



# Commodity Tax User's Guide

This guide describes the commodity tax Input-Output model associated with the SPSM. It combines commodity taxes levied at the industry level with those levied directly on households to produce the retail-equivalent effective sales tax rates. These rates are used in the SPSM to compute 'consumable income'.



Statistics  
Canada

Statistique  
Canada

Canada



## Table of Contents

Release Summary.....	2
Guide Summary .....	2
Introduction to Input-Output Methods.....	2
Modeling Commodity Taxes Using the SPSD/M.....	4
Calculating the Commodity Tax Liability of Households.....	4
Commodity Tax Coverage.....	5
Federal Government Taxes .....	5
Provincial Government Taxes.....	7
Local Property Taxes on Owner-occupied Dwellings .....	8
Model Flags, Options, Parameters, and Variables.....	8
Adjustment Factors .....	11
Appendix I - The Input-Output Framework and Commodity Tax Modeling.....	11
General Overview of the Accounting Framework.....	12
Margins and Commodity Tax Matrices .....	14
The Input-Output Model.....	14
A Simple Open Model and Assumptions .....	15
The Leakage Adjusted I-O Model .....	16
Calculating Commodity Taxes Using the I-O Model.....	17
Calculating the GST.....	18
The Effective Commodity Tax Rates and Tax Removal Rates .....	19
Appendix II - Details on the Expenditure Components.....	20
Contents of the Expenditure Components .....	20
Differences between the Input-Output and Expenditure Survey Data.....	33

## Release Summary

Following the changes in the SNA classification of goods, the COMTAX model was adjusted to accommodate the increase in the number of aggregated goods in final demand from 40 to 48.

**WARNING: Use the ct model variables for analysis at the household level only. Errors will result if the ct variables are specified in analyses at the individual level or on other family types.**

## Guide Summary

This guide describes how the SPSPD/M commodity tax model parameters are used to calculate the commodity tax liabilities of households and individuals. The guide also discusses the input-output model system which generates these parameters. The commodity tax model distinguishes twelve separate tax types: six federal commodity taxes and six provincial commodity taxes.

### Guide Contents

- Section *Introduction to Input-Output Methods* is an overview of input-output techniques.
- Section *Modeling Commodity Taxes Using in SPSPD/M* begins with an introduction to commodity tax modeling in the SPSPD/M and then describes the model parameters, options, etc. necessary to perform commodity tax simulations in the SPSPD/M. There are also descriptions of the commodity tax types.
- Appendix I contains a mathematical description of the input-output accounting framework, a simple commodity tax model, and parameter generation formulas.
- Appendix II provides the contents of the expenditure components and discusses the conceptual differences between expenditure in the input-output accounting framework and the SPSPD/M.

## Introduction to Input-Output Methods

Through input-output techniques, the taxation of business purchases of goods and services can be associated with the products consumed by households, governments, and foreigners (i.e. exports). These "upstream" or "indirect" taxes can be added to the observed or "direct" taxation of the final demand components to produce the total tax liability which households, governments, etc. face. It is this total commodity tax liability concept which underlies the commodity taxation of households on the SPSPD/M. This section is intended to introduce these input-output concepts. Users who wish to learn of the technical details should consult.

Goods and services in the economy are either consumed by the components of final demand (i.e. households, governments, hospitals, exports, and investment in capital stock) or by business in order to produce their outputs. Input-output techniques determine how the

commodities consumed for industrial production are embedded in each final demand component. Therefore, one can associate the commodity taxes paid by business on their inputs to the vector of final demand components.

This association assumes that firms engaged in the production process pass the entirety of their commodity tax costs forward down the production stream. Therefore, the components of final demand ultimately bear both the commodity taxes stemming from purchases made directly by households, governments, etc. and the "indirect" commodity taxes found in the business sector purchases. A number of other assumptions associated with input-output methods are discussed in detail in Appendix II.

Federal and Provincial governments use a number of taxes to generate revenues from the sales of specific goods and services. For example, Table 1 shows the total federal and provincial commodity taxes modeled in the SPSPD/M levied directly and indirectly (as a reallocation of the taxes paid on inputs for the goods used by the sector) on the household sector and the other sectors of the final demand in 1998.

**Table 1**  
**Direct and Indirect Taxes by Final Demand Sectors, 1998**  
(‘000 000)

		Federal		Provincial	
		GST	Other Ind	Sales Tax	Other Ind
Household	Indirect	1563	1038	2217	1289
	Direct	16517	7578	14904	9263
Total Household		18080	8616	17121	10552
Other Sectors	Indirect	1053	1745	4251	2109
	Direct	4291	529	3339	134
Total Other Sector		5344	2274	7590	2243
SNA		23424	10891	24711	12795

**Table 2**  
**Shares of Direct and Indirect Taxes by Final Demand Sectors, 1998**

		Federal		Provincial	
		GST	Other Ind	Sales Tax	Other Ind
Household	Indirect	6.7%	9.5%	9.0%	10.1%
	Direct	70.5%	69.6%	60.3%	72.4%
Total Household		77.2%	79.1%	69.3%	82.5%
Other Sectors	Indirect	4.5%	16.0%	17.2%	16.5%
	Direct	18.3%	4.9%	13.5%	1.0%
Total Other Sectors		22.8%	20.9%	30.7%	17.5%

Source:COMTAX, SNA

Table 2 shows the share of the federal and provincial indirect taxes by sector of final demand. SPSPD/M produces only federal and provincial indirect taxes for the household sector. In 1998, the household sector contributed for 77.2% of all GST collected and slightly more for the other indirect taxes (import, excise import, other excise taxes). At the provincial level, the household sector was responsible of 69.3% of the provincial sales tax. This is because universities, college, school boards, and municipalities are only partly refunded for their sales tax. The household sector supports a larger share of the other provincial indirect taxes, 82.5%, because tobacco, alcohol and amusement taxes are paid only by the household sector.

## Modeling Commodity Taxes Using the SPSPD/M

### CALCULATING THE COMMODITY TAX LIABILITY OF HOUSEHOLDS

Each household observation on the SPSPD/M contains an aggregation of all the purchases that the household has made over a given year into one of 48 expenditure components. The commodity tax liability of a SPSPD/M household is determined by applying the effective commodity tax rate vector of length 48, generated by the input-output model, to the conceptually equivalent vector of 48 expenditure components contained within each SPSPD/M household observation.

Our definition of the effective tax rate for each expenditure component is the ratio total commodity taxes paid to the total selling price of the expenditure component exclusive of these taxes. Thus, the denominator of the rate includes all wholesale, retail, transportation, and other margin's value added as well as the original producer's value added for each final demand component. One could alternately describe the rate as a "tax exclusive retail equivalent sales tax rate". More succinctly,

$$\text{effective sales tax rate} = \frac{(\text{direct taxes} + \text{all taxes re-allocated from the production process})}{(\text{producers value added} + \text{all trade margins value added})}$$

Identical effective commodity tax rates are applied to all households who face the same sales and excise tax regimes (i.e. households living in the same province). By contrast, the personal income tax and transfer algorithms generate levels of income tax, received benefits, etc. specifically for each individual or household.

The input-output model produces effective commodity tax rate vectors of length 48 for each of the six federal tax types. However, since inter-provincial trade flow data are not available, it is not possible to allocate the provincial commodity taxes levied on business inputs to the province where the final demand component embedding these inputs was consumed. Our solution was to aggregate the provincial tax types levied on production to the Canada total and, via the national i-o tables, estimate average "indirect" tax rates which would be applied to all provinces. Recall that this only applies to the provincial taxation on inputs to production, i.e. sales and gasoline taxes. The six provincial tax types levied directly on the final demand components are completely province specific. See section 4 for the variable names and parameters affected by this aggregation.

