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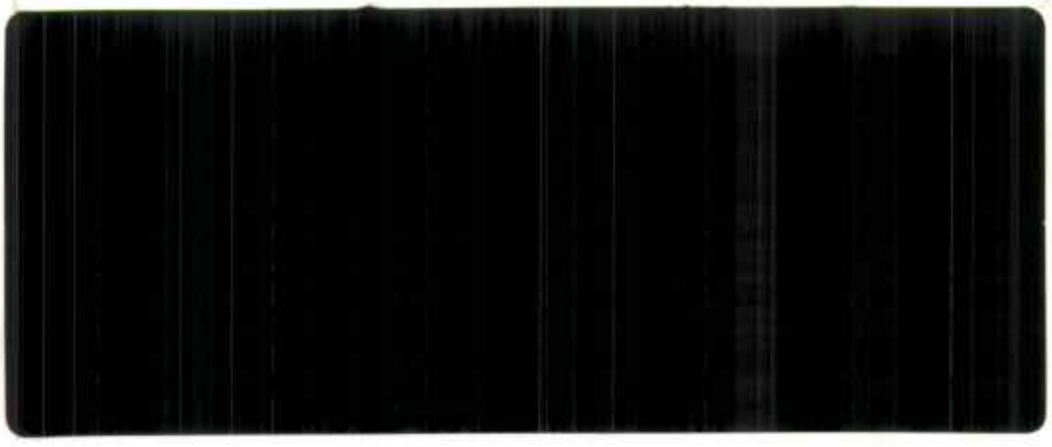

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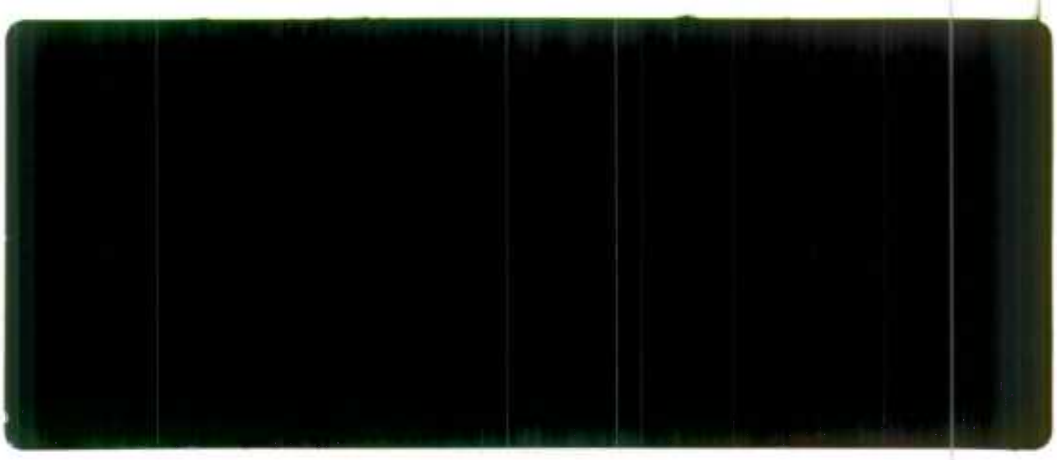

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Preliminary

# INPUT-OUTPUT MODELLING OF COMMODITY INDIRECT TAXES FOR MACROECONOMIC ANALYSIS

By

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# 13

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# 1 - Introduction

This note presents an input-output based proposal for estimating the effective commodity tax rates by type of tax that are associated with final demand expenditures. Such estimates may be used as exogenous variables in macroeconomic models and for other types of economic analysis. The introduction presents basic input-output concepts and definitions related to indirect taxation followed by some basic modelling principles. It is recognized that basic input-output modelling techniques can be applied to estimate effective tax rates for final demand expenditures over the historical record but that more sophisticated input-output models can also be built which could simulate the effective tax rates conditionally on predetermined statutory tax rates. These more sophisticated models could then be used in conjunction with macroeconomic models in forecasting or policy analysis simulations. The basic input-output model which is described next is nevertheless the only one presented in this note.

