Reforming the Canadian Sales Tax System: A Regional General Equilibrium Analysis

Bob Hamilton and Chun-Yan Kuo*

PRÉCIS
Les conséquences des changements proposés au système de taxe de vente au Canada, tant au niveau fédéral que provincial, ont fait l’objet d’un débat intensif. Ce débat avait été déclenché par l’initiative du gouvernement fédéral visant à remplacer l’ancienne taxe fédérale de vente, également connue sous le nom de taxe de vente des fabricants, par la taxe sur les produits et services. Comme neuf gouvernements provinciaux perçoivent actuellement une taxe provinciale sur les ventes de détail, cette réforme fédérale a résulté en deux taxes différentes s’appliquant au niveau du détail dans ces provinces. Les gouvernements et les analystes ont donc continué à examiner les conséquences qu’entrainerait la fusion de la taxe de vente fédérale et des taxes de vente provinciales en une seule et même taxe nationale sur les ventes.

Cet article décrit un modèle régional d’équilibre général de l’économie canadienne qui a servi à analyser les effets que ces importants changements au système canadien de taxe de vente entraîneraient dans les divers secteurs de l’économie et dans les différentes régions. Le modèle décrit le Canada comme une petite économie ouverte, et inclut des données sur la structure de la production et de la consommation de chaque région. Le modèle reflète aussi de façon assez détaillée les effets de l’imposition des taxes de vente fédérale et provinciales au niveau de l’activité économique. Les résultats que projette notre modèle indiquent que le remplacement de la taxe fédérale de vente par la taxe sur les produits et services entraîne une augmentation de la production réelle du Canada de 1,4 pour cent à long terme. En intégrant également les taxes de vente provinciales, la production réelle connaîtrait une croissance supplémentaire de 0,8 pour cent.

* Of the Department of Finance, Ottawa. This paper is based on ongoing research in the tax policy branch of the department. The views expressed herein are the authors’ and do not necessarily represent those of the department. The authors are grateful to Katie Johnson and Céo Gaudet for their assistance in developing the model and data used for the analysis. Valuable comments and suggestions were provided by David Dodge, Michael Horgan, John Lester, David Moloney, Michael Sabia, John Sargent, Michael Smart, and John Whalley.

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ABSTRACT
In recent years the implications of proposed changes to Canada’s sales tax system, at both the federal and the provincial level, have been the subject of considerable debate. The catalyst for the debate has been the federal government’s actions to replace its longstanding federal sales tax, also known as the manufacturers’ sales tax, with the new goods and services tax. Since nine provincial governments currently impose a provincial retail sales tax, the federal reform has resulted in two separate retail-level taxes in these provinces. Consequently, governments and analysts have continued to examine the implications of combining the federal and provincial systems into one integrated national sales tax.

This article describes the use of a regional general equilibrium model of the Canadian economy to analyze the sectoral and regional impacts of these major changes to the Canadian sales tax system. The model portrays Canada as a small open economy, and incorporates data on the structure of production and consumption in each region. The model also contains considerable detail on the manner in which federal and provincial sales taxes affect economic activity. The results projected by our model indicate that replacing the federal sales tax with the goods and services tax increases real output in Canada in the long run by 1.4 percent. If the provincial sales taxes are also integrated, real output increases by a further 0.8 percent.

INTRODUCTION
In recent years the implications of proposed changes to Canada’s sales tax system, at both the federal and the provincial level, have been the subject of considerable debate. The catalyst for the debate has been the federal government’s actions to replace its longstanding federal sales tax (FST), also known as the manufacturers’ sales tax (MST), with the new goods and services tax (GST). Since nine provincial governments (the exception is Alberta) currently impose a provincial sales tax (PST), the federal reform has resulted in two separate retail-level taxes in these provinces. Consequently, governments and analysts have continued to examine the broader option of combining the federal and provincial systems into one integrated national sales tax (NST).

Replacing the old FST, which applies largely to sales of manufactured products, with a broad-based, value-added tax, the GST, represents a fundamental change to the Canadian tax system. By removing the FST from business inputs and broadening the tax base to include services as well as retail and wholesale margins, the GST affects the relative prices faced by producers and consumers. As a result, the reform has a significant impact on resource allocation and the structure of economic activity.

The PST systems have many of the same distorting features as the FST, although, quantitatively, the distortions tend to be less severe. Nevertheless,
all the PSTs apply to a relatively narrow base, and a substantial portion of
total revenue is collected from business inputs. As a result, integrating the
provincial taxes with the broad-based, value-added GST is also expected to
have a significant impact on economic activity.

In this study, a general equilibrium (GE) model of the Canadian economy
is used to evaluate the impacts of these tax changes on resource allocation,
aggregate real output, and the distribution of real output across sectors and
regions. The model is similar in structure to a number of others used over
the past two decades to analyze tax and trade policy issues.¹

Many previous studies have analyzed the impacts of reform to the Cana-
dian sales tax system. For the most part, the studies have used large-scale
macroeconomic models and have focused on the effects of the reform on
macroeconomic indicators such as employment, interest rates, and infla-
tion.² There have also been several studies that have used GE models and
have focused on longer-term impacts on resource allocation, production,
and welfare.³

The model used in this study is unique in that it provides both a regional
dimension and a very detailed representation of the sales tax system. In
addition, the model attempts to capture the effects of changes in the price
of capital goods on the cost of capital to Canadian producers. This linkage
is particularly important given that the FST imposes, on average, a 4 percent
tax on capital goods. The removal of the FST is therefore expected to have
important effects on the cost of capital to Canadian producers.