Providing effective rates for the range of years 1986 to 1992 is straightforward as the Input-

Output division of Statistics Canada has produced national input-output tables and detailed commodity tax tables for these years. For subsequent years, up to 2009, the SPSPD/M team has estimated i-o and commodity tax tables based upon the most current economic data available and legislative amendments which pertain to commodity taxation at both the federal and provincial levels.

## **COMMODITY TAX COVERAGE**

The following subsections describe the major commodity taxes taken into account in this model. As the SPSPD/M provides parameters capable of simulating the commodity tax systems for the period covered, not all of the following tax types apply to every year. All the taxes were implemented up to current budget year as described in the Addendum. As an example, Table 3 lists the twelve commodity tax types covered by the SPSPD/M for the years 1984, 1988, 1992. A short description of each tax type follows. Users interested in more information underlying the tax types that is described here should contact members of the SPSPD/M development team.

**Table 3**  
**Total Commodity Tax Revenues by Tax Type**  
**(millions of dollars)**

	1984	1988	1992
<b>Federal Commodity Taxes</b>			
Customs Import Duties	3802	4612	3292
Excise Duties	1423	1521	2811
Excise Taxes	14705	4939	6239
Other Energy Taxes	1614	0	0
Manufacturer's Sales Tax	7353	14728	0
GST	0	0	19616
<b>Federal Total</b>	<b>15663</b>	<b>25803</b>	<b>31958</b>
<b>Provincial Commodity Taxes</b>			
Profits on Liquor Commissions	1984	2261	2400
Liquor Gallonage Tax	381	507	614
Gasoline Tax	3161	4158	5008
Amusement Tax	184	219	240
Tobacco Tax	1537	2233	2872
Retail Sales Tax	10496	16309	18837
<b>Provincial Total</b>	<b>17745</b>	<b>25688</b>	<b>29971</b>

Note: totals may not add due to rounding

### **Federal Government Taxes**

#### **Federal Customs Import Duties**

Customs import duties are levied on imported goods used for both manufacture and final consumption. They are ad-valorem based. Their impact is being diminished as GATT discussions lead to rate reductions. These duties are incorporated into the producer's price of

a good such that subsequent downstream revenues generated by manufacturer's sales taxes, federal excise taxes, and provincial retail sales taxes are affected by the custom import duty rates.

## **Federal Excise Duties**

Under the Excise Act duties are levied on tobacco products and alcoholic beverages (other than wines) made in Canada. These duties, like the customs import duties, are included in the producer's price of the commodity. They typically take the form of specific quantity rates; they are not an ad-valorem tax. By being incorporated into the initial sale price their levels affect the revenue generated by the manufacturer's sales taxes and provincial retail sales taxes.

## **Federal Excise Taxes**

A collection of tax types defined in the Excise Tax Act has been merged under this heading. These taxes are not directly applied to exported goods.

Gasoline, Diesel, and Aviation Fuel Excise Tax - this was originally levied on the non-commercial use of these fuels as a specific \$ rate per liter basis.

Tobacco Excise Tax - these commodities are taxed ad-valorem under this scheme.

Alcohol Excise Tax - Only domestically produced wines are taxed in this way as they were exempt from any import or excise duty. The tax is on a \$ per liter basis.

Other taxes - They include: Air Transportation Tax; Telecommunications Programming Tax; other excise taxes levied on heavy cars and automobile air conditioners; jewelry; clocks; watches; lighters; playing cards; and smokers' accessories.

## **Other Federal Energy-based Excise Taxes (phased out in 1986)**

These are taxes which were mostly brought in under the 1981 National Energy Program. They had significant impacts on Federal Government revenues through the early 80's (\$1.6 billion in 1984) but by 1986 they have been phased out. They are as follows:

- Natural Gas & Gas Liquids Excise Tax
- Oil Export Charge
- Canadian Ownership Special Charge

The Petroleum Compensation Levy has been left out of this framework since its task was to redistribute energy costs from one region of Canada to another. We have not implemented a Regional Input/Output model and therefore cannot track these effects.

## **Federal Manufacturer's Sales Tax (phased out in 1991)**

This tax is replaced by the Goods and Services Tax in 1991. Please note that the manufacturer's sales tax and the goods and services tax are mutually exclusive. In the model, the former is applied up to 1990 and the latter thereafter.



The manufacturer's sales tax has been the largest in the family of federal sales and excise taxes. It is levied on:

- all finished manufactured goods at the producer's sales price irrespective of whether wholesalers, retailers, or individual consumers are the purchasers;
- the customs value of imported goods, inclusive of any custom import or federal excise duties.

There are exemptions. Most importantly, all consumer service products are exempt. In 1985, partially finished inputs purchased by manufacturers for further processing were exempt as are all machinery and apparatus used directly in the production process. There are a variety of other exemptions such as on site construction materials and equipment, drugs, heating fuels and electricity, food, clothing and footwear, transportation equipment, educational material, farm and forest products, marine and fisheries items, goods manufactured in institutions, and insulation material. Some items have lost their exemption status over the years, which adds to the complexity of this tax type.

### **Federal Goods and Services Tax (effective in 1991)**

The GST is levied on the industries gross value added. The tax operates via the application of an ad-valorem tax to the value of their sales while receiving a tax credit for the implicit costs of the GST in the prices of their production inputs.

### **Provincial Government Taxes**

#### **Provincial Profits on Liquor Commissions**

These profits are defined as the value of gross sales less the costs of goods sold less administrative and general expenses. The value of the gross sales is, in part, a function of the markups over cost the provincial government applies. Utilizing profits gives governments greater ability to keep revenues on target. Shifts in market demand can be compensated via changes to the markups. These changes do not require statutory revisions.

#### **Provincial Liquor Gallonage Tax**

This fee applies to domestic beer producers in only four of the provinces: British Columbia, Ontario, Quebec, and Newfoundland.

#### **Provincial Gasoline Tax**

The tax applies to most gasoline used in the production process and all final demand consumption.

#### **Provincial Amusement Taxes**

A small amount of revenue is generated in all provinces save Newfoundland through the application of an amusement tax. This tax pertains to admissions to theaters, traveling amusements (i.e. circuses) and the like. This tax is not responsible for revenues earned on

pari-mutuel betting activities. There exist as many tax schemes as there are provinces.

### **Provincial Tobacco Taxes**

This tax is applied to cigarettes and cut tobacco. In both cases it is a specific rate tax either by the cigarette or by the gram.

### **Provincial Retail Sales Taxes**

These taxes apply everywhere except Alberta.

### **Harmonized Sales Tax (Implemented in SPSPD/M in 1998)**

The harmonized sales tax is the provincial rate applied to the goods and services covered by the GST. The HST applies to Newfoundland, Nova Scotia and New Brunswick. The combined rate is 15%.

### **Local Property Taxes on Owner-occupied Dwellings**

This tax type is not generated by the input-output system, but comes directly from the expenditure survey data. It is defined as all property taxes paid by households on their principal residences, vacation homes, and secondary living quarters.

### **MODEL FLAGS, OPTIONS, PARAMETERS, AND VARIABLES**

Commodity tax analysis in the SPSPD/M is conducted by applying a series of 48-element vectors of effective commodity tax rates to household observations. These vectors have all been estimated using a time series of input-output data. Table 4 lists all the commodity tax flags, options, parameters, and variables in the SPSPD/M. All model flags, options, and parameters are found in the model parameter (mpx) files.

**WARNING:** Use the ct model variables for analysis at the household level only. Errors will result if the ct variables are specified in analyses at the individual level or on other family types.

