentially large consequences for the distribution of tax burdens between business and consumers, and among sectors of the economy. As we show below, however, in the end the distributional effects of substituting a provincial VAT for a provincial RST are surprisingly small.

#### ECONOMIC INCIDENCE OF SALES TAX HARMONIZATION

The HST reform changed the effective tax rates imposed on final sales to consumers—through changes in both the base and the statutory rates of tax—and also reduced taxes paid on business purchases in the reforming provinces. What was the ultimate burden of these changes on consumers? That sales and excise taxes are generally shifted forward to final consumers is a central, but largely untested, precept of public finance. There are a number of reasons why one might expect less than full pass-through of tax changes. First, when firms have market power and consumers are imperfectly informed about taxes, it may be reasonable to suppose that business markups change when tax rates change, and especially when "hidden" taxes on business inputs are replaced by explicit taxes on consumers (Chetty, Looney, and Kroft 2007). Second, since RSTs apply to only some business inputs, the effects of the reform on consumer prices are in principle more complicated than a pure, neutral shift in statutory tax incidence from sellers to purchasers. Third, RSTs on business inputs are levied on a source basis—paid by firms producing commodities

within the taxing province; by contrast, the HST on consumers is levied on a destination basis—paid where the commodity is consumed, regardless of where it was produced.<sup>11</sup> To the extent that the taxed commodities are “tradable”—that is, they compete with imports in the producing province or are exported for sale elsewhere—it may be reasonable in at least some instances to suppose that RSTs on business inputs are shifted backward to factors of production rather than embedded in the sale prices of commodities.

To address the economic incidence question, we analyze the actual effects of the 1997 HST reform on consumer prices in the three reforming provinces of Nova Scotia, New Brunswick, and Newfoundland and Labrador. We examine the relationship between changes in consumer prices and changes in effective tax rates in these provinces in the years following the 1997 reform, exploiting comparisons with the non-reforming provinces to control for economic and especially for monetary factors that otherwise affected the rate of consumer price inflation at the same time.

A similar empirical strategy of examining changes in consumer prices after the reform was also employed by Murrell and Yu (2000), who estimated the effect of HST reform as the average forecast error after 1997 from an estimated autogressive process for consumer prices in the reforming provinces. The present analysis differs from theirs chiefly by incorporating measures of the effective tax-rate changes by expenditure category, and by estimating *differences* in price changes between the HST and RST provinces, in order to control for nationwide factors unrelated to the reform that may have affected the rate of price inflation after 1997.<sup>12</sup> One such factor, which is likely to have exerted an important influence on price changes throughout the country during the period, is monetary policy. From July 1997, when the reform was implemented, to the latter half of 2000, the bank rate rose from 3.25 percent to 6 percent, suggesting a significant tightening of monetary policy that may well have

impeded price growth in the reforming and non-reforming provinces alike.

In some respects, the 1997 reform exerted a different influence on prices than might be anticipated to result from further harmonization in the remaining RST provinces. In the 1997 reform, tax rates fell from 11.77 percent in Nova Scotia and New Brunswick and 12.84 percent in Newfoundland and Labrador to 8 percent in all three HST provinces. At present, while sales-tax rates in the remaining RST provinces range from 5 to 10.5 percent, all but one have rates of 8 percent or lower. This might suggest that the tax base in the RST provinces is already broader than it was in the HST provinces prior to the reform, that provincial revenues declined with the 1997 reform (Blagrove 2005), or both. In addition, to the extent that a smaller portion of the value-added chain lies within the HST provinces (which are smaller and have less developed secondary and tertiary economic sectors) than would be true in the remaining RST provinces, the elimination of taxes on business inputs in the former group would have had a smaller effect on business costs than it would in the RST provinces, where embedded input taxes are larger in proportion to consumer expenditures. Since elimination of input taxes would “cascade” through the value-added chain, the move to a VAT might therefore potentially result in more than proportional reductions in costs in the remaining RST provinces.

Nevertheless, comparing changes in effective tax rates in the 1997 reform to the corresponding changes in consumer prices allows us to estimate the average degree of “pass-through” of tax changes to price changes. In particular, we are able to test the hypothesis that tax changes are fully shifted forward to consumer prices, consistent with the standard theory.