¹ The basic concepts of applied general equilibrium analysis can be found in Arnold C.
Harberger, “The Incidence of the Corporation Income Tax” (June 1962), 70 Journal of Politi-
cal Economy 215-40, and John B. Shoven and John Whalley, “Applied General Equilibrium
Models of Taxation and International Trade: An Introduction and Survey” (September 1984),
22 Journal of Economic Literature 1077-51. Examples of other regional models include Glenn
W. Harrison and Lawrence Kimbell, “How Reliable Is Numerical General Equilibrium Anal-
ysis?” (unpublished manuscript, University of Western Ontario, London, January 1983); John
Whalley and Irene Trela, Regional Aspects of Confederation, Collected Research Studies of
68 (Toronto: University of Toronto Press, 1986); Rich Jones and John Whalley, “Regional
Effects of Taxes in Canada: An Applied General Equilibrium Approach” (October 1988), 37
Journal of Public Economics 1-28; and William Morgan, John Mutti, and Mark Partidge, “A
Regional General Equilibrium Model of the United States: Tax Effects on Factor Movements
and Regional Production” (November 1989), 71 The Review of Economics and Statistics 626-
35.

² See, for instance, D.P. Dungan and T.A. Wilson, “The Proposed Federal Goods and
Services Tax: Its Economic Effects Under Alternative Labour Market and Monetary Policy

³ See, for instance, Wayne R. Thrift, Indirect Federal Taxes, the Cost of Capital, and the
Issue of Tax Incidence, Discussion Paper no. 294 (Ottawa: Economic Council of Canada,
November 1983); Bob Hamilton and John Whalley, “Efficiency and Distributional Effects of
the Tax Reform Package,” in Jack Mintz and John Whalley, eds., The Economic Impacts of
Tax Reform, Canadian Tax Paper no. 84 (Toronto: Canadian Tax Foundation, 1989), 373-98;
and Jones and Whalley, supra footnote 1. The model used in Jones and Whalley has a regional
dimension.

Results of the simulation show that replacing the FST with a value-added tax, the GST, could increase welfare by about 0.9 percent and gross domestic product (GDP) by about 1.4 percent. Replacing PSTs could further increase welfare by 0.4 percent and GDP by 0.8 percent. In both reforms, the largest GDP increases occur in capital-intensive, export-oriented sectors because of the removal of sales taxes on capital goods. Correspondingly, the regions in which these sectors are concentrated experience the largest output expansions.

These results suggest that the impacts of sales tax reform are larger than other studies have predicted. The key factors in accounting for the differences in the results appear to be the modeling of Canada as a small open economy, and the fact that the model attempts to capture the effects of the reform on the cost of capital to Canadian producers.

The article begins with a brief description of the main distortions in the old FST and PST systems. The next sections discuss the structure of the regional GE model and present the empirical results of the simulation. The final section offers some concluding remarks.

THE MAIN DISTORTIONS IN THE OLD FST AND PST SYSTEMS

Before we examine the structure of the regional GE model and the empirical results of our analysis, it is useful to outline the main channels by which the old FST\(^4\) influences economic decisions, and to review the anticipated effects of the reforms that have now begun with the implementation of the GST on January 1, 1991.

The FST applies to sales of manufactured products at a general rate of 13.5 percent. Construction materials are taxed at a rate of 9 percent, and alcohol and tobacco at 19 percent. The PSTs apply to sales by retailers at rates ranging from 6 to 12 percent. While the provincial systems create many of the same distortions that are present in the FST, the PST imposes a greater tax burden on business inputs since it applies at a pre-retail level.

The FST and the PSTs create several distortions on the production side of the economy. First, they apply to some capital goods used in the production process. While the effects vary across industries and across types of assets, on average, the FST represents about 4 percent of the price of capital goods and the PSTs about 3.7 percent. These taxes on capital goods increase the cost of capital to domestic producers and lower the level of investment in Canada. In addition, since they impose differential burdens across assets and industries, they distort the allocation of investment.

Second, sales taxes are applied to other business inputs, such as motive fuels, building materials, and telecommunication services. These taxes distort the producer’s decisions by altering the relative prices of inputs to the

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production process. They also increase the costs faced by domestic producers relative to foreign firms producing similar products.

Finally, the FST imposes an additional burden on domestically produced goods relative to imports. The tax base for domestic products is the manufacturer’s sale price or, for some items such as automobiles, the wholesaler’s price. This price often includes marketing and distribution costs, which naturally form part of the tax base. However, imported goods are taxed on their duty-paid value, which does not typically include these costs, nor the freight and insurance costs to the Canadian border. As a result, the FST on domestic products is, on average, about one-third higher than for comparable imported goods.3

In summary, the PSTs and the FST, especially the latter, have substantial impacts on domestic production, particularly of products—either exports or import-competing domestic products—that rely heavily on taxed inputs and compete in international markets.