## 1.1 Basic input-output concepts

Final demand expenditures of most Canadian macroeconomic models are either those of the Income and Expenditure accounts or those of the Input-Output tables. The Input-Output tables contain a finer breakdown of final demand expenditures into catogories than the Income and Expenditure accounts. The final demand categories are comprised of categories of personal expenditures, investment expenditures by businesses and governments, government current expenditures on goods and services (net of government revenues in the case of the Income and Expenditure accounts), imports and exports, and inventory changes.

The various components of the Canadian System of National Accounts has reached a level of integration such that the Income and Expenditure categories of final demand can be obtained by aggregating over the final demand categories of the Input-Output tables. In the latter accounts, each category of final demand expenditures is further broken down into its detailed commodity

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components. These commodity components, in the Canadian Input-Output system are measured at producers' prices. The spread between purchasers' prices and producers' prices is composed of commodity indirect taxes, trade and transport margins. These margins appear as separate rows in the final demand matrix of the Input-Output accounts. Import duties are treated as part of producers' value of imports.

The margins can be allocated back to the expenditures of each commodity to obtain their final (market) price value known as users' prices. However, data constraints prevent the distribution of most of the provincial sales taxes over the commodities except for the year 1984 for which special compilations have been undertaken. The "final" prices of commodities in the Canadian input-output tables, therefore, relate to the prices before the allocated provincial sales tax. Except for 1984, only the total provincial sales taxes associated with each category of final demand (and some industries at the intermediate level) are known.

### 1.2 Commodity indirect taxes: concepts and data

Indirect commodity taxes are composed of various federal, provincial, and municipal taxes collected at the final sales level and on intermediate transactions in the production sector of the economy. The types of taxes are the following:

1 - The federal gasoline tax (on final sales only);
2 - The federal natural gas and liquid gas tax;
3 - The federal excise tax;
4 - The federal excise duties;
5 - The federal sales tax;
6 - The federal air transportation tax;
7 - The federal canadian ownership charges;
8 - The federal oil export charge ;
9 - The federal petroleum levy ;
10 - The import duties;
11 - The provincial liquor gallonage tax;
12 - The provincial liquor commission board profits;
13 - The provincial gasoline tax;
14 - The provincial and municipal sales tax (natural gas, telephone, telegraph and electricity);
15 - The provincial and municipal amusement tax (on final sales only);
16 - The provincial and municipal sales tax (other than natural gas, telephone, telegraph and electricity);

In the published input-output tables, these indirect taxes appear as a single aggregate margin associated with each category of final demand and with each industry's total inputs, except for the provincial sales tax (item 16 in the list above). Detailed calculations of these taxes by type of tax and by users, namely, industry or category of final demand are done. However, a special study for 1984 has yielded the allocation of provincial sales taxes by commodity. Thus for the year 1984 all commodity taxes could be treated as a margin.

These data are confidential but they can be used within the framework of an accounting model to estimate effective tax rates, provided the results are released at a level of detail which is in accordance with confidentiality guidelines.

### 1.3 Effective and statutory commodity tax rates

The effective tax rate (by type of tax) is defined as the amount of tax revenue collected on the value of the taxed transactions divided by the value of these transactions. The value of the taxed transactions is called the **taxation base**. In contrast, **statutory tax rates** are the nominal rates set by legislation. Effective and statutory rates are theoretically identical. In practice, however, these rates will differ because the taxation bases used to calculate the effective tax rates can only approximate the statutory "true" statutory taxation bases for two major reasons: (1) the statutory taxation bases are determined by various application rules which have the effect of exempting part of the use of a commodity and (2) input-output "commodities" are aggregates of finer commodity classes over which the statutory rates are actually defined.

The definition of effective tax rates just given is not operational without defining exactly the amount of taxes collected and the base value of the transactions. The commodity taxes may include only the taxes paid by the final purchaser of a given commodity, which, in the vocabulary of input-output analysis would be called the "directly" perceived taxes. But they may also include the hidden taxes paid by intermediaries on the market and "indirectly" paid by the ultimate buyer of the commodity. In order to avoid any confusion, the expressions "direct" and "indirect taxes", will be taken here as meaning respectively the taxes perceived on income and taxes perceived on expenditures. We will call the directly perceived commodity indirect taxes, the final (sales) taxes and the indirectly

perceived commodity taxes, the intermediate (sales) taxes.