The goal is to estimate the relationship between consumer prices, cost, and taxes,

$$(1) \quad q_{it} = (1 + DIRTAX_{it})^{\beta} p_{it}(\tau_{it}),$$

where  $q_{it}$  is the consumer price of a particular commodity group in province  $i$  and year  $t$ ,  $DIRTAX_{it}$  the corresponding tax rate levied directly on sales to consumers, and  $p_{it}$  the producer price (or marginal cost) of the good, which may in principle depend on the full vector of input tax rates  $\tau_{it}$ . In this formulation,  $\beta$  is the elasticity with which taxes on the sale of the commodity in province  $i$  are shifted forward to consumers. As noted earlier, this parameter may depend on the extent of imperfect competition in the sector and (for perfectly competitive markets) on the elasticity of supply.

While equation (1) depends on the producer price  $p_{it}(\tau_{it})$ , in our data we observe consumer prices and direct and indirect tax rates, but not producer prices; we therefore proxy the producer price by the function

$$(2) \quad p_{it} = p^0_{it}(1 + IND TAX_{it})^\gamma,$$

where  $IND TAX_{it}$  is the estimated percentage by which unit costs of the good sold in province  $i$  are increased through the input tax system in place in year  $t$ , and  $\gamma$  is a parameter measuring the elasticity with which the source-based tax on production costs  $IND TAX$  is shifted forward to consumer prices. Observe in particular the two polar cases: when  $\gamma = 1$ , taxes on production costs are fully shifted forward to consumer prices; whereas when  $\gamma = 0$ , they are shifted backward to factors of production, which may be consistent with theory for the case of a pure source-based tax on production of a commodity that competes with goods produced in other jurisdictions. In equation (2),  $p^0_{it}$  is the unobserved component (costs) in producer prices unrelated to taxes, the empirical implementation of which is discussed next.

Combining (1) and (2) gives a general reduced-form estimating equation

$$(3) \quad \log q_{it} = \alpha_i + \delta_t + \beta \log(1 + DIRTAX_{it}) + \gamma \log(1 + IND TAX_{it}) + \varepsilon_{it},$$

where  $\alpha_i$  and  $\delta_t$  are fixed effects to be estimated, which together capture unobserved factors influencing the unobserved component in both producer prices and pricing behaviour that vary persistently among provinces or nationally over time;  $\varepsilon_{it}$  is an error term. In equation (3), the parameters  $\beta$  and  $\gamma$  measure the elasticity of consumer prices with respect to direct and indirect taxes—the extent to which taxes are shifted forward to consumers. Under full forward shifting, for example,  $\beta = \gamma = 1$ . If residence-based taxes on consumers are shifted forward but source-based taxes on businesses are shifted backward, then  $\beta = 1$  and  $\gamma = 0$ .

In practice, in our data, changes in  $DIRTAX$  and  $IND TAX$  are highly collinear,<sup>13</sup> since both tax rates fell for most commodity groups in the HST provinces after the 1997 reform, which makes separate estimation of the two elasticities difficult. We therefore constrain  $\beta = \gamma$  and define the combined tax rate as

$$(4) \quad TOT TAX_{it} = (1 + DIRTAX_{it})(1 + IND TAX_{it}) - 1,$$

yielding the final estimating equation

$$(5) \quad \log q_{it} = \alpha_i + \delta_t + \beta \log(1 + TOT TAX_{it}) + \varepsilon_{it}.$$

The assumption that  $\beta = \gamma$ , while not testable with our data, is a natural one: it states that the economic incidence of taxes is the same, regardless of whether they are levied on producers' costs or on consumers' purchases.<sup>14</sup>

## DATA AND ESTIMATES

To estimate equation (5), we obtained from Statistics Canada's Input-Output Division estimates of the effective tax rates on consumer purchases of goods and services under all provinces' RSTs in 1996, and for the reforming provinces in 1998, after the reform had been implemented. The effective tax rates incorporate both the taxes imposed directly on



consumer purchases and indirectly on business input costs, and are based on a detailed reading of the sales-tax laws of each of the provinces.<sup>15</sup> The effective tax rates were then aggregated to the level of the eight major expenditure categories in the Consumer Price Index survey, 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.

To give a sense of the magnitude of the 1997 changes, simple averages of provinces’ pre-reform effective tax rates are reported in Table 1. Note in particular that “direct” taxes on consumption are in most categories much larger than “indirect” taxes on production. In addition, owing to exemptions, the effective tax rates for both the direct and indirect components are well below the statutory rates.