### **Model Flags and Options**

#### **CTFLAG**

CTFLAG controls whether any commodity tax calculations are performed at all. When set to 1 (default value), it calculates commodity tax liabilities.

#### **CTDFLAG**

With the CTDFLAG is set to 0 (default value) the SPSPD/M produces only the total commodity household commodity tax liability variables cttxfc and cttxpc and the total commodity individual commodity tax liability variables imtxfc and imtxpc. If CTDFLAG is set to 1 then all of the ct and imtx variables are calculated.

#### **CTOPT**

For every household observation there is an explicit disposable income / expenditure identity which stems from the source of SPSPD/M expenditure information. It is as follows,

```
hhld disposable income = hhld net expenditure on components 0 through 47
+ all federal and provincial commodity taxes
+ local property taxes
+ other household costs
```

CTOPT should always be set to 2 for all simulations. Under this setting the SPSPD/M modeled household disposable income replaces the survey disposable income value in the identity. The SPSPD/M then ensures the identity is satisfied by scaling all the expenditure components appropriately. Therefore, the estimated commodity tax liabilities are conditioned on the SPSPD/M income measure which has been corrected for several sources of income under-reporting inherent in Survey of Labour and Income Dynamics (SLID). In addition, the simulation results will be linked to any other user specified tax-transfer parameter changes which affect the SPSPD/M level of modeled disposable income.

If CTOPT is set to 1 then the raw survey disposable income concept is used in the identity. This option is designed for testing purposes and should never be specified.

**Table 4**  
**Summary of Commodity Tax Model options, parameters, and variables**

**Model Flags**

CTFLAG	Commodity tax activation flag
CTDFLAG	Commodity tax detailed calculation flag

**Model Options**

CTOPT	Commodity tax calculation method
-------	----------------------------------

**Model Parameters**

CTFCID	effective tax rate: federal custom import duties
CTFEXD	effective tax rate: federal excise duties
CTFEXT	effective tax rate: federal excise taxes
CTFOEN	effective tax rate: federal other energy taxes
CTFMFG	effective tax rate: federal manufacturer's sales tax
CTFGST	effective tax rate: federal goods and services tax
CTPPLQ	effective tax rate: prov profits on liquor commissions
CTPLGL	effective tax rate: prov liquor gallonage tax
CTPAMU	effective tax rate: prov amusement tax
CTPGAS	effective tax rate: prov gasoline tax on hhlds
CTPTOB	effective tax rate: prov tobacco tax
CTPRST	effective tax rate: prov sales taxes on hhlds
CTLPROP	scaling factor: local property taxes'
CTNES	scaling factor: expenditures not elsewhere specified
CTSAVE	scaling factor: household savings
CTTXRM	Base year commodity tax removal factor [com , prov]

**Model Tax Variables**

imtxfc	total individual federal commodity tax liability
imtxpc	total individual prov commodity tax liability
cttxfc	total hhld federal commodity tax liability
cttxfc0 -> cttxfc47	total hhld fed com tax for expenditure components 0 -> 47

ctfcid	total hhld federal custom import duties
ctfexd	total hhld federal excise duties
ctfext	total hhld federal excise tax
ctfoen	total hhld federal other energy tax
ctfmfg	total hhld federal manufacturer's sales tax
ctfgst	total hhld federal GST
cttxpc	total hhld provincial commodity tax liability
cttxpc0 -> cttxpc47	total hhld prov com tax for expenditure components 0 -> 47
ctplq	total hhld prov profits on liquor commissions
ctplgl	total hhld prov liquor gallonage tax
ctpamu	total hhld prov amusement tax
ctpgas	total hhld prov gas tax levied directly on hhlds
ctptob	total hhld prov tobacco tax
ctprst	total hhld prov sales tax levied directly on hhlds
ctlprop	total hhld local property taxes
<b>Model Other Variables</b>	
ctnexp	total hhld expenditure net of all commodity taxes
ctnexp0 -> ctnexp47	total hhld net expenditure for components 0 -> 47
ctsav	total hhld savings
ctothmon	household money from other sources
ctnes	hhld costs necessary to complete the income-expenditure identity

### Model Parameters

The effective commodity tax rate parameters listed in Table 4.3 are all generated by the input-output system. Users should be wary of making changes to these parameters without first contacting members of the SPSPD/M team.

The scaling factor model parameters are supplied to allow the adjustment of household savings, property taxes, and other costs. These parameters could be used to examine the sensitivity of commodity tax liability to changes in the savings rate. Note that the parameters are not used to scale base year savings etc. to the simulation year. That is done through adjustment parameters which are discussed in the sub-section *Adjustment Factors*.

### Model Variables: Household Level (all ct variables)

These variables are only valid for household level analysis in the SPSPD/M. Simulations specifying ct variables for individual, nuclear, census, or economic family levels will generate double counting errors.

### Model Variables: Individual Level (imtxfc imtxpc)

Commodity taxes are allocated to individuals within each household via each member's share of the total disposable income. The income share of the household's head includes three additional variables from the expenditure survey not otherwise included in the SPSPD disposable income concept but necessary to complete the income - expenditure identity. They are: dissavings, other money receipts, and net sales of durables. The individual shares

reflect the within family income distribution after this modification.

## **ADJUSTMENT FACTORS**

Some modifications to the household expenditure observations are performed before the commodity tax calculations can be done. The following adjustment parameters, found in the apr files, control these modifications. These factors should not be modified without first contacting the SPSPD/M development group.

### **Growth Factor Parameters**

The apr files also contain a set of growth factor parameters which take the raw expenditure data on the SPSPD/M and scale it to match the expenditure levels of the year to be simulated. These variables are named GFxxx and should not be changed.

### **CTTXRM (adjustment parameter)**

The SPSPD/M expenditure components must be stripped of their original commodity tax content to get net expenditure values before the effective commodity tax rates can be applied. The SPSPD/M accomplishes this by applying the input-output computed commodity tax removal parameter CTTXRM found in the apr file to expenditures. Appendix I describes mathematically how this commodity tax removal parameter is calculated. The results are stored in the ctnexp variable.

### **CTCFALC, CTCFTOB, CTCFGAS (adjustment parameters)**

The sum of the expenditure observations on the SPSPD/M for the alcohol, tobacco, and gasoline components is well below the levels of known control totals. The role of these three adjustment parameters is to scale the consumption of these goods on the SPSPD/M to meet the controls. To increase the efficiency of adjusting SPSPD/M to SNA, those parameters are now estimated simultaneously with the other parameters in CTFAMSNA, and those three parameters are now always set to 1.

### **CTFAMSNA (adjustment parameter)**

There exist some conceptual differences between the input-output expenditure components and the SPSPD/M observations stemming from survey data. Appendix II discusses these differences in more detail. This adjustment parameter is used to bring the SPSPD/M observations into alignment with the input-output framework. This ensures that the commodity tax revenues generated by the SPSPD/M are consistent with the input-output model results.

## **Appendix I - The Input-Output Framework and Commodity Tax Modeling**

**Note:** This section is not intended to detail the conceptual nature of the i-o system, but to describe one particular application. Although a general overview of the accounting framework is provided here, users requiring more detail as an aid to comprehension should consult the Statistics Canada publication 15-510 *"The Input-Output Structure of the*

*Canadian Economy 1961-1981*". Matrix algebra is used in this section. Uppercase variables denote matrices; lowercase represents vectors.

## GENERAL OVERVIEW OF THE ACCOUNTING FRAMEWORK

The definitions which follow all pertain to the schematic representation of the Canadian input-output (i-o) accounting framework given in Figure 1.