From an accounting point of view, market prices include all intermediate and final taxes irrespective of who is supporting the tax burden. From an economic theoretic point of view, the manufacturer or the distributors may have to lower the prices of the commodities net of taxes below what they would have been in the absence of the taxes. By reducing their sales margins in the presence of taxes, the sellers of commodities on the market may in effect not "shift" the whole amount of the taxes to the final purchasers, therefore absorbing part of the tax burden.
But tax shifting is something which cannot be determined in a pure accounting framework. It involves estimates of demand and supply elasticities which are not part of such frameworks. Nevertheless, effective tax rates can be computed in an accounting model as they are simply the ratio between collected tax revenue and the taxation bases.

## 1.4 Modelling issues

One may or may not include intermediate taxes in the definition of the effective tax rates of final sales, depending on the structure of the ecomometric model to be used. Econometric models defined on both intermediate and final sales transactions will preferably exclude them as the taxes can be computed in these models separately on both intermediate and final sale transactions. Traditional macroeconomic models typically include only one aggregate production sector and its associated final sales. Intermediate transactions, because they are not included in these models cannot be used as a fiscal "taxation base" for the computation of taxes collected by governments at the intermediate level. All taxes must be associated with final sales whether directly or indirectly perceived. This means that the effective tax rates must be inclusive of intermediate and final taxes. Indeed, proceeding otherwise would leave the collection of intermediate taxes unspecified.

This raises serious modelling issues for the indirect taxes which are collected on intermediate inputs. These inputs are use to produce final goods and are potentially taxed at a different rate than the final goods into which they are incorporated. In addition, intermediate transactions may be exempt from some commodity taxes while final demand transactions typically are not. The converse case is also possible. For instance, household furniture is subject to the federal manufacturers

sales tax while largely exempt from the provincial sales tax in Quebec.

The previous issue is partly resolved by disaggregating the tax revenues by type of tax and level of government. It remains, nevertheless, that except for taxes levied on final sales, the "true" taxation base cannot be easily approximated within such models. But taking final sales as a proxy for the taxation base is the only possible choice within the macroeconomic model. This raises the issue of linking the effective tax rates to the statutory rates in an efficient manner within the model for the purpose of simulating the economic impact of changes in the statutory tax rates.

This issue can be satisfactorily solved if one accepts to compute effective tax rates outside the macroeconomic model. Using the input-output accounting identities, it is indeed possible to compute, historically, the taxes directly and indirectly paid on any final sales. Dividing these taxes by the value of the final sales transactions gives the effective tax rates which may be entered exogenously into the macroeconometric model. This computation only requires minor adaptations of the standard input-output model. It consists mainly in breaking down the unique commodity tax margin coefficient of the standard model into as many tax margin coefficients as there are types of commodity indirect taxes.

Taxation bases can also be derived from these identities which would be much closer to the true taxation bases than the macroeconomic model taxation bases. These taxation bases would be defined as the total value of the commodities purchased at producer's prices by category of final demand or by industry, excluding the purchase of primary inputs.

Given these taxation bases, effective tax rates can be computed by type of tax and by category of final or intermediate demand (industry). A separate model can then be built which would relate the effective tax rates to the statutory rates so as to simulate the impact of changes in the latter on the former rates. However, a better model can be built for that purpose. This model would be based on purchases by commodity and by use rather than by category of final or intermediate demand. Indeed, the effective tax rates may strongly differ from one commodity to another within an industry or final demand category for various reasons. More precise results can certainly be obtained by computing the tax collected on each transaction and dividing the tax by the value of that specific transaction rather than taking

the tax collected over a set of transactions and dividing by the total value of this set of transactions.