The combined effect of the 1997 tax-rate changes, together with the corresponding expenditure shares for the Consumer Price Index (CPI) basket, is reported in the first two columns of Table 2. The overall effect of the reform was to reduce effective taxes by 0.5 percent of consumer expenditures, indicating that the decline in statutory tax rates and the elimination of input taxes more than offset the impact of expanding the base to include additional consumer expenditures. While the overall decline is small, there is considerable variation among expenditure categories: effective tax rates have risen for shelter costs, and clothing and footwear due to base expansion, whereas rates have declined by as much as 3.4 percent of expenditures for alcohol and tobacco products, reflecting the reduction in statutory tax rates (as well as other changes in excise taxation that were contemporaneous with the HST reform but are not discussed further here).

We turn next to the corresponding changes in consumer prices around the reform date. Figures 1

and 2 display graphs of average consumer prices in the reforming and non-reforming provinces for two of our seven categories, employing CPI data for the 1992–2005 period, since the CPI reference basket changed in 1992. The two categories shown are not randomly chosen: they have the largest changes in average tax rates under reform (except for alcohol and tobacco products, where, as noted above, prices may be subject to very different influences). These graphs offer both a first look at our results and an illustration of our empirical method.

Figure 1 shows prices for the household operations and furnishings category, where average tax rates dropped 1.2 percentage points with the reform. Nominal prices for this category in the HST provinces continued to rise after 1997, but at a significantly lower rate than previously, and lower than contemporaneously in the non-reforming provinces. Figure 2 shows the analogous results for the recreation, education, and reading category, for which the estimated tax-rate reduction was 2.0 percentage points. Examination of the graph suggests that price inflation in this category did slow after 1997, but not significantly more than in the non-reforming HST provinces. Indeed, since there was some slowing of inflation for this category that predated the reform in the HST provinces, it is possible that the observed divergence over the longer time period reflects factors other than the tax reform.

Before turning to elasticity estimates, we first consider a regression in which the tax term in equation (5) is replaced by a dummy variable for the HST reform, in addition to the dummy variables for each province and year.<sup>16</sup> This generates a convenient estimate of the percentage by which prices fell in the HST provinces after the reform, compared with the contemporaneous change in the RST “control” provinces. The regressions are performed separately for each of the eight major expenditure categories in the CPI bundle, as well as for the aggregate of all commodities. Of course, innovations in the price series tend to be persistent over time, which may



TABLE 2  
The Impact of HST Reform on Taxes and Consumer Prices

	<i>Expenditure Shares (%)</i>	<i>Change in Tax Rate (%)</i>	<i>Change in Price (%)</i>	<i>Implicit Elasticity</i>	<i>Estimated Elasticity</i>
All items	100.0	-0.5	-0.3 (0.29)	0.6	1.0 (0.45)
Food	16.8	-0.6	-0.7 (0.47)	1.2	1.4** (0.60)
Shelter	26.3	1.0	1.4** (0.66)	1.4	1.4** (0.62)
Household operations and furnishings	11.1	-1.2	-2.9*** (0.39)	2.4	2.1*** (0.33)
Clothing and footwear	6.0	1.6	1.5** (0.71)	0.9	1.0*** (0.20)
Transportation	19.4	-0.5	0.8 (0.65)	-1.6	-1.5* (0.91)
Health and personal care	4.6	-0.3	-1.4*** (0.51)	4.7	8.6*** (1.89)
Recreation, education, and reading	12.5	-2.0	-0.4 (0.46)	0.2	0.2 (0.24)
Alcohol and tobacco products	3.3	-3.4	-3.2* (1.73)	0.9	1.0* (0.55)

Note: HST = harmonized sales tax. Columns 3 and 5 present difference-in-difference generalized least squares (GLS) estimates of HST price changes, given panel-specific AR(1) errors. The implicit elasticity in column 4 is the ratio of column 3 to column 2. Standard errors in parentheses.

\*Significant at 10 percent level. \*\*Significant at 5 percent level. \*\*\*Significant at 1 percent level.

Source: Authors' calculations.