The sales taxes also affect consumer demand. The FST applies directly to only a very narrow range of products—about one-third of domestic consumption—although the cascading of taxes on inputs results in virtually all goods and services bearing some FST. The PSTs apply to a somewhat broader base, but still exclude most services. Therefore, these taxes distort the relative prices faced by consumers.

**THE STRUCTURE OF THE GE MODEL**

The model used for this analysis is a static GE model of the Canadian economy and is composed of 12 different regional economies—10 provinces and 2 territories. The regional economies interact with each other, and with the rest of the world, by importing and exporting goods and services for final consumption and for use as inputs in production.

In the model, each regional economy contains 12 industries, and producers in each industry face an exogenously determined world price for their tradeable products. Producers maximize their profits based on the relative price of their inputs and on the parameters describing their production techniques. Each region contains one representative household that maximizes its utility subject to its income received from factor endowments and government transfers.

The underlying structure and functional forms of production and consumption are assumed in the model to be identical in all regions, with the data determining the parameter values in a particular region. To facilitate the description of the model’s structure, each region can be considered a separate submodel, and regional subscripts are suppressed in all equations.

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3 The bias in favour of imported goods was estimated to be approximately one-third of the domestic effective FST rate in 1984. This estimate was computed from a survey undertaken by Woods Gordon Ltd. of Toronto. Results can be found in Canada, Department of Finance, *Tax Reform 1987: Sales Tax Reform* (Ottawa: the department, June 18, 1987), 17.
One important structural feature of the model is the treatment of the foreign sector. In the model, Canada is assumed to be a small open economy, and goods produced in Canada are assumed to be perfect substitutes for similar goods produced outside Canada. As a result, goods produced in Canada and those produced abroad are assumed to trade at a common world price.

An alternative approach that has been used in other models involves differentiating goods according to the country in which they are produced—the Armington assumption. The difficulty with that assumption is that it implies relatively large terms-of-trade effects even with high trade elasticities; reliable estimates of trade elasticities for Canada are not easily obtained. In addition, the supply of, and demand for, these goods outside Canada is normally large enough that decisions of Canadian producers and consumers are assumed to have no effect on the world prices of the goods. Of course, domestic prices can deviate from world prices because of domestic policies such as subsidies, taxes, and tariffs.

Explicitly modeling Canada as a small open economy has several implications for the structure of the model. Treating domestic and foreign goods as perfect substitutes gives rise to the potential for complete specialization in production in response to tax policy changes. To ensure that all goods continue to be produced, there must be at least as many internationally immobile factors of production as there are traded goods. In this analysis,

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6 See Paul S. Armington, "A Theory of Demand for Products Distinguished by Place of Production" (March 1969), 16 International Monetary Fund Staff Papers 159-78, for a conceptual discussion; and Richard Harris, A Guide to the GET Model, Working Paper no. 88-10 (Ottawa: Department of Finance, 1988) and Jones and Whalley, supra footnote 1, for an application to Canada.

7 Indeed, the large terms-of-trade effects are among the key differences between our results and those found in Jones and Whalley, supra footnote 1.

8 The explicit application of a small open price-taking model to the Canadian economy can be found in Gordon Lenjosek and John Whalley, "A Small Open Economy Model Applied to an Evaluation of Canadian Energy Policies Using 1980 Data" (Spring 1986), 8 Journal of Policy Modelling 89-110 and Hamilton and Whalley, supra footnote 3. Other studies, such as Richard Harris, "Applied General Equilibrium Analysis of Small Open Economies with Scale Economies and Imperfect Competition" (December 1984), 74 The American Economic Review 1016-32, and Harris, supra footnote 6, assume that Canada is a price-taker for imports, but has some influence on export prices. To date, no studies have identified precisely which Canadian products might enjoy market power in world markets. Eric Applebaum and Ulrich R. Kohli, "Canada-United States Trade: Tests for the Small-Open-Economy Hypothesis" (February 1979), 12 The Canadian Journal of Economics 1-14, rejected the hypothesis that Canada was a price-taker on export markets. However, there appears to be no empirical evidence to suggest that the Canadian supply of a particular product can influence the world price for that commodity, or, if so, to what extent it can do so.

each sector is assumed to use an industry-specific factor in production, yielding a sufficient number of factors to implement the approach.\textsuperscript{10}

The small-open-economy framework also has important implications regarding the incidence of a sales tax. It implies that taxes on inputs in sectors producing tradeable goods will not be passed forward in the form of higher prices because of the fixed world prices for the output. Instead, these taxes will be passed backward and, ultimately, will be borne by factors of production. Moreover, the additional PST on domestically produced goods relative to imported goods will also be shifted backward onto factors of production.

The model contains detail on the effects of the sales tax system on relative prices and the decisions of producers and consumers. For example, the PST applies prior to the retail level on a narrow range of commodities, producing a situation where effective PST rates vary significantly across commodities and where producers' inputs bear a substantial sales tax burden.\textsuperscript{11} To capture the effects of these distortions in the analysis, considerable attention is paid to the channels through which the PST affects economic decisions. Producers and consumers are assumed to alter their decisions in response to the relative price changes resulting from the change in tax regimes. The above features are also present, albeit to a lesser extent, in the provincial retail sales taxes.