The i-o tables contain two sets of interrelated accounts, the commodity accounts, and the industry accounts. The former details the supply and disposition of individual commodities (goods and non-factor services). The latter details the commodity composition of production (including profits) of industries. For more details concerning the accounting structure see the i-o publication referenced above.

Define  $V$  to be the matrix of the values of commodity outputs; also called the "make" matrix. In it, each row shows the distribution by commodity of the aggregate output of each industry, each column shows the distribution by industry of the aggregate output of a commodity. The gross output of an industry is the aggregate value of goods and services produced and work done by the industry. It is equal to the value of industry's sales plus any increase (less any decrease) in the value of physical change in stocks of finished products and work in progress.

Define  $U$  to be the matrix of intermediate commodity inputs; also called the "Use" matrix. In it, each row shows the distribution by industry of the input of a commodity, each column shows the distribution by commodity of the input of the industry.

Define  $F$  to be the matrix of the values of commodity inputs of final demand categories: personal expenditure on consumer goods and services; fixed capital formation, business and government; value of physical change in inventories, withdrawals and additions; gross government current expenditure on goods and services; exports; imports; and government revenue from the sales of goods and services. It is also called the "Final Demand" matrix. The classification that describes all possible consumers of goods is called the "activity" dimension. It consists of the set of all industries, together with the set of all final demand categories.

Define  $YI$  to be the matrix of the values of primary inputs of industries. Primary inputs are those inputs which are not current outputs of other industries. These are indirect taxes, subsidies, wages and salaries, supplementary labour income, net income of unincorporated business, and other operating surplus.

Define  $YF$  to be the matrix of the values of primary inputs associated with final demand categories. These consist of indirect taxes, labour income, and depreciation (part of the surplus). Labour income in  $YF$  includes wages and salaries and supplementary labour income paid by the government and personal sectors. The surplus portion of  $YF$  relates to the government sector and non-profit institutions in the personal sector.

**Figure I: The Accounting Framework of Canadian Input-Output Tables**

Commodities	Industries	Final demand categories								Row Total
		PE	FCF	Less	VPCA	GGCE	X <sub>D</sub>	X <sub>R</sub>	Less	Less

		VPCW (v)	(x)	(r)	M (m)	GR (a)	
Commodities	U						q
Industries							g
Commodity							
indirect taxes							
Other indirect							
taxes							
Less subsidies							
Wages and salaries							
Supplementary	YI						n
labour income							
Net income of							
unincorporated							
business							
Other operating							
surplus							
Column Total	q'	g'					z'

### Final Demand Categories

- PE - Personal expenditure on goods and services
- FCF - Fixed capital formation, business and government
- VPCW - Value of physical change in V: is a matrix of the values of outputs  
Also denoted as the vector v in the mathematical description
- VPCA - Description which follows.
- GGCE - Value of Physical change in inventories, additions
- X<sub>D</sub> - Gross government current expenditure on goods and services  
Domestic exports of goods and services  
Also denoted as the vector x in the mathematical description
- X<sub>R</sub> - which follows.  
re-exports of goods and services  
Also denoted as the vector r in the mathematical description
- M - which follows.  
Imports of goods and services  
Also denoted as the vector m in the mathematical description
- GR - which follows.  
Government revenue from sale of goods and services  
Also denoted as the vector in the mathematical descriptions  
which follows.

**Notation**

V:	is a matrix of the values of outputs
U:	is a matrix of the values of intermediate inputs
F:	is a matrix of the values of commodity inputs of final demand categories
YI:	is a matrix of the values of primary inputs of industries
YF:	is a matrix of the values of primary inputs of final demand categories
q:	is a vector of the values of total commodity outputs
g:	is a vector of the values of total industry outputs
z:	is a vector of the values of total inputs (commodities plus primary) of final demand categories
n:	is a vector of the values of total primary inputs (industries plus final demand categories)
e:	(not shown) is a vector of the values of total inputs by commodity of final demand categories. It is equal to the sum across final demand categories of F.

**MARGINS AND COMMODITY TAX MATRICES**

The i-o tables described above are given in producer's prices. This valuation method maintains the link between the original sources of supply of a good (domestic industries or imports) and the intermediate and final consumer of the goods, with the additional cost elements incurred by the purchaser recorded as separate purchases of commodities. These additional cost elements between the producer's price and the purchaser's price are called margins. In the Use and Final Demand matrices the entries for the margin vectors reflect the total of each type of margin purchased by that industry or category of final demand on all of its commodity purchases.

There are seven margins in all: a retail margin, a wholesale margin, a commodity and other indirect tax margin, a transportation margin, a gas margin, a storage margin, and a pipeline margin. The framework has been extended to add to each element of the Use and Final Demand matrices (valued in producer's prices) their respective value of the seven margins. This adds a third dimension to the framework depicted in Figure 1 with the first "slice" of the matrix being the producer's price valuation and the seven subsequent "slices" corresponding to the margins. Summing across this "slice" dimension produces purchaser price Use and Final Demand matrices valued in purchaser's prices.

A further articulation of the commodity margin "slice" or matrix is available. The single commodity indirect tax margin has been disaggregated into 12 distinct tax types (6 federal taxes and 6 provincial taxes), often by activity (industry and final demand categories) and by commodity. For all tax types we have detail by activity but not necessarily by commodity.

**THE INPUT-OUTPUT MODEL**

The i-o modeling approach provides a method by which all direct and indirect domestic production activities are associated with final demand requirements. For example, if a household purchases an automobile, then the level of activity in the Steel, Rubber, etc. industries required to produce this product can be determined. Furthermore, Mining, Smelting, etc. are required for the production of steel. Therefore, an increase in the demand for automobiles leads to increased activity in various sectors of the economy. This secondary



production requirement can be associated with the responsible final demand category using i-o modeling.

In the same way that one can associate production requirements with final demand goods and services, the commodity indirect taxes associated with production processes can also be linked to final demand. It will be shown below that by constructing tax rates by industry, one can associate these production-related taxes with final demand categories using certain modeling assumptions.

In the following discussion, two input-output models are presented. The first is a simple open model, and is used primarily to introduce the basic i-o identities and concepts. The second model incorporates production leakages. Finally, we show how to compute retail equivalent sales tax rates for each final demand category.

### **A Simple Open Model and Assumptions**

The first assumption involves the allocation of commodity production among industries. It is assumed commodity irrespective of the levels of production. The mathematical expression of this assumption is the following equation:

$$g = D * q \quad (1)$$

As Figure 1 depicts, vector  $g$  represents the value of industry outputs and vector  $q$  the value of domestically-produced commodity outputs. The matrix  $D$ , denoted as the *market share matrix*, is a coefficient matrix constructed by dividing each element in a column of the output matrix  $V$  by the corresponding total commodity output.

The second assumption relates to the production functions of each industry. It is assumed that the values of the inputs of each industry are fixed proportions of the value of the total output of the industry and are therefore independent of the composition, or level, of this output. The mathematical expression of this assumption is the following equation:

$$U * I = B * g \quad (2)$$

In this equation  $i$  is a column vector, equal in dimension to the number of industries, whose elements are equal to 1. The matrix product on the left hand side of the equation represents a vector containing the sum of the intermediate inputs of all industries classified by commodity. Matrix  $B$ , termed the industry technology matrix, is obtained by dividing each element in a column of matrix  $U$  by the corresponding industry output.

If the economy is a simplified one in which no leakages (i.e. imports, exports, government production, withdrawals from inventories) exist, then the identity of total supply versus total disposition would be:

$$q = B * g + e \quad (3)$$

which reads: *the commodity vector of domestic output of an economy is equal to the transformed industrial production requirements, i.e. intermediate outputs, plus a commodity*

*column vector of final demand requirements, denoted as  $e$ .*

Using the basic assumptions of equations (1), (2), and (3) we now proceed to the formulation of a simple open input-output model which computes the level of industrial activity ( $g$ ) from the level of Final Demand ( $e$ ).