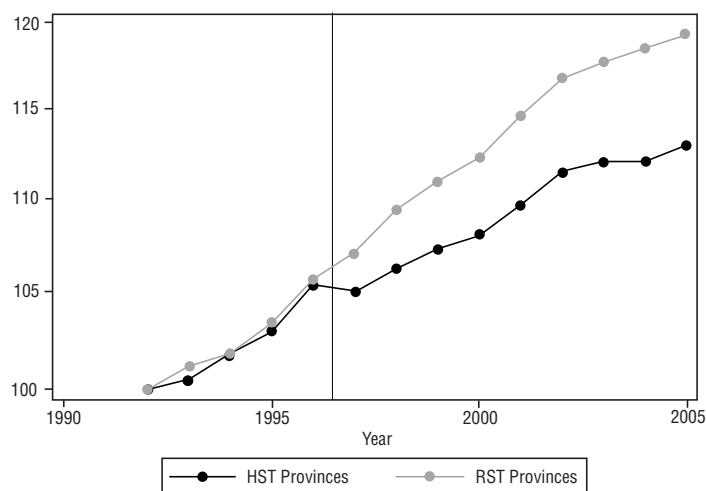
reduce the efficiency of OLS (ordinary least squares) coefficient estimates and bias the estimated standard errors. We deal with this by using annual rather than monthly CPI data for 1992–2005 and by reporting Prais-Winsten Generalized Least Squares estimates, which allow for province-specific first-order autocorrelation in the error term.

The results of this regression exercise for each expenditure category are reported in the third column of Table 2. The first row shows that aggregate

CPI prices fell by about 0.3 percent in HST provinces after 1997, relative to the corresponding change in RST provinces. This difference is statistically insignificant but close to the estimated 0.5 percent reduction in taxes under the reform shown in the second column of the table.

The regression results reported in the third column for each of the eight component expenditure categories tell a similar story. On average, prices in HST provinces declined relative to RST provinces

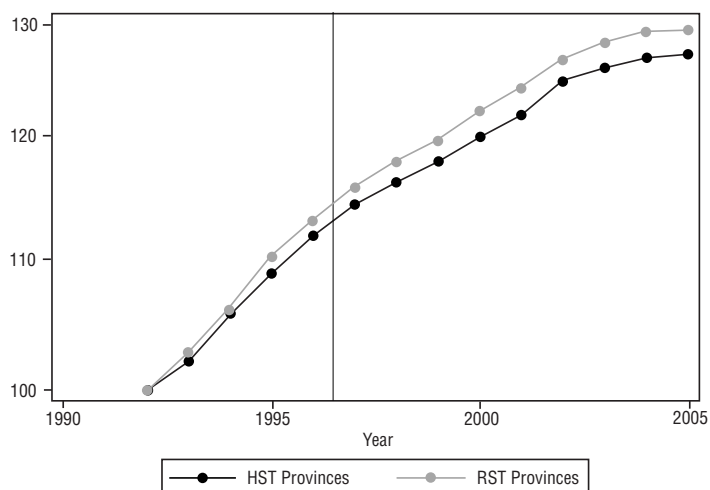
FIGURE 1  
CPI Prices of Household Operations and Furnishings



Note: CPI = Consumer Price Index. HST = harmonized sales tax. RST = retail sales tax.

Source: Statistics Canada (1992–2005), CANSIM Table 326-0021.

FIGURE 2  
CPI Prices of Recreation, Education, and Reading



Note: CPI = Consumer Price Index. HST = harmonized sales tax. RST = retail sales tax.

Source: Statistics Canada (1992–2005), CANSIM Table 326-0021.

for five of the eight categories and rose for three. The signs correspond to the sign of the estimated change in the effective tax rate in all categories but one (transportation, where prices rose despite a decline in taxes), and the magnitudes are generally quite similar.

Particularly notable, perhaps, is the estimated 1.4 percent price increase for shelter, reflecting the extension of the tax base to include new house purchases, and the 1.5 percent price increase for clothing and footwear, which also likely reflects the broader base of the HST. Since expenditure shares for these categories tend to be larger for low-income households, this raises the possibility that the reform was regressive, raising the average prices faced by low-income households while decreasing them overall.<sup>17</sup> The notion that the federal GST is less progressive than the Manufacturers' Sales Tax (MST) it replaced in 1991 or than an equal-yield expansion of federal income taxes has been a significant issue since its inception (see, e.g., Ruggeri and Bluck 1990). Differences in progressivity between the GST and the provincial RSTs should presumably be smaller, however, since the bases are much closer than were the MST and GST bases.