Production
Each region in the model consists of 12 industries: primary industries; minerals and energy products; food; beverage and tobacco; non-durable manufacturing; durable manufacturing; construction; transportation; retail and wholesale trade; services; utilities; and public administration.

Each industry produces a single commodity using two composite inputs in fixed proportions—primary factors and intermediate inputs.\textsuperscript{12} If $X_j$ denotes the output of the $j$th commodity, $Y_j$ the value added by primary factors in producing the $j$th commodity, and $H_j$ the use of the composite of all other commodities in producing the $j$th commodity, the production function can be written as

$$X_j = \min \left( \frac{Y_j}{v_j}, \frac{H_j}{q_j} \right), \quad j = 1, 2, \ldots, 12,$$

\textsuperscript{10} Industry-specific factors are, typically, natural resources, highly skilled labour, and specific machinery and equipment. However, it is difficult to incorporate them into the model, since there is very little information on the returns to industry-specific factors in national accounts data. In this analysis it is assumed that a portion of labour is industry-specific.

\textsuperscript{11} The effective sales tax rate for each commodity is defined in this article as the ratio of the direct sales taxes on the commodity to the producer price of the commodity. The effective PST rates vary considerably across commodities, and estimates can be found in Chun-Yan Kuo, Thomas C. McGirr, and Satya N. Poddar, "Measurement of the Non-Neutralities of Sales and Excise Taxes in Canada" (May-June 1988), 36 Canadian Tax Journal 655-70.

\textsuperscript{12} See John Whalley, Trade Liberalization Among Major World Trading Areas (Cambridge, Mass.: MIT Press, 1985), chapter 2.
where \( y_j \) and \( q_j \) are the fixed composite value-added and intermediate good requirements per unit of output of the \( j \)th commodity, respectively.

There are three primary factors of production: capital \((K)\), labour \((L)\), and an industry-specific factor \((P)\). These production factors differ in the extent to which they can relocate in response to relative price changes. Capital is assumed to be fully mobile across sectors, regions, and internationally. Thus, the equilibrium rate of return on capital is assumed to be uniform across all regions and equal to the rate determined in global markets.

Labour is assumed to be mobile across sectors, but not across regions or internationally. Hence, in equilibrium, the amount of labour used by each industry adjusts to ensure that wage rates (net of labour taxes) are uniform within a region, but the wage rates can differ across regions.\(^{13}\)

Industry-specific factors are assumed to be completely immobile. As a result, specific factor returns adjust to ensure an equilibrium, and the returns to these factors will typically vary across industries and regions.

A constant elasticity of substitution (CES) value-added function is used to describe the substitution possibilities between primary factors. The value-added function for the \( j \)th industry is

\[
Y_j = A_j \left( \alpha_{kj} K_j^{-\rho_j} + \alpha_{lj} L_j^{-\rho_j} + \alpha_{pj} P_j^{-\rho_j} \right)^{-\frac{1}{\rho_j}}
\]

(2)

where \( A_j \) is a scale parameter; \( \alpha_{kj}, \alpha_{lj}, \) and \( \alpha_{pj} \) are the factor intensity parameters; and \( \rho_j \) is a parameter that is related to the elasticity of factor substitution \( \sigma_j \) by the equation \( \sigma_j = 1/(1 + \rho_j) \).

Firms select the cost-minimizing combination of primary input requirements in meeting the per unit value-added requirement in the production of each good. The relationships between the relative prices of the factors and the demand for these factors per unit of output in each industry are

\[
\frac{l_j}{k_j} = \left[ \frac{\alpha_{lj}}{\alpha_{kj}} \left( \frac{P_j}{L_j} \right) \right]^{\rho_j}
\]

and

\[
\frac{f_j}{k_j} = \left[ \frac{\alpha_{pj}}{\alpha_{kj}} \left( \frac{F_j}{L_j} \right) \right]^{\rho_j}
\]

(3)

(4)

where \( k_j, l_j, \) and \( f_j \) represent the demand for capital, labour, and the industry-specific factor per unit output of the \( j \)th commodity, and \( r_j, w_j \) and \( u_j \) are the corresponding factor prices including factor taxes.

\(^{13}\) This is an analytic simplification and may not reflect the actual workings of the economy where labour is able to move between regions in response to wage differentials, unemployment rate differentials, and locational preference. However, empirical studies have yet to produce estimates of the extent to which labour is mobile between regions that are suitable for GE analysis.
These relationships yield a demand for capital per unit of output in industry $j$ that can be expressed as

$$k_j = A_j^{-1} \left\{ \alpha_k \left[ 1 + \left( \frac{\alpha_0}{\alpha_k} \right)^{\gamma} \left( \frac{f_j}{w_f} \right)^{\gamma - 1} + \left( \frac{\alpha_0}{\alpha_k} \right)^{\gamma} \left( \frac{f_j}{w_f} \right)^{\gamma - 1} \right] \right\}^{\frac{1}{\gamma - \sigma_f}}. \quad (5)$$

The per unit demand for the other factors can be derived and expressed in a similar fashion.