As mentioned above this technical note deals only with the basic input-output model at producers' prices which can be used to generate the historical "macroeconomic" final demand based effective taxation rates by types of tax. A separate note will present the commodity transactions model required to link efficiently the effective tax rates to the statutory tax rates.[2]

## 2 - The basic accounting tax model

### 2.1 The macroeconomic model tax equations

The (input-output tax) accounting model will be defined in general terms so as to be applicable to any Canadian macroeconomic model. The value of the categories of final demand of the macroeconomic model, whether exogenously or endogenously determined, have to be taken as exogenous (with some adjustments to be introduced below) in the accounting model. Intermediate demand and the imports associated with this intermediate demand will be determined endogenously in the accounting model similarly to their determination in the standard Canadian input-output model[3]. These specifications could nevertheless be dropped if necessary, that is, when preferred alternative specifications are available in the macroeconomic model. Let us start by defining the macroeconomic model tax equations which, by their structure, will then define the additional equations required for the specification of the input-output tax accounting model. Beginning with provincial sales tax on final demand expenditure categories, $t_p$, where p stands for the provincial governments, the tax equations by type of tax entering into the macroeconomic model can be written as:

$$t_p = \Sigma \tau_p S \qquad (2.1.1)$$

2 The development of the detailed tax model would requiresome additional development to the indirect tax data bases.

3 For a description of the model see: The Input-Output Structure of the Canadian Economy 1961-1981, Statistics Canada, catalogue number 15-510.

where the $\tau$'s are the effective (macroeconomic) tax rates and the S's are the corresponding current price value of the categories of final demand entering into the macroeconomic model. The federal sales tax equations of the macroeconomic model may likewise be written as

$$t_f = \Sigma \tau_f S \qquad (2.1.2)$$

where the subscript f stands for the federal government. Finally, import taxes will be defined by

$$t_m = \tau_m m \qquad (2.1.3)$$

where $m$ represents total imports in current prices.

## 2.2 Taxes on final sales in the input-output model

In the input-output tax model, taxes are computed separately for final and intermediate expenditures. The final expenditure categories excluding imports, government revenues and inventory depletion are transformed into commodities (including all the tax margins on final sales and other primary commodities) by the equation

$$E = S \hat{s} \qquad (2.2.1)$$

where E is the matrix of final expenditures at producers' prices by commodities (rows) and categories (columns), including the primary commodities, S a matrix of coefficients transforming the expenditure category vector s at market prices into the matrix E and simply defined over the historical record by solving equation (2.2.1) for S itself. The tax matrices by type of tax and expenditure category on final sales at the provincial and federal level, $T_{op}$ and $T_{of}$, where the subscript o represents for final sales (and where we have used a different font to distinguish the input-output model equations from those of the macroeconomic model), can simply be computed historically by reading the appropriate rows of the matrix E. Equation (2.2.1) is therefore trivial over the historical period but the same equation could be used in conjunction with the following tax equations to generate the tax matrices for arbitrary values of s.

$$T_{op} = N_p E$$

$$= N_p S \hat{s} \qquad (2.2.2)$$

$$T_{of} = N_f E$$

$$= N_f S \hat{s} \qquad (2.2.3)$$

where $N_p$ and $N_f$ are matrices whose row vectors are those of the identity matrix corresponding to the appropriate tax row coefficients of S. As simulation equations, the tax equations assume that there cannot be substitution or income effects acting on the commodity structure within a given category of final demand. This is not a strong assumption as substitution and income effects can be allowed for between the categories of final demand in the macroeconometric model. The commodity structures themselves are made of fewer commodities and generally dominated by a single commodity at a highly disaggregated level. Hence, provided that the econometric model contains fairly disaggregated categories of final demand, the rigidity of final demand commodity structures imposes very little constraint on the interpretation of the results. The effective tax rates on final sales categories can therefore be given by:

$$T_{op} = T_{op} \hat{s}^{-1} \qquad (2.2.4)$$

and

$$T_{of} = T_{of} \hat{s}^{-1} \qquad (2.2.5)$$

Substituting (2.2.2) and (2.2.3) into (2.2.4) and (2.2.5) gives the following reduced forms:

$$T_{op} = N_p S \hat{s}\hat{s}^{-1}$$

$$= N_p S \qquad (2.2.6)$$

$$T_{of} = N_f S \qquad (2.2.7)$$

that is simply, the row coefficients of S corresponding to the various provincial and federal taxes. One may note, however, that the taxation bases selected are the elements of s itself, that is the expenditures including all tax and non-tax margins. It would be preferable to define the taxation bases as s excluding the provincial sales tax for the computation of the provincial sales tax. Similarly, for the federal taxes, it would be preferable to define the taxation bases before all margins such as trade and transportation margins. Statutory tax rules