A simple way of measuring progressivity of the estimated price changes is to consider a notional household that allocates 20 percentage points more of its income to the categories of food, shelter, and clothing and footwear than the shares in the aggregate CPI bundle reported in the first column of Table 2, which corresponds roughly to the way Statistics Canada estimates low-income cutoff levels below which families are often deemed to be poor.<sup>18</sup> Using these weights to aggregate the estimated tax and price changes, we find that on average effective tax rates were unchanged for low-income households, but the corresponding price index rose by 0.24 percent. Our conclusion is that the HST reform apparently had at most a mild regressive impact. In the absence of similarly detailed information on the pattern of effective tax rates in the remaining RST provinces, we are unable to determine whether

moving to a VAT would be equally regressive. To the extent that sales-tax reform might adversely affect low-income people, an appropriately offsetting refundable credit system (like the present GST credit) is a more equitable and efficient way to deal with the problem than base exemptions (or the GST/HST equivalent of zero-rating).

In any case, our primary concern here is the "pass-through elasticity," that is, the degree to which tax changes in each category are shifted forward to consumer prices. Table 2 presents two approaches to determining such elasticities. First, and most directly, an "implicit" estimator of the pass-through elasticity may be obtained simply as the ratio of the estimated changes in each row of columns 2 and 3 of the table. These implicit elasticity estimates are shown in column 4. Excluding the transportation sector where the estimated changes are of opposite sign, though insignificant, and the health and personal care sector where the estimate is 4.7, the elasticity estimates range between 0.2 for recreation, education, and reading and 2.4 for household operations and furnishings.

An alternative way to estimate the pass-through elasticity is as a point estimate of the tax term coefficient in equation (5) above. This estimator also exploits the variation in tax changes among provinces within the reforming group (which initially had separate RST systems imposing different effective tax rates).<sup>19</sup> The results of this approach for each expenditure category are reported in the final column of Table 2. The estimated pass-through elasticity for the aggregate price index in this approach is in fact 1.0, and the estimates for individual categories range from -1.5 for transportation to 8.6 for health and personal care. These estimated elasticities are in fact statistically indistinguishable from 1.0 (full pass-through) for four of the eight component categories, as well as the aggregate. Furthermore, as the reported standard errors indicate, the estimates are in most cases fairly precise. In the four categories where we cannot reject a pass-through elasticity of unity, the estimates are

significantly different than zero at 90 percent confidence or higher. In the remaining four categories, it is possible to reject the hypothesis of full pass-through with 95 percent confidence. In two categories in this second group, the estimate is significantly greater than unity, suggesting that taxes are “overshifted” to consumers—a common finding in the empirical literature on tax incidence in oligopolistic markets.

In summary, the results show that 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. Overall, consumer prices in the harmonizing provinces fell with the reform, although prices rose somewhat for purchases of shelter and clothing and footwear, which tended to make the reform slightly regressive. The pattern of reform-induced tax changes would presumably differ in the remaining RST provinces, but the results are consistent with the notion that taxes are fully shifted forward (or even overshifted) in most sectors, so that the change in statutory burdens would not result in large distributional effects.

## CONCLUSION

An important reason why so little attention has been paid to the obvious economic gains from substituting VATs for RSTs in provinces such as Ontario and British Columbia is that it is generally thought that to be revenue neutral it would be necessary to increase visible tax burdens on consumers substantially, perhaps most importantly through the broadening of the base to include purchases of new homes. The important question, however, is to what extent shifts in statutory burdens are reflected in shifts in true economic incidence. The answer to this question depends on the extent to which input taxes are shifted forward to consumers, or backward to factors of production, under the existing RSTs.

In the case of the RST-VAT substitution in Canadian provinces, our analysis shows that 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. Indeed, overall consumer prices fell with the reform, although prices rose somewhat for purchases of shelter and clothing and footwear, which tended to make the reform slightly regressive. The pattern of reform-induced tax changes would presumably differ in the remaining RST provinces (or in US states), but our results suggest that because taxes imposed through RSTs are fully shifted forward (or even overshifted) in most sectors, moving to more explicit statutory burdens on consumers by introducing a VAT would not result in large distributional effects.

## NOTES

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<sup>1</sup> Consistent with this view, Smart and Bird (2008) demonstrate that the provinces that have already adopted VAT bases experienced significant increases in business investment following the reform. As well, RSTs have narrow bases (often exempting services), which distort relative prices of consumption goods, and they are more susceptible to tax evasion than are VATs (Bird, Mintz, and Wilson 2006).

<sup>2</sup> Thus Smart and Bird (2007) report estimates that replacing the existing five provincial RSTs with a base similar to the GST would reduce taxes on business inputs by \$6.2 billion annually. Ring (1999) likewise reports that a similarly high percentage of US state sales taxes is levied on business inputs.