In equilibrium, the model requires that domestic endowments of labour and industry-specific factors in each region are fully employed; that is,

$$\sum_{j=1}^{12} l_j \cdot X_j = L \quad \text{and} \quad (6)$$

$$\sum_{j=1}^{12} f_j \cdot X_j = F_j, \quad j = 1, 2, \ldots, 12. \quad (7)$$

In addition to primary factors, each industry uses the outputs of its own and other industries as intermediate inputs. Producers are assumed to minimize costs in determining the quantity of each of the commodities required to form the composite intermediate input in each industry.

The 12 intermediate inputs specified in the model include transportation margins, trade margins, and 10 other commodities. The model assumes that producers are able to vary their mix of intermediate inputs in forming the composite intermediate input. The substitution possibilities among intermediate inputs are represented by a three-level nested CES function in this model. The first level specifies substitution possibilities across the 10 non-margin goods. At the second level, substitution occurs between a composite non-margin good and transportation margins. Finally, substitution takes place between the second-level composite commodity input and trade margins to form a composite intermediate input.

In equilibrium, producers are assumed to make no surplus profits, which implies that the producer’s price of each commodity ($P_j$) equals its unit cost including the gross-of-tax payments to primary factors and intermediate inputs. This condition can be expressed as

$$P_j = r(1 + t_c)k_j + w(1 + t_l)l_j + c_j(1 + t_c)j_j + \sum_{i=1}^{12} P_i(1 + t_0)\alpha_{ij},$$

$$j = 1, 2, \ldots, 12, \quad (8)$$

where $r$, $w$, and $c_j$ are the net-of-factor-tax prices of capital, labour, and the industry-specific factor; $\alpha_{ij}$ is the per unit use of the $i$th good in the $j$th industry; $t_c$ is the ad valorem tax rate on the $j$th industry’s use of capital; $t_l$ is the ad valorem tax rate on the $j$th industry’s use of labour; $t_0$ is the ad valorem tax rate on the $j$th industry’s use of the industry-specific factor; and $t_j$ is the combined ad valorem rate of the federal and provincial excise and sales taxes levied on the $j$th good used in the $j$th industry.

The model’s representation of the production process outlined above permits a very detailed representation of the decisions of producers in the presence of taxes. Sales taxes, by taxing some intermediate inputs, distort
the relative prices of those inputs and thereby alter their use in the production process. The move to the GST removes these distortions, and the model, by allowing substitution between intermediate inputs, captures the effects of this change on producers' decisions.

Domestic Demand
Producer goods are demanded by domestic households, producers, federal and regional governments, and by foreigners in the form of exports. The demand functions for domestic agents are derived from maximization of CES utility functions subject to their budget constraints. Agents receive income from endowments of primary factors and from government transfers. The excess demand or supply of a product by foreigners is determined residually by the difference between the domestic supply of a product and its domestic demand.

Households derive utility from the consumption of nine consumer goods—food and non-alcoholic beverages, alcohol and tobacco, clothing and footwear, housing, energy, household products, services, autos and repairs, and a residual category (others). Consumer goods are derived from producer goods and are linked in the model through a CES transformation function. As a result, demands for consumer goods imply demands for the underlying producer goods. For example, purchases of clothing and footwear imply demands for producer goods such as non-durable manufacturing, retail, and transportation margins. In this way, the model captures the effects of broadening the sales tax base to include retail, wholesale, and transportation margins.

A household's consumption decisions are based on a six-level nested CES utility function. The nesting structure allows for the use of different elasticity values for different consumer categories. At each level of the nest, the demand for consumer good \( i \) \( (C_i) \) is a function of income \( (I) \) and prices:

\[
C_i = \frac{\sum b_j I}{\sum b_j \hat{P}_j - \delta}, \quad i = 1, 2, \ldots, 9,
\]

(9)

where \( b_j \) is the distribution coefficient for \( C_i \), \( \delta \) is the elasticity of substitution among consumer goods, and \( \hat{P}_j \) is the price, including sales taxes, of the \( i \)th consumer good.

It is difficult to model the dynamic phenomena of savings and investment in a static framework. In this analysis, it is assumed that savings observed in the benchmark equilibrium represent purchases of capital goods by an

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\(^{14}\) The substitution elasticity in a CES function can be approximated by the own-price elasticity of demand for a commodity if the commodity's expenditure share is small. Therefore, by singling out individual commodities at different levels of the nest, the substitution elasticity can be set at approximately that commodity's own-price elasticity.

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investment sector. The investment sector can be thought of as a mutual fund that uses the economy's savings to purchase capital goods. The investment sector's demand for capital goods is based on maximization of a CES utility function, and therefore these decisions are influenced by sales taxes imposed on capital goods.

Two levels of government are present in the model. In addition to the federal government, each region has its own consolidated provincial/local government. Each government collects revenue from factor taxes (corporate, property, and payroll), excise and sales taxes, other production taxes (net of government subsidies), and personal income taxes. A portion of the government's revenue is used to provide transfer payments to the various households. The remaining revenue is retained by government and is used, along with capital income from government-owned capital, to finance its expenditures on goods and services. Subject to this budget constraint, each government maximizes its utility according to a single-level CES function.