indicate that the transformed tax bases are the ones which actually apply and hence which would be more appropriate in order to relate more efficiently the effective tax rates to their statutory counterparts. This is an example of the kind of refinements which could be brought by a full input-output specification of the effective tax rate calculations. Without a peripheral input-output tax model, the tax bases can only be slightly adjusted by the tax margins themselves as the other margins do not enter into the macroeconomic model. These problems are compounded when the true (statutory) tax bases are intermediate transactions. But in the simple accounting scheme presented here no corrections will be brought to the tax bases. The tax bases of the input-output model will be considered as being identical with the tax bases of the macroeconomic model.

## 2.3 Taxes on intermediate transactions

In order to compute taxes on intermediate transactions, we first have to derive the intermediate transactions themselves. This is accomplished by computing the matrix of gross output **G** giving the output of all business industries associated with each non-leakage category of final demand.

$$\mathbf{G} = [\mathbf{g}_1, \mathbf{g}_2, \ldots, \mathbf{g}_r, \ldots, \mathbf{g}_s] \qquad (2.3.1)$$

where

$$r = 1, \ldots, s$$

is the index of non-leakage final demand categories. In order to compute, say $\mathbf{g}_r$, it is first necessary to compute the intermediate and final demand associated with category r of final demand (excluding the import, government revenue and inventory depletion categories of which only the former is assumed to be part of the macroeconomic model) and which is satisfied by domestic business industries. Except for exports, this is given by

$$\mathbf{q}_r = (\mathbf{I} - \hat{\mathbf{u}} - \hat{\mathbf{a}} - \hat{\mathbf{b}})\,(\mathbf{d}_{*r} + \mathbf{e}_r) \qquad (2.3.2)$$

where $\mathbf{d}_{*r}$ is the intermediate input demand associated with the level of activity $\mathbf{g}_r$ and $\mathbf{e}_r$ is the $r^{th}$ component commodity vector of **E** excluding the tax margins and other primary input components and where the diagonal vectors **u**, **a** and **b** are respectively the leakage coefficients associated with imports, government revenues and inventory depletion. For exports,

direct leakages only include government revenues and inventories. Industries' gross output vector $g_r$ is computed by allocating the total net demand to the industries according to their market shares given by the matrix D. The rows of D contains the market shares coefficients of each industry on each commodity:

$$g_r = D\, q_r \qquad (2.3.3)$$

But intermediate demand is in itself a function of the level of activity of the various industries. This is given as usual by:

$$d_{*r} = B\, g_r \qquad (2.3.4)$$

where B is the matrix of intermediate technical coefficients whose elements are the ratios of industries' commodity uses to gross output. Substituting the latter equation into (2.3.2) and solving for $g_r$ using (2.3.3) gives:

$$g_r = [I - D(I - \hat{u} - \hat{a} - \hat{b})B]^{-1}\, D(I - \hat{u} - \hat{a} - \hat{b})\, e_r \qquad (2.3.5)$$

The parameters u, a and b of equation (2.3.5) are set to values such that summing the output vectors over the categories r of final demand excluding the leakage categories will exactly generate the estimated historical vector of total gross output. Indeed, these parameters are set so as to generate exactly the total leakages when applied to intermediate and final (non-leakage) demand categories. However, we are facing a problem here in that the above equation treats imports and other leakages as endogenous to the input-output model while we said above that these variables would be considered as predetermined. Indeed some of these variables such as total imports may be endogeneous to the macroeconomic model itself leading to an overdetermination of these variables. Before going any further, we thus have to tackle this issue.

The impact matrix associated with a completely exogenous final demand can be easily derived and compared with the impact matrix of (2.3.5). Noting the vector of net final demand by commodity by e the latter is simply given by

$$e = N_c\, E\, i \qquad (2.3.6)$$

where i is the summation vector, $N_c$, a truncated identity matrix containing only the rows corresponding to the non-primary commodities and where E now includes the leakages categories.