<sup>3</sup> Newfoundland and Labrador, Nova Scotia, and New Brunswick introduced the Harmonized Sales Tax (HST) on the same base as the federal GST in 1997. Quebec during the 1990s gradually introduced the Quebec Sales Tax (QST), a value-added tax that now has a base quite similar to that of the GST. We do not consider the

experience in Quebec in the present paper: for some discussion, however, see Smart and Bird (2008).

<sup>4</sup> Presumably, similar results might also be expected in the 45 US states that have similar RSTs: for some discussion of the US case, see Bird (2007).

<sup>5</sup> However, HST provinces can and do alter the effective HST rate applied to particular items or activities through differential rebates on final consumption: for example, among the three HST provinces only Nova Scotia rebates to public sector bodies like universities, schools, and hospitals the same proportion of the 8 percent provincial tax that the federal government rebates with respect to the 5 percent GST, and only New Brunswick (like Quebec) provides a point-of-sale rebate (in effect, zero-rating) for books.

<sup>6</sup> All three provinces must agree in order to lower this rate, although only two of the three need to agree in order to increase it. This asymmetry was presumably introduced to reduce the possibility of “sales tax competition” among the provinces.

<sup>7</sup> These rates include the effects of levying the statutory RST rates on the GST-inclusive retail price, which all three HST provinces did before moving to the HST.

<sup>8</sup> Although the statutory rate in Prince Edward Island is only 10 percent, it is shown here as 10.5 percent because PEI is the only RST province that (like Quebec) applies its RST to the sales price including the 5 percent federal GST.

<sup>9</sup> 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.

<sup>10</sup> There is a 36 percent rebate (implying an effective GST rate of about 4.5 percent when the standard rate was 7 percent as it was in the period we analyze) 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 percent 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.

<sup>11</sup> This is a simplification. In fact, the “place of supply” rules applying at the provincial level in effect attribute all services supplied to final consumers (technically, to non-VAT registrants) to the place of “performance,” which is usually where the establishment directly involved is located. This contrasts to the usual international rules (applied to the GST, for instance), which attribute the place of supply of mobile intangible services in principle to the place of residence of the consumer or the place where services are used or enjoyed. While there are perhaps good practical reasons for this difference in definition—for example, it is difficult to define a unique location for suppliers with establishments in different provinces—the result is that such services are taxed on an origin rather than on a destination basis, that is, where the service is “performed” not where it is consumed. Data do not permit us to take this factor, which is in any case likely to be relatively small, into account in this paper.

<sup>12</sup> Of course, the experience of the RST provinces may not control perfectly for other factors influencing consumer prices in the reforming provinces, particularly if economic circumstances were evolving differently in the two groups of provinces over the reform period. But real GDP growth was virtually identical over the 1997–2005 period in the RST provinces (30.6 percent) and in the HST provinces (29.9 percent), suggesting that comparability is high.

<sup>13</sup> For the aggregate of all commodities, for example, the correlation coefficient for changes in direct and indirect tax rates is +0.927.

<sup>14</sup> A similar assumption underlies the common textbook discussion of the incidence of excise taxes, which in effect asserts that who “bears” a given tax is independent of which side of the market (supplier or demander) formally has to pay the money over to the government. For a recent analysis that calls this assumption into question, however, see Slemrod (2008).

<sup>15</sup> 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

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

which is the basis for the estimates in the data.

<sup>16</sup> In fact, the index numbers are normalized so that each series equals 100 in all provinces in 1986, so that province fixed effects tend to be small and often insignificant.

<sup>17</sup> Note, however, that Feehan (1985) found little evidence that the then-common exemption of clothing and footwear from RSTs—a “tax expenditure” equal to perhaps 2–3 percent of RST revenue—was particularly progressive.

<sup>18</sup> Thus the expenditure shares for food, shelter, and clothing and footwear rise to 23.6 percent, 37.0 percent, and 8.4 percent, respectively, while the other shares scale down proportionately in order that the total sum to 100 percent. This does not correspond exactly to the definition of the low-income cutoff, which is the income level at which a typical household's expenditures on food, shelter, and clothing exceeds that of the average family with the same demographic characteristics by 20 percentage points.

<sup>19</sup> It is presumably the inclusion of this “interprovincial variation” factor that accounts for the substantial difference in the health and personal care category between the implicit estimate in column 4 and the estimate shown in column 5. Estimates from both methods for all the other sectors are surprisingly close.

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