The federal government interacts with each region by collecting tax revenue in the region, paying transfers to the region's households and governments, and purchasing goods and services.

External Sector
From the perspective of an individual region, the external sector represents the other regions in Canada and the rest of the world. The excess demand for a product by the external sector is therefore determined residually by the difference between the region's production of the product and the demand for the product within the region.

The zero external balance condition dictated by the GE framework requires that the value of net exports plus net transfer payments received must equal net capital service inflows:

\[ \sum_{j=1}^{12} P_j E_j + T_j - (\sum_{j=1}^{12} r K^p_j - r \bar{K}) = 0, \]  

where \( E_j \) is net exports of commodity \( j \), \( K^p_j \) is capital demanded by industry \( j \), \( \bar{K} \) is the domestic endowment of capital, and \( T_j \) is the net transfer payments received by the region.

The Cost of Capital
Many capital goods are subject to tax under the FST and provincial sales tax systems. The removal of these sales taxes on capital goods would be expected to reduce the price of capital goods and thereby to reduce the cost of capital used to produce goods and services in Canada. As a result, special attention

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15The treatment of savings adopted in this model follows an approach used in other static models. See, for example, John Piggott and John Whalley, UK Tax Policy and Applied General Equilibrium Analysis (Cambridge, Eng.: Cambridge University Press, 1985), and Hamilton and Whalley, supra footnote 3.

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is paid to the model's representation of capital services used in production and to the effects of sales tax reform on the relative price of those services.

The standard approach to modeling the production process in a static model focuses on the productive services flowing from primary factors in a particular period. The capital stock and the labour force yield a service flow in each period, and these services in turn are used in the production of goods and services and yield a return to the owners of the factors in each period. In the case of capital, the return, net of corporate taxes, is normally referred to as the rental price of capital ($r$). Perhaps the simplest way to think of this process is as a leasing arrangement where the capital owners lease the capital to producers each period for a price equal to $r$.

In the standard formulation just described, the cost of capital faced by Canadian producers is not affected by changes in the price of capital goods. In other words, changes to the price of capital goods do not alter the cost of capital services purchased by firms, and therefore have no effect on production decisions. This formulation clearly misses a linkage that is potentially important for the analysis of sales tax reform.

In order to fully capture the effects of the sales tax reform in that type of formulation, this analysis establishes a link between the price of a capital good and the rental price of the capital services yielded by that capital good when it is used in the production process. Although capital services are not directly subject to sales tax, the price of these services does reflect the sales tax on the capital good itself. In other words, if the lessor has to pay sales tax on a capital good, the lessee presumably has to pay higher lease payments.

In the model, the relationship between the rental price, the gross of sales tax price of the capital good ($P_k$) and the net of capital tax rate of return on capital ($\psi$) is

$$\psi = \frac{r}{P_k}.$$ (11)

Because capital is assumed to be perfectly mobile, the rate of return on capital (net of capital taxes) is assumed to remain constant in the long run.

The imposition of a sales tax on capital goods will increase $P_k$. The fact that $\psi$ remains constant implies that the rental price of capital services will adjust to an increase in $P_k$ such that, in the long run, the percentage change in $r$ will equal the percentage change in $P_k$.

**Data and Parameters**

The model described above has been calibrated using data on the Canadian economy for 1984, culled mainly from Statistics Canada's 1984 preliminary provincial input-output tables, a comprehensive data source that identifies the structure of production in each industry in each province and territory. Various other sources include the provincial economic accounts and the

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16 See, for instance, Hamilton and Whalley, supra footnote 3.
balance of international payments. The detailed sales tax parameters used in the model were updated to reflect the final pre-GST federal and provincial sales tax systems, and incorporate the changes to the GST rates and the broadening of the base since 1984.  

**EMPIRICAL RESULTS**

This section presents the results of our analysis. The GE model and the data described above have been used to analyze the effects of changes to the sales tax system on relative prices and resource allocation in the economy. Two basic policy changes are considered: the federal-only sales tax reform, or GST; and, further, a joint federal-provincial sales tax reform.

**The Federal-Only Sales Tax Reform (GST)**

The federal-only sales tax reform used in our analysis is based on the federal government's 1989 published proposal for a goods and services tax. In addition to replacing the FST, the GST package includes an enrichment of the refundable sales tax credit and a tax rebate for newly constructed residential dwellings.

Results of our analysis suggest that the federal-only sales tax reform will increase the economy's GDP by approximately 1.4 percent. The expansion in GDP is largely attributable to the removal of the distortions to the relative prices of production inputs, resulting in an increase in the use of capital services and an increase in factor productivity.