Pre-multiply equation (3) by  $D$ , to get:

$$D * q = D * B * g + D * e$$

Substitute using equation (1) to get:

$$g = D * B * g + D * e$$

Rearrange terms to get:

$$(I - D * B) * g = D * e$$

The final simplified I-O model equation becomes,

$$g = (I - D * B)^{-1} * D * e \quad (4)$$

### **The Leakage Adjusted I-O Model**

In order to perform commodity tax modeling, the following enhancement to the above system must be made. First, the introduction of a more detailed supply versus disposition identity is necessary. It is as follows:

$$q + m + a + v = B * g + e^* + x + r \quad (3a)$$

where,

$e^*$  = domestic final demand vector  
= personal expenditure  
+ fixed capital formation  
+ additions to inventories  
+ total government current expenditure

$m$  = imports

$a$  = government production

$v$  = withdrawals from inventories

$x$  = domestic exports

$r$  = re-exports

Using this extended notation, the equation for the simple open model becomes:

$$g = (I - D * B)^{-1} * D * (e^* + x + r - m - v - a) \quad (4a)$$

This model does not account for any leakages from domestic industries. To the extent that imports, and/or withdrawals from inventories, and/or government production of goods and services share with the domestic industries in the supply of a commodity, the impact in the increase of the final demand on domestic industries will be reduced. These leakages are specified in the three following equations.

$$m = \mu * (B * g + e^* + r) \quad (5)$$

In this equation, the vector  $m$  represents imports and  $\mu$  is a diagonal matrix of coefficients whose elements are calculated as the ratios of imports to the total domestic market by commodity, defined as  $B * g + e^* + r$ . This import share assumption implies that domestic exports of a commodity are supplied from domestic industries that produce the commodity. Of course, exports may have imports directly embodied in them to the extent that producing industries import their intermediate inputs.

$$a = \alpha * (B * g + e^* + x) \quad (6)$$

In this equation, the vector  $a$  represents government production of goods and services and  $\alpha$  is a diagonal matrix of coefficients whose elements are calculated as the ratio of government production to use, use being defined as  $B * g + e^* + x$ .

$$v = \beta (B * g + e^* + x) \quad (7)$$

In this equation, the vector  $v$  represents withdrawals from inventories (VPC) and  $\beta$  is a diagonal matrix of coefficients whose elements are calculated as the ratio of withdrawals to use, use defined as  $B * g + e^* + x$ .

Equations (3a) and (4a) can now be rewritten as,

$$q = B * g + e^* + r - \mu * (B * g + e^* + r) - \alpha * (B * g + e^* + x) - \beta (B * g + e^* + x) \quad (3b)$$

$$g = (I - D * (I - \mu - \alpha - \beta) * B)^{-1} * D * [(I - \mu - \alpha - \beta) * e^* + (I - \alpha - \beta) * x + (I - \mu) * r] \quad (4b)$$

### **CALCULATING COMMODITY TAXES USING THE I-O MODEL**

The commodity taxes collected from intermediate use are "pushed forward" to final demand space using equation (4b) with an articulated  $e^*$  that is not collapsed over its commodity dimension. Define the leakage-adjusted Final Demand matrix  $F^*$  as follows using the notation for sub-matrices of the Final Demand matrix  $F$  given in Figure 1.

$$F^*_{PE} = (I - \mu - \alpha - \beta) * PE \quad \text{adjusted personal expenditure sub-matrix}$$

$$F^*_{FCF} = (I - \mu - \alpha - \beta) * FCF \text{ adjusted investment sub-matrix}$$

$$F^*_{VPCA} = (I - \mu - \alpha - \beta) * VPCA \text{ adjusted additions from inventories vector}$$

$$F^*_{GGCE} = (I - \mu - \alpha - \beta) * GGCE \text{ adjusted current government expenditure matrix}$$

$$F^*_{Xd} = (I - \alpha - \beta) * x \text{ adjusted exports vector}$$

$$F^*_{Xr} = (I - \mu) * r \text{ adjusted re-exports vector}$$

Note that  $F^*$  is simply an articulation, into final demand categories, of the term in square brackets in equation (4b). Therefore, the other sub-matrix components of  $F^*$  are set to zero. They are:  $VPCW$  (withdrawals from inventories),  $m$  (imports), and  $GR$  (government production).

$F^*$  and equation (4b) can be combined to give an industry output matrix whose dimensions are industry by final demand category. Denote this matrix as  $G$ . Note that the row sum of this matrix exactly equals the vector  $g$ .

$$G = (I - D * (I - \mu - \alpha - \beta) * B)^{-1} * D * F \quad (8)$$

For a given commodity tax margin matrix,  $T$  levied on business inputs, we can compute a vector whose elements are the ratios of commodity taxes to industry outputs with  $i$  and  $j$  denoting the commodity and industry dimensions respectively,

$$\theta_j = \sum_i T_{ij} / g_j$$

If we pre-multiply the  $G$  matrix by this vector of ratios we obtain a vector whose elements are the "indirect" commodity taxes associated the vector of final demand components.

$$\bar{t} = \theta * G$$

The commodity tax incidence tax associated with each final demand category is completed by adding the "indirect" taxes to the observed "direct" taxes associated with final demand purchases. With  $S$  denotes the tax margin matrix for final demand components with dimension  $h$ , we have

$$t_h = \sum_i S_{ih} + \bar{t}_h$$

The above three equations have been repeated for each commodity tax type since separate commodity tax matrices are available for each tax.

## **CALCULATING THE GST**

The calculation of the GST follows the methodology described above but requires a more complex i-o system and treatment of tax-exempt goods. The details are not presented here,

but they can be obtained by contacting the SPSPD/M team.

## THE EFFECTIVE COMMODITY TAX RATES AND TAX REMOVAL RATES

The tax-exclusive retail-equivalent effective tax rates for each federal level tax type can be written as,

$$\theta_h = t_h / \sum_p N_{hp}$$

Provincial tax-exclusive retail-equivalent effective tax rates are written in the same fashion except they include a provincial dimension,  $p$

$$\theta_{hp} = t_{hp} / N_{hp}$$

The calculation of these rates require,  $N$ , the matrix of expenditures net of both indirect and direct commodity taxes by expenditure component and province.  $N$  is calculated through the following identity.

$$\begin{aligned} \text{expenditures net of commodity taxes} &= \text{gross expenditures} \\ &\quad - (\text{indirect} + \text{direct federal commodity taxes}) \\ &\quad - (\text{indirect} + \text{direct provincial commodity taxes}) \end{aligned}$$

$$\text{or } N_{hp} = E_{hp} - t_{hp}^f - t_{hp}^p$$

Unfortunately, the federal taxes are not observed by province. Therefore, we solve for  $N$  the following way,

$$\text{let } n_h = e_h - t_h^f - \sum_p t_{hp}^p \text{ and } \lambda_h = t_h^f / n_h$$

$$\text{then } n_h = e_h / (1 + \lambda_h)$$

which can be extended to the provincial dimension in the following manner,

$$N_{hp} = (E_{hp} - t_{hp}^p) / (1 + \lambda_h) \text{ for all } p$$

The SPSPD/M contains expenditure information which includes direct and indirect commodity taxes. In the base year, it is necessary to remove the taxes from each household's expenditure before applying any alternative effective tax rate. This matrix of tax removal rates, the CTTXRM adjustment parameter, is simply,

$$\delta_{hp} = N_{hp} / E_{hp}$$

## Appendix II - Details on the Expenditure Components

### CONTENTS OF THE EXPENDITURE COMPONENTS

Table II.1 lists the 48 household expenditure components for the years 1984, 1988, and 1991 and 1995. Additional information on the contents of the expenditure components follows.