Total net demand in the economy is given by

$$q = d_x + e \qquad (2.3.7)$$

Hence, gross output is given by

$$g = D\,q \qquad (2.3.8)$$

which, using the previous equation and (2.3.4), gives

$$g = (I - DB)^{-1} D\,e \qquad (2.3.9)$$

Treating all final demand categories as exogenous therefore leads to (2.3.9) rather than to (2.3.5), that is to a quite different impact matrix. But the end result over the historical period is the same level g of output from which intermediate sales and their associated taxes can be computed. Since the purpose of the exercise is to compute the taxes associated with each category of final demand separately, it would appear that specification (2.3.9) would be preferable if the leakages could be exogenously apportioned to each category of final demand (including the associated intermediate input leakages) which could then be entered net of all leakages in that equation. The information that would be requires for that purpose does not exist. Imports cannot be apportioned to intermediate and final demand categories in any other way than on the basis of some assumption. The same reasoning applies to the other leakages. We will therefore assume, in what follows, that the standard input-output model assumption of proportionality of leakages to uses applies. The imports are prorated to all uses excluding exports while the other leakages are prorated on all uses in the standard input-output model. Other assumptions could be made which would lead to derivations similar to the ones presented below.

If the input-output tax model is used in conjunction with the macroeconomic model for simulation analysis outside the historical path, then the same assumptions as above can be maintained even if total imports are endogenous to the macroeconomic model. In that case, the input-output endogenous specification of imports can be reconciled with the macroeconomic model specification by setting the commodity import leakages coefficients u endogenously so as to generate the import control total of the macroeconomic model. The same reasoning applies to the other leakages although these rarely enter macroeconomic model specifications. To conclude on this issue, the input-output model endogenous specification of intermediate and final demand

categories are only used to complement the macroeconomic model specifications rather than to supplant them.

Now, our interest is to trace taxes back to intermediate inputs. These taxes enter the primary input matrix Y of the input-output tables. The latter is given by

$$Y = H\,\hat{g} \qquad (2.3.10)$$

where H is the matrix of primary input coefficients defined by solving (2.3.10) for H itself. The provincial and federal indirect taxes can be extracted from the simulated primary input matrix, $Y_r$, associated with the final demand vector $e_r$, using the reduced form of (2.3.5) and (2.3.10) with $g_r$ substituted for g in (2.3.10). This can be done by constructing truncated identity matrices $M_p$ and $M_f$ similar to the matrices $N_p$ and $N_f$ defined above. Provincial taxes on intermediate transactions by level of government and types of taxes are therefore given by

$$T_{xpr} = M_p Y_r \qquad (2.3.11)$$

The matrix $T_{xpr}$ gives the taxes that are associated with the final demand vector $e_r$ (i.e. with final demand category $s_r$) by type and by industry. But we are only interested in having taxes by type which could be obtained by summing the columns of $T_{xpr}$.
Summing these columns and using (2.3.10) and (2.3.5) gives the tax vector

$$t_{xpr} = M_p\,H\,[I - D(I - \hat{u} - \hat{a} - \hat{b})B]^{-1}\,D(I - \hat{u} - \hat{a} - \hat{b})\,e_r \qquad (2.3.12)$$

and, at the federal level,

$$t_{xfr} = M_f\,H\,[I - D(I - \hat{u} - \hat{a} - \hat{b})B]^{-1}\,D(I - \hat{u} - \hat{a} - \hat{b})\,e_r \qquad (2.3.13)$$

Grouping again only the non-leakage categories of final demand together in the vector s we obtain the corresponding non-primary commodity rows of E by:

$$N_c\,E = N_c\,S\,\hat{s} \qquad (2.3.14)$$

The matrix of gross output by industry associated with each component of s is then given by:

$$G = [I - D(I - \hat{u} - \hat{a} - \hat{b})B]^{-1}\,D(I - \hat{u} - \hat{a} - \hat{b})\,N_c\,S\,\hat{s} \qquad (2.3.15)$$

We can then get the associated primary input matrix Y by:

$$Y = H\,G \qquad (2.3.16)$$

Hence,

$$T_{x_p} = M_p\,H\,[I - D(I - \hat{u} - \hat{a} - \hat{b})B]^{-1}\,D(I - \hat{u} - \hat{a} - \hat{b})\,N_c\,S\,\hat{s} \qquad (2.3.17)$$

and

$$T_{x_f} = M_f\,H\,[I - D(I - \hat{u} - \hat{a} - \hat{b})B]^{-1}\,D(I - \hat{u} - \hat{a} - \hat{b})\,N_c\,S\,\hat{s} \qquad (2.3.18)$$

The indirect tax matrices (2.3.17) and (2.3.18) gives all provincial and federal sales taxes indirectly perceived by the corresponding governments by type of tax (rows) on each category of final demand (columns) valued at market prices.