The results also suggest that the reform will alter the pattern of flows between Canada and the rest of the world. In aggregate, the increased demand for capital services stimulates additional imports of capital services from abroad and a corresponding increase in net exports, which ensures that Canada's transactions with the foreign countries remain in balance. The increase in net exports consists of an increase in exports and a decrease in

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18 Solving the model involves iterating through the production and demand sides of the model at different assumed GST rates until all markets clear and the federal government revenues are restored. The procedure can be summarized as follows: (1) select an initial value for the GST rate necessary to restore government revenues; (2) find the regional wage rates and allocation of capital and labour in each region that equate each factor's value marginal product to its per unit return; (3) use the labour allocations across sectors to determine the output of each industry; (4) use the zero profit condition to determine the return to each industry's specific factor; (5) calculate relative prices and each agent's income to derive final demands for each commodity; (6) determine intermediate input demand for each commodity; (7) compute the foreign excess demand for each commodity; (8) determine net capital service outflows; and (9) check that government revenues equal revenue requirements—if they do not, revise the GST rate in (1) and repeat steps (2) through (9) until an equilibrium is reached.

imports. The removal of the current tax on inputs and the import bias causes proportionally more of the demand to be met by domestic production, tending to reduce imports. The decrease in imports is dampened by an increase in imports resulting from increased consumption.

The effect of sales tax reform will be widely spread through the different sectors and regions. Because of concerns about the reliability of detailed data for some sectors and provinces, our results are presented below at a more aggregate level.

**Sectoral Impacts**

Real output expansion in all sectors is due to the efficiency gains resulting from the removal of FST distortions. However, the change in real output varies by sector. Table 1 reveals that industries that are heavy users of manufactured products benefit more from the reform than does the manufacturing sector itself. This is in contrast to a general assertion that reform of the federal sales tax system would benefit the manufacturing sector, and would therefore benefit central Canada at the expense of other regions. Our results suggest that sectors that currently pay a substantial amount of FST on their inputs—the primary and utilities sectors, for example—expand the most. The transportation sector also expands significantly because of the removal of FST from its inputs such as fuel and some vehicles. Even the service sector, which is often perceived as a beneficiary under the FST, expands as a result of the removal of taxes from its inputs.

The food, beverage, and tobacco sector expands only slightly, since taxable inputs account for a relatively small portion of its production activity.

The manufacturing sector is composed of durable goods (machinery and equipment, for example) and non-durable goods other than food, beverage, and tobacco products (clothing and plastics, for example). Real output increases in these sectors largely because of the removal of the FST's bias in favour of imports. This sector pays relatively little FST on its production inputs, and therefore real output does not increase by as much as it does in some of the other sectors. It should be noted that the output in the durable manufacturing sector is heavily taxed under the FST.

**Table 1: Effects of Sales Tax Reform on Sectoral Real Output**

<table>
<thead>
<tr>
<th>Sector</th>
<th>Federal-only reform (GST)</th>
<th>National reform (NST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>3.3</td>
<td>3.8</td>
</tr>
<tr>
<td>Food, beverage, and tobacco</td>
<td>0.3</td>
<td>0.8</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>1.4</td>
<td>1.8</td>
</tr>
<tr>
<td>Construction</td>
<td>1.6</td>
<td>1.5</td>
</tr>
<tr>
<td>Transportation and utilities</td>
<td>3.1</td>
<td>3.6</td>
</tr>
<tr>
<td>Services</td>
<td>1.6</td>
<td>2.7</td>
</tr>
<tr>
<td>Total</td>
<td>1.4</td>
<td>2.2</td>
</tr>
</tbody>
</table>

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The removal of tax from building materials results in a significant increase in the output of the construction sector. This sector does not benefit from increased international competitiveness, however, since trade in construction products is very limited.

Regional Consequences
A uniform-rate GST applied to a comprehensive base has only limited regional implications in a small open price-taking economy. It affects regions differently only to the extent that regions have different ratios of consumption to income or different consumption patterns. Otherwise, taxes are borne in proportion to the consumption activity in that region.

The old FST, however, because of its narrow tax base and its taxation of production inputs, affects regions differently to the extent that these regions have different production and consumption patterns. The effects of replacing the FST with the GST are therefore expected to differ across regions.

The effects of the reform on production in each region are shown in the first column of table 2. The regional impacts reflect the sectoral effects discussed above. Real output in each region expands substantially, with output in the Prairies expanding the most. The importance of resource industries in the prairie provinces is the primary reason for the large expansion. Similarly, the Atlantic provinces and British Columbia gain substantially from the removal of taxes on inputs to production in their industries.

Real output expands in Ontario and Quebec, but by less than the national average. These provinces contain a wide variety of industries and are less reliant on the sectors that expand the most, such as primary industries, compared with other regions. Indeed, on average, the industries located in these provinces are not as severely affected by the FST on production inputs, and this circumstance is reflected in the below-average increase in real output.

Welfare Effects
The most comprehensive measure of the economic impacts of the sales tax change from the FST to the GST is its effect on the welfare of Canadians overall. That measure incorporates the effects of the reform on both prices and incomes and therefore reveals the extent to which Canadians are better or worse off.

<table>
<thead>
<tr>
<th>Region</th>
<th>Federal-only reform (GST)</th>
<th>National reform (NST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlantic</td>
<td>1.4</td>
<td>2.5</td>
</tr>
<tr>
<td>Quebec</td>
<td>1.0</td>
<td>1.7</td>
</tr>
<tr>
<td>Ontario</td>
<td>1.1</td>
<td>1.9</td>
</tr>
<tr>
<td>Prairies</td>
<td>2.5</td>
<td>3.0</td>
</tr>
<tr>
<td>British Columbia</td>
<td>1.3</td>
<td>2.2</td>
</tr>
<tr>
<td>Canada</td>
<td>1.4</td>
<td>2.2</td>
</tr>
</tbody>
</table>

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Removing the various economic distortions caused by the FST improves the allocation of resources in the economy and thereby increases national welfare. Our analysis suggests that welfare will increase by about 0.9 percent of GDP. The welfare gain is less than the real output gain because of the payments for the additional capital services imported from abroad.