<b>Table II.1: Household Expenditure Components</b>				
<b>(millions of dollars)</b>				
<b>Expenditure Components</b>	<b>1984</b>	<b>1988</b>	<b>1991</b>	<b>1995</b>
0- food & non-alcoholic beverage	31324	38542	43270	50117
1- alcoholic beverages	7962	10140	10699	12156
2- tobacco products	5192	7250	10454	11994
3- men's and boy's clothing	5300	6954	7180	8221
4- men's and boy's repair & alt.	54	70	73	83
5- women's&children's clothing	7507	10046	10896	12411
6- women's&children's repair & alt.	76	101	110	125
7- footwear	2220	2894	3105	3548
8- shoe repair	69	90	96	110
9- gross imputed rents	32800	45581	58327	70003
10- gross rent paid	12510	16966	21698	26123
11- other lodging	919	1199	1322	1589
12- electricity	4988	6999	9338	11211
13- natural gas	2272	2459	2741	3330
14- other fuels	2569	2159	2429	2730
15- "furn.,carpets&floor" covering	3579	5235	4980	5405
16- upholstery & furniture repair	149	218	207	225
17- durable hhld. Appliances	3494	4989	4831	5699
18- Household equipments repair	184	263	254	300
19- semi-dur hhld furn&supplies	6467	8982	9334	10823
20- non-durable hhld. Supplies	5208	7141	8048	9521
21- domestic & child care services	2229	3677	4588	5555
22- other household services	1502	2265	2663	3164
23- medical care	5248	6615	7808	9219
24- hospital care and the like	1274	1837	2405	2804
25- Accident and sickness insurance	544	987	1115	1416
26- drugs and sundries	3248	5170	6074	7277
27- new & used (net) motor vehicles	12050	19858	18601	21971
28- motor vehicles parts & acces.	2353	3756	4019	4524
29- motor vehicles repairs	2654	4235	4532	5101
30- motor fuels and lubricants	9643	10573	12622	14423
31- other auto related services	1802	2948	3952	4654
32- purchased transportation	5033	7279	8061	9363
33- communications	4222	5714	6698	7896
34- "rec.," sports & camping equip	7758	12422	12585	14602
35- rec. equip. repair and rentals	776	1242	1258	1460

36- reading & entertainment supp.	4238	5873	6668	7883
37- recreational services	5721	9229	11344	13584
38- education & cultural services	7570	10038	12559	15377
39- "jewellery,watches"	1535	2102	2145	2256
40- "jewellery,watches" repairs	81	111	113	119
41- Leather goods & other pers. goods	238	349	370	432
42- toilet "articles,cosmetics"	2226	3212	3830	4676
43- personal care	1973	3096	3940	4517
44- restaurants & hotels	15634	22990	26257	31096
45- "financial,legal" & other serv.	11114	17825	24328	27780
46- oper. exp. non-profit orgn.	4876	6690	8607	10101
47- net expenditures abroad	0	0	0	0
Source: COMTAX				

*0 - food and non-alcoholic beverages*

- locally and on day trips
- while on trips overnight or longer

*1 - alcoholic beverages*

- beer
- wine & cider
- liquor
- expenditures on supplies and fees for self-made beer, wine or liquor

*2 - tobacco products*

- tobacco
- cigars & similar products
- cigarettes

*3 – men's and boys' clothing*

- leather or fur coats & jackets
- winter-weight coats & jackets
- other light-weight coats & jackets
- suits
- sport jackets & blazers
- jeans
- other pants (incl. shorts)
- dress shirts
- woven sport shirts
- knitted sport shirts
- sweaters
- t-shirts and other shirts
- socks
- underwear

- pajamas & loungewear
- skiwear
- other active sportswear
- other specialized clothing
- gloves & mitts
- neckties
- belts and wallets
- other accessories

*4 - men's and boys' clothing repair & alteration*

- apparel

*5 – women's and children's clothing*

- leather coats & jackets
- fur coats & jackets
- winter-weight coats & jackets
- raincoats (incl. all-weather coats)
- other light-weight coats & jackets
- suits (incl. pant suits)
- dresses
- jeans
- pants & shorts (excl. jeans)
- skirts
- blouses & shirts
- t-shirts & other tops
- sweaters
- skiwear
- beachwear
- other active sportswear
- other specialized clothing
- foundation garments
- lingerie
- hosiery
- sleepwear
- loungewear
- gloves & mitts
- belts, handbags & wallets
- other accessories
- skirts, slacks, shorts & beachwear
- socks, other hosiery & underwear
- sweaters, headwear & mittens
- sleepwear
- other infants clothing

*6 – women's' and children's clothing repair and alterations*



- apparel

*7 – footwear*

- shoes and fashion boots
- athletic shoes
- other footwear

*8 – footwear repair*

- shoe repair
- shines

*9 - gross imputed rents*

- regular mortgage payments
- property taxes
- condominium charges
- mortgage insurance premiums
- property taxes and sewage charges - vacation homes
- maintenance of vacation homes
- other expenses associated with a vacation or secondary residence (e.g., survey costs, legal fees, etc.)

*10 - gross paid rents*

- rent
- security deposit

*11 - other shelter expenses*

- water
- premiums for homeowners' insurance covering fire, theft and other perils
- other accommodation while at school or away from home

*12 - electricity*

*13 - natural gas*

- piped gas

*14 - other fuels*

- fuel oil and other liquid fuel
- bottled gas
- fuel wood
- other fuel and heating costs

*15 – furniture and floor coverings*

- convertible sofas
- chesterfields(incl. matching chairs)
- other upholstered furniture

- wooden furniture
- bedroom furniture
- living room furniture
- dining room furniture
- kitchen furniture
- bookcases, wall units, desks, etc
- other eg nursery & bathroom, etc.
- other indoor furniture
- outdoor furniture
- springs, mattresses, bases and frames
- replacement of carpeting
- room-size and area rugs, mats and underpadding
- other furnishings

*16 - upholstery and furniture repair*

- maintenance and repairs

*17 - household appliances*

- refrigerators & refrigerator-freezers
- freezers
- washing machines
- clothes dryers
- cooking stoves and ranges
- microwave ovens & convection ovens
- replacement built-in appliances
- purchase of telephones etc.
- room air conditioner, portable humid/dehumidifiers
- gas barbecues
- vacuum cleaners & rug cleaning equipment
- automatic dishwashers
- electric sewing machines
- major household appliances, attachments and parts
- other for cooking & warming food
- electric appliances for food preparation
- electric irons
- other electric equipment & appliances
- electric hair-styling equipment
- personal care electric equipment
- repairs & maintenance
- major household appliances
- lawn & garden tractors and tillers
- power lawn-mowers
- other lawn & garden tools and equipment
- snow-blowers

*18 – household equipment repairs*

- major household appliances
- other equipment

*19 - semi-durable household furnishings*

- curtains
- draperies
- other (shades & blinds)
- sheets and pillow cases
- other bedding
- other household textiles
- mirror and picture frames
- art goods & decorative ware
- original works of art
- antiques
- glass mirrors
- hand operated kitchen tools etc.
- tableware and flatware
- precious metal
- stainless steel & other metal
- other (excl. disposable)
- china, porcelain & other ceramic
- glass and crystal
- other household equipment and accessories
- notions
- material (for curtains, draperies etc.)
- yarn (excl. craft)
- suitings and coatings
- dress material
- other clothing material
- collector's items
- pet related goods
- non-electric laundry equipment
- portable electric lamps
- lamps and lampshades
- home security equipment
- tools & equipment purchased for work
- power hand tools
- other power tools and equipment
- other tools and equipment