## 2.4 Import duties

The tax margin row of the import category of final demand include all import duties. Import duties are also included in the producers' price valuation of all commodity uses at the intermediate and final demand stages including the imports by commodity themselves. The commodity balance equation then reads as follows: the total uses of a commodity including the import duties minus the import of that commodity including the import duties equals the domestic production of that commodity at producers' prices excluding the import duties. The tax margin of the import category is entered with a positive sign while the commodity imports are entered negatively. The column sum, therefore, exclude the import duties. This is the only column of final demand whose total is not at market prices. This is because imports are incorporated directly or indirectly in all other final use categories. The sum of these categories minus imports at factor costs therefore gives the total GDP at market prices. In addition, if imports and import duties by commodity are known, the distribution of imports on intermediate and final demand uses remains unknown. Imports in the input-output model have been distributed, as mentioned above, on the basis of a modelling assumption. Import duties could be distributed on the basis of the same assumption. However, in the simple model presented here, there is no need to do so as the effective tax rate on imports can be directly applied to the total imports themselves.

The average effective tax rate on before tax imports can be easily computed by dividing the tax margin by total imports:

$$\tau_{m} = t_{m}/m \qquad (2.4.1)$$

Obviously this equation is much too simple to be usable to simulate the import duties outside the historical path followed by the economy and, a fortiori, to simulate the impact of changes in the statutory import duty rates.

## 2.5 Total intermediate and final taxes on final sales

All that remains now is to bring together the results of the previous sections to compute the total commodity taxes associated with each final expenditure category. Indirect taxes on imports are given by (2.4.1) while the commodity taxes on the other categories of final demand are given by (2.2.2), (2.2.3), (2.3.17) and (2.3.18). The latter tax matrices by level of government have the same dimensions and can be added up to yield the total taxes by type of taxes, directly and indirectly levied, by category of final demand. For the provincial sales taxes we have:

$$T_{p} = T_{op} + T_{ip} \qquad (2.5.1)$$

and for the corresponding federal sales tax:

$$T_{f} = T_{of} + T_{if} \qquad (2.5.2)$$

The effective tax rates by level of government are finally given by:

$$\mathcal{T}_{p} = T_{p}\,\hat{s}^{-1} \qquad (2.5.3)$$

and

$$\mathcal{T}_{f} = T_{f}\,\hat{s}^{-1} \qquad (2.5.4)$$

## 3 - Concluding remarks

We have introduced above a simple input-output effective tax rate model to be used with a macroeconomic model. The input-output model computes effective tax rates which are introduced as exogenous variables into the macroeconomic model. The latter

model may then be used to simulate commodity indirect taxes conditionnal on various levels of final demand categories of expenditures. The impact of arbitrary changes in the effective tax rates may also be simulated with the macroeconomic model. But these effective tax rate changes cannot be related to changes in the statutory tax rates in either the macroeconomic or the input-output tax model in an efficient way although the latter would perform better on such a task. Indeed, the input-output model can generate taxation bases which are closer to the true statutory taxation bases than the macroeconomic model. But in order to relate the effective tax rates to their statutory counterparts more efficiently, it would be possible to develop a more sophisticated input-output model in which each transaction in each industry's intermediate demand or each final demand category would be taken as a taxation base. This model was not developed here but could potentially be developed for the year 1984. For other years, the detailed commodity breakdown of taxes is only available for the federal taxes. Some assumptions based on the observed 1984 provincial tax distribution would be necessary to develop the model for other years.

The input-output and macroeconomic model can be seen as complementary models. The input-output model provides the necessary details to compute the effective tax rates. On the other hand, only the macroeconomic model can assess, if properly specified, the incidence of changes in the effective tax rates on prices and quantities. The necessary behavioral assumptions for that purpose are not part of the input-output model structure unless one is prepared to assume full tax shifting.

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