Our welfare estimate differs from those obtained by other studies. In particular, the results are quite different from those reported by Jones and Whalley. In their study, replacing the FST with a broadly based sales tax worsens welfare and only the central regions benefit. There are two key reasons for these differences. First, the Jones and Whalley model does not capture the impacts of changes in the price of capital goods on producers' decisions. Second, their model shows a large terms-of-trade deterioration for Canada that outweigh the efficiency gains. In contrast, our model assumes that Canada is a small open economy, and that therefore there are no terms-of-trade effects.

A Joint Federal-Provincial Sales Tax (NST)
The joint federal-provincial national sales tax reform involves the integration of the existing provincial sales tax systems with the federal GST. In this scenario, it is assumed that no other provincial tax measures would accompany the changes to the sales tax system.

Like the FST, the PSTs are levied on a range of intermediate commodity inputs and capital goods. Although the distortions created by the provincial systems are typically not as severe as those caused by the FST, they are significant. Tables 1 and 2 show that an integrated NST increases real output by approximately 2.2 percent—about 50 percent more than the federal-only GST reform. The key effect of the reform is the removal of the tax on capital goods, since provincial taxes also impose a significant tax on capital goods. For the nation as a whole, the effective PST rate on capital goods is estimated to be about 3.7 percent.

The changes in the distribution of output roughly parallels the federal-only reform. The sectors that experience the largest output gains under an NST, as with the federal-only reform, are the capital-intensive industries such as mining and utilities.

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20 For example, Thirsk, supra footnote 3, Jones and Whalley, supra footnote 1, and Hamilton and Whalley, supra footnote 1. The results obtained by Hamilton and Whalley are also repeated in John Whalley and Deborah Frey, The Economics of the Goods and Services Tax, Canadian Tax Paper no. 88 (Toronto: Canadian Tax Foundation, 1990).

21 Supra footnote 1.

22 This difference also applies to Thirsk, supra footnote 3, and Hamilton and Whalley, supra footnote 3. In addition, Thirsk's model has a different structure from ours. Thirsk's model is very aggregated, based on 1980 data, and does not reflect changes to the FST since 1980. The Hamilton and Whalley model is closer in structure to our model but it is a national model.

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The welfare gain from the NST is estimated to be about 1.3 percent of GDP. This represents an additional gain of about 0.4 percent of GDP over the gains from a federal-only reform. As in the federal-only reform, the welfare gain is lower than the incremental increase in the real output increase because of payments for additional capital services from abroad.

It seems clear that the incremental benefits from adding the provincial sales tax systems to the federal GST reform package are substantial. More important, however, there would be considerable savings in administration and compliance costs—effects not captured by this analysis.

Finally, we have also used the model to evaluate the efficiency of these taxes in raising additional revenues by comparing the marginal excess burden of various taxes. This procedure compares the deadweight loss produced by increases in each tax source. The results show that a uniform-rate federal GST costs about 10 cents per dollar of tax revenue raised, whereas the PST's cost, on average, about 30 cents per dollar and the FST about 70 cents per dollar.

CONCLUDING REMARKS

In this article, we have presented an evaluation of the impacts on economic activity of changes to the Canadian sales tax system. We have described a regional general equilibrium model of the Canadian economy, along with the results from this model. We have assumed that Canada is a small open economy, and the model contains a detailed representation of the Canadian sales tax system and its effects on economic activity.

The simulation results indicate that in our model, a federal-only sales tax reform, the GST, leads to real output increases of about 1.4 percent. These real output gains are largely due to the removal of the sales tax on capital goods and other business inputs and to the elimination of the bias in favour of imported products. National welfare increases by approximately 0.9 percent of GDP, since part of the increased output pays for the additional capital services imported from abroad.

If provincial sales taxes are also replaced, our model shows that the incremental benefits are an increase of 0.8 percent in real output and 0.4 percent in welfare.

These results suggest that the economic benefits from sales tax reform are significant. The sectors that expand the most are those that currently pay substantial amounts of sales taxes on their inputs, that is, the capital-intensive industries such as primary industries and utilities. In addition, real output expands in all regions, with the prairie provinces expanding the most because of their reliance on resource-based industries that pay substantial amounts of sales taxes on their inputs.

Although the model provides important insights into the long-term consequences of major sales tax reforms on economic activity, a few caveats are in order. First, policy changes of this magnitude clearly involve some transitional adjustments that have important effects. However, GEM models are
not well suited to an analysis of either the transitional implications of the reform or its effects on key macroeconomic variables such as employment, interest rates, and inflation. Second, the implications of the reform on compliance and administration costs are outside the scope of the analysis. This analysis nevertheless yields important insights into the long-run economic impacts of sales tax reforms.