*20 - non-durable household supplies*

- canned dog and cat food
- other dog and cat food

- other pet food
- laundry detergent (incl. soap)
- liquid detergent (excl. laundry)
- automatic-dishwasher detergent
- toilet-bowl cleaner
- cleaning and scouring powders
- polishes and waxes
- other cleaning & polishing supplies
- bleach
- fabric softeners
- disinfectants and deodorizers
- other chemical specialties
- paper towels
- facial and bathroom tissue
- plastic garbage bags
- other plastic supplies
- foil supplies
- other household supplies
- disposable diapers
- nursery & greenhouse stock (shrubs, trees)
- potted plants, cut flowers, etc.
- herbicides, insecticides & rodenticides
- fertilizers, soil, & soil conditioners

*21 - domestic and child care services*

- domestic & other custodial services
- week-day child care in the home
- other child care in the home
- day-care centers & day nurseries
- other child care outside the home

*22 - other household services*

- veterinarian and other services
- dressmaking and tailoring
- other services of furniture and equipment (eg. making of draperies)
- clothing storage
- other clothing services
- laundry service
- dry-cleaning service
- horticultural services
- snow removal
- rental of heating equipment

*23 - medical care*

- physicians care
- orthodontic & periodontal procedures
- prescription & fitting of dentures
- other dental procedures
- other health care practitioners
- weight/smoking control programs
- other medical services

*24 - hospital care and the like*

- hospital care

*25 – accident and sickness insurance*

- public hospital and medical plans
- private health care plans

*26 - drugs & pharmaceutical products*

- health care supplies
- prescription drugs
- other pharmaceutical products
- eye glasses
- prescription contact lenses
- other eye care goods
- other health care goods

*27 - new and net used motor vehicles*

- automobiles
- separate sale of automobiles
- trucks (incl. vans)
- separate sale of trucks
- motor homes
- truck campers

*28 - motor vehicle parts and accessories*

- automobile radios & tape players
- other accessories & attachments
- tires
- batteries
- other maintenance & repair parts and supplies

*29 - motor vehicle repairs*

- oil changes and lubrication
- tune-ups
- other mechanical and electrical
- body (including painting)
- other maintenance and repair

*30 – motor fuels and lubricants*

- gasoline and other fuels

*31 - other motor vehicle related services*

- private & public vehicle insurance premiums
- insurance premiums on recreational vehicles
- garage rent and parking at dwelling (not incl. in rent)
- other parking costs
- other operation services
- driving lessons
- registration fees & licences
- rental fees (incl.basic insurance)
- optional insurance charges
- other expenses
- leasing fees for automobiles & trucks
- rental & leasing fees

*32 - purchased transportation*

- package travel tours
- sightseeing tours & excursion pkgs
- street car, city bus & subway
- commuter bus & train
- other local transportation
- rail
- highway bus
- other passenger transportation
- air
- other inter-city transportation
- local taxi service
- delivery services (local and inter-city)
- household movers, storage, & delivery
- household movers & storage

*33 - communications*

- installation and repairs
- basic charge for telephone services
- other local charges
- long distance toll charges
- cellular services
- internet services
- postal & other comm. serv.(ex. parcels)

*34 - recreation sporting and camping eq.*

- golf

- ice hockey equipment
- ice skates
- downhill skiing
- cross-country skiing
- fishing
- home exercise equipment
- other sporting & athletic equipment
- playground equipment incl. aboveground pools
- computer hardware
- computer software
- computer supplies
- 35-millimetre cameras
- other cameras
- camera parts & accessories
- other photographic goods (excl. film)
- musical instruments, accessories and parts
- camping and picnic equipment (excluding BBQ's)
- supplies and parts for recreational equipment
- bicycles, parts and accessories
- travel trailers
- tent trailers
- snowmobiles
- motorcycles
- truck campers
- outboard motors
- personal watercraft
- rental, maintenance & repairs
- audio components
- radios (incl clock & tel. combinations)
- audio combinations
- records, c.d.s & pre-rec. audio tapes
- blank audio tapes
- television sets (incl combinations)
- videotape recorders/players
- television/video components
- blank & pre-rec. videotapes & discs
- other home entertainment equipment

*35 - recreation equipment repair and rentals*

- recreation equipment rental
- maintenance and repair
- video game rental
- bicycle maintenance and repair
- maintenance and repair supplies and parts

- maintenance and repair jobs
- rental of videotapes and video discs
- rental of home entertainment equipment
- other services re. home entertainment equipment

*36 - reading and entertainment supplies*

- purchase of pets & related goods
- photography film
- dolls (incl. clothing)& stuffed toys
- toy vehicles & construction toys etc.
- other toys
- sleighs, toboggans & children's vehicles
- electronic games & parts
- artists' materials
- handicraft kits
- handicraft materials
- hobbycraft kits and materials
- other games & puzzles
- other recreation equipment
- stationary (excluding school supplies)
- other paper supplies
- newspapers
- subscriptions paid
- purchase of single copies
- paper backed books
- hard cover books
- maps, sheet music & other printed matter
- nursery, elem. & secondary textbooks and supplies
- post-secondary textbooks and supplies
- duplicating, library fees and fines

*37 - recreational services*

- photographers
- photographic services
- motion picture showings
- football
- hockey
- baseball
- other live sports spectacles
- live staged performances (eg. concerts)
- admission to other activities and venues
- rental of cablevision
- rental of satellite services
- membership fees and dues for sports clubs



- golf
- bowling and billiards
- skiing
- racquet sports
- health clubs & recreation assoc.
- coin-operated amusement games, etc.
- other recreation facilities & serv.
- children's camps
- other cultural and recreational services and facilities
- government-run pool & lottery tickets
- casinos and slot machines
- bingos
- other lottery, pool & raffle tickets
- winnings from games of chance

*38 - education and cultural services*

- admission to museums, exhibitions etc
- nursery, elem. & secondary education
- post-secondary
- other lessons & courses (excl. driving)
- other education services

*39 - jewellery and watches*

- watches
- precious jewellery
- other jewellery (incl. costume)

*40 - jewellery and watch repair*

- watches
- precious jewellery
- other jewellery (incl. costume)

*41 – leather goods and other personal effects*

- leather accessories
- luggage
- matches
- other smokers' supplies

*42 - toilet articles and cosmetics*

- creams & lotions
- eye make-up
- lip preparations
- other make-up
- perfumes, toilet water & colognes
- other fragrance preparations

- hair conditioners & cream rinses
- shampoos
- home permanents, hair tints & dyes
- other hair preparations
- manicuring preparations
- personal deodorants
- soaps
- shaving cream & soap
- pre-shave & after-shave products
- other toilet preparations & cosmetics
- toothpaste
- other oral hygiene products
- disposable razors & razor blades
- other personal care supplies and equipment

*43 - personal care*

- men's hair
- women's hair
- other hair grooming services
- other personal care supplies & equipment
- other personal grooming services
- other miscellaneous services

*44 - restaurants and accommodations services*

- while on trips overnight or longer
- at work
- at school
- other meals out
- between-meal food
- on a job
- at school & college
- on vacation & other trips
- hotels
- motels
- campgrounds
- tourist homes & other acc.
- board paid by family members incl. roomers

- rented vacation homes

*45 - financial and other legal services*

- premiums on life and disability insurance
- stock and bond commissions
- legal fees not elsewhere stated
- financial services: banks, tax advice, etc.
- legal fees not related to accommodation

*46 - operating expenses of non-profits org.*

- dues to unions & professional association
- contributions and dues for social clubs
- religious organizations
- other charitable organizations

*47 - Net Expenditures Abroad (=0)*

- Since there is no commodity taxes associated with expenditures abroad we have set this variable to zero.

*other hhld costs*

- replacements
- replacement of equipment
- other replacements
- commissions for sale of real estate
- interest on personal loans
- annuity contracts
- other (excl. rrsp)
- drivers
- registration fees (excl. govt ins.)
- forfeit of deposits, fines, money lost etc
- other miscellaneous goods
- gifts to persons living inside Canada
- gifts to persons living outside Canada
- other gifts eg. flowers, clothing, toys

## **DIFFERENCES BETWEEN THE INPUT-OUTPUT AND EXPENDITURE SURVEY DATA**

The input-output based commodity tax model calculates tax rates for 48 personal expenditure categories. The tax rates are based upon gross personal expenditure whose source is the System of National Accounts (SNA). These rates are applied to SPSPD/M households to analyze their impact at the micro level. However, the personal expenditure components of the SPSPD are derived solely from two different expenditure surveys; The Survey of Household Spending (SHS) 1997 to present and the Survey of Family Expenditures (FAMEX) before 1997. The following table presents a detailed comparison between the two sources of personal expenditure data in 1996.

Table II.2 is for illustrative purposes only. The purpose being to understand the conceptual difference between SNA expenditure data and expenditure data received via expenditure surveys.

<b>Table II.2: Differences between the Expenditure Components – 1996</b>			
<b>System of National Accounts (SNA)</b>			
<b>Survey of Family Expenditures (FAMEX)</b>			
<b>(millions of dollars)</b>			
<b>Expenditure Components</b>	<b>FAMEX</b>	<b>COMTAX</b>	<b>%DIFF</b>
0- food & non-alcoholic beverage	48351	51445	-6.0%
1- alcoholic beverages	5678	12478	-54.5%
2- tobacco products	5684	12311	-53.8%
3- men's and boy's clothing	6347	8439	-24.8%
4- men's and boy's repair & alt.	46	85	-45.9%
5- women's&children's clothing	10006	12740	-21.5%
6- women's&children's repair & alt.	76	129	-41.1%
7- footwear	3412	3642	-6.3%
8- shoe repair	75	113	-33.6%
9- gross imputed rents	29363	71858	-59.1%
10- gross rent paid	25230	26815	-5.9%
11- other lodging	833	1631	-48.9%
12- electricity	9444	11508	-17.9%
13- natural gas	3533	3418	3.4%
14- other fuels	2318	2803	-17.3%
15- "furn.,carpets&floor" covering	4423	5548	-20.3%
16- upholstery & furniture repair	327	231	41.6%
17- durable hhld. appliances	4996	5850	-14.6%
18- Household equipments repair	308	308	0.0%
19- semi-dur hhld furn&supplies	4815	11109	-56.7%
20- non-durable hhld. supplies	10444	9773	6.9%
21- domestic & child care services	4095	5702	-28.2%
22- other household services	6920	3248	113.1%
23- medical care	4485	9463	-52.6%
24- hospital care and the like	52	2879	-98.2%
25- Accident and sickness insurance	3027	1453	108.3%
26- drugs and sundries	3406	7470	-54.4%
27- new & used (net) motor vehicles	20925	22553	-7.2%
28- motor vehicles parts & acces.	2805	4643	-39.6%
29- motor vehicles repairs	5637	5236	7.7%
30- motor fuels and lubricants	14601	14805	-1.4%
31- other auto related services	16075	4777	236.5%
32- purchased transportation	8222	9611	-14.5%
33- communications	9428	8105	16.3%
34- "rec.," sports & camping equip	12835	14989	-14.4%
35- rec. equip. repair and rentals	1833	1499	22.3%
36- reading & entertainment supp.	5539	8092	-31.5%

37- recreational services	11854	13944	-15.0%
38- education & cultural services	4903	15785	-68.9%
39- "jewellery,watches"	1010	2316	-56.4%
40- "jewellery,watches" repairs	97	122	-20.5%
41- Leather goods & other pers. goods	239	444	-46.2%
42- toilet "articles,cosmetics"	5080	4799	5.9%
43- personal care	3437	4637	-25.9%
44- restaurants & hotels	20490	31920	-35.8%
45- "financial,legal" & other serv.	4465	28516	-84.3%
46- oper. exp. non-profit orgn.	6783	10368	-34.6%
47- net expenditures abroad			

---

Total	353952	489610	-27.7%
-------	--------	--------	--------

Source: COMTAX,FAMEX 1996

User's should remember that the FAMEX data apply only to the household sector alone while the personal sector is the scope for SNA personal expenditure. The personal sector includes self-employed professionals and non-profit organizations as well as the household sector. This partially explains the differences in appliances, recreation equipment, business, and automobile purchase items. Users interested in a more general discussion of these sectoral differences should consult: Adler, H., Wolfson, M. [1987]:"A Prototype Macro-Micro Link for the Canadian Household Sector", Statistics Canada, Analytical Studies Branch Research Paper Series #7, Ottawa, Canada or Review of Income and Wealth December, 1988. The remainder of this section details some specific differences.

### *1 Alcohol and 2 Tobacco*

It is well known that FAMEX under-reports these two series. The SNA uses provincial government sales numbers. Note that in the default modeling setting described in the next section we have adjusted the SPSD figures to concord exactly with that of the SNA. This was done due to the importance of these two commodities within the current tax structure. In effect, uniform proportional under-reporting has been assumed.

### *9 Gross Imputed Rents*

The FAMEX does not impute the rent of any owner-occupied dwellings. There is a secondary difference: house insurance premiums are net of claims in the SNA and not in FAMEX.

### *19 Semi-Durable Supplies*

It is not known why this major discrepancy exists although it is often difficult to distinguish between some imputed rent items and semi-durable items. In the default modeling setting described in the next section we have adjusted the SPSD figures to concord exactly with that of the SNA. This was done due to the importance of this component within the current taxation structure.

### *23 Medical Care*

Most often visits to Health Care professionals and clinics. The SNA figures are the gross sales by these agents. The FAMEX is the personal contribution alone.

### *24 Hospital Care*

The SNA figures are gross sales of profit making hospitals, and special care facilities. The FAMEX is the personal contribution alone.

### *25 Other Medical Care*

Mostly private insurance schemes (plus Worker's Compensation) so SNA nets out claims while the FAMEX does not.

### *31 Other Auto Related Services*

FAMEX is greater as it does not net claims on auto insurance.

### *32 Purchased Transportation*

There are two differences: 1) FAMEX distinguishes packaged trips from other air travel and therefore there exists a blurring between allocating this item between travel & hotel expenses; 2) Foreigners could purchase transportation here which would not be picked up by FAMEX.

### *34 Recreation, Sports, & Camping Equipment*

The SNA estimate is higher as it includes equipment purchases by non-profit organizations as well as households.

### *36 Reading and Entertainment Supplies*

The SNA estimate is higher as it includes books purchased by educational institutions as well as households.

### *37 Recreational Services*

FAMEX may be missing some lottery expenses (however SNA is net of claims) and some pari-mutual betting.

### *38 Educational & Cultural Services*

SNA figure is gross expenditures on university and private schools independent of the source of funding. FAMEX is just the personal portion i.e. tuition fees.

### *44 Expenditures in Restaurants & Hotels*

Recall the problem with package trips in the Purchased Travel series. Note that in the

default modeling setting, we have adjusted the SPSP figures to concord exactly with that of the SNA. This was done due to the importance of this component within the current tax structure.

#### *45 Financial, Legal and other Services*

The SNA imputes a large number of financial service items, the largest being banking services.