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Regionalization of Commodity-by-Industry
Input-Output Accounts:
The Canadian Case

By

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Abstract The paper summarizes conceptual and operational problems encountered in a project to regionalize Canada's national input-output tables in a fully consistent way within the framework of the Canadian SNA. The first section describes the accounting frameworks for both the national and the regional (interprovincial) levels. The following section deals with regionalization on an issue by issue basis, outlining the problems encountered and the approaches chosen. The discussion allows some generic conclusions to be drawn from the regionalization exercise which may have broader relevance and usefulness.

1. Introduction

The purpose of this paper is to discuss some of the more noteworthy or problematic issues encountered in regionalizing the Canadian input-output tables in current prices. Parallel with the regionalization exercise discussed here, interregional trade flows of goods and services were estimated in another project at the Input-Output Division of Statistics Canada. These projects have demonstrated that it is feasible to produce interregional input-output accounts that are fully integrated and reconciled with the other sub-systems of the CSNA.

Background

Input-output tables for the Canadian economy are produced on an annual basis in current as well as in constant prices with a 2 1/2 year lag from the reference year. Presently, a time series of these tables is available spanning the period from 1961 to 1992. Besides performing an auditing role for the Canadian statistical system, the national input-output tables serve as benchmarks for the Income and Expenditure Accounts, the Balance of Payments Accounts (in current prices) and Monthly Gross Domestic Product (GDP) by industry (in constant prices). Additionally, the tables provide control totals both in current and constant price for the annual provincial GDP by-industry programme and annual labour income estimates by industry.

The need for interregional input-output tables to provide an adequate and rigorous framework for regional impact analysis was always recognized by governments in Canada. The tables are an important part of the overall system because the Canadian economy is characterized by a high degree of regional diversity and specialization as well as a markedly high volume of trade among various regions (provinces and territories). These features of the Canadian economy were shaped by a number of geographic and political factors. For example, Canada's natural geography has tended over the centuries to favour the evolution of commercial activities, and later manufacturing activities, in the proximity of major ports along the St. Lawrence Seaway and the Great Lakes, roughly between Quebec City to the east and the City of Sault Ste. Marie on the shore of Lake Huron to the west. The provinces of Ontario and Quebec, which encompass this highly industrial region, account for about one-half and one-quarter of total manufacturing in Canada respectively[1]. In 1990[2], most interregional exports of manufactured goods (notably metal products, chemicals, machinery, transport equipment, electrical and communications equipment) originated in these provinces. In addition, these provinces in Central Canada make up the core areas for commercial and financial activity. About 65% of exports of financial services and more than 50% of exports of business services to other

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[1] . See Statistics Canada (1991).

[2] . The source for data quoted on regional trade and GDP in this section is Messinger *et. al.* (1995). The reader is referred to this source for a more complete presentation of data and discussion related to interprovincial trade and the structure of provincial economies in Canada in 1990.

provinces originated in Ontario. On the other hand, exports of forestry products to other regions is important to the economies of Quebec and New Brunswick in the east and British Columbia in the west. In the Atlantic provinces, Newfoundland's economy is mainly focused on extracting and processing natural resources, including fishing and forest products as well as processing of these products; the province of Prince Edward Island is a mainly agricultural economy; Nova Scotia has the largest North Atlantic fishery, but also produces and processes mineral and forest products while its manufacturing industry is relatively small; in New Brunswick, forest products and fisheries are major resource industries, while mining and some manufacturing industries are also present. By contrast, provincial economies in western Canada have a different character: Manitoba and Saskatchewan are mainly agricultural provinces, with some metal mining in Manitoba and important potash mining in Saskatchewan. Alberta dominates the production and regional exports of oil and gas, mostly to Ontario and Quebec, but also produces grains and livestock as well as a variety of manufactured goods. In British Columbia on the Pacific coast, resources form the basis of the economy. The forest products industry is important both as a primary activity and as the largest component of the manufacturing industry; Lumber is the main forest product, and the production of pulp and paper is important as is mineral extraction. The economies of the two territories, Yukon and the North West Territories, are quite distinct from those of the west and essentially revolve around metal mining, while the latter also produces some oil and gas.

In addition to natural factors, Canadian governments consciously pursued international trade policies for more than a century to promote the flow of trade in Canada along an east-west nexus, resisting the tendency of resource rich areas to trade their primary products with the large American markets which lie a short distance to the south. It is often argued that historical trade and regional development policies have succeeded in raising the volume and value of interregional trade and in strengthening commercial linkages among regions of Canada.

Canada is a highly open economy, with exports and imports abroad *each* exceeding 25% of its GDP in 1990. However, the geographic and political factors noted above have fostered levels of interregional trade which rival the magnitude of its external

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trade. In 1990, interregional trade amounted to $141 billion, compared to Canadian foreign exports of $161 billion. Based on 1990 interregional input-output tables, it was estimated that regional exports were more important than foreign exports in terms of the employment associated with them, supporting 1.7 million jobs compared to 1.6 million for foreign trade. The magnitudes of regional GDP and regional and foreign trade can be gleaned from appendix table A2.

Against the background of a highly regional and trade intensive economy, it is not surprising that the role of input-output accounting in facilitating an understanding of regional economic linkages and in formulating economic policies has long been recognized. The earliest attempt to articulate provincial linkages were made when Quebec and British Columbia pioneered the provincial input-output table (Gigantes, 1968). In a collaborative effort, Statistics Canada (then the Bureau of Statistics) undertook a project under the direction of professor Keri Levitt and compiled and published the input-output tables for the four Atlantic provinces for 1965 (Levitt, 1975). Statistics Canada also produced the very first interregional input-output tables for the year 1966. Following this experimental work, interregional tables were prepared for 1974, 1979, and 1984 as modeling exercises.[3]

Estimates of provincial GDP by industry derived from these tables did add up to the national input-output benchmarks. However, these were not reconciled with the independently derived and published estimates of provincial GDP by Statistics Canada. To redress this shortcoming, a Working Group drawn from Statistics Canada's SNA divisions was formed to examine conceptual and methodological issues in fully regionalizing national input-output tables in current prices. The report of the Working Group formed the basis for constructing the regional input-output tables in current prices for 1990 discussed in this paper. These tables are derived within a fully integrated national-provincial framework in that the estimates of provincial GDP by industry compiled and published annually by Statistics Canada are completely reconciled with the

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[3] . As provincial input-output tables, these tables have been subject to important limitations because many concepts and methods used in their estimation were not consistent with, and were not reconciled with, those in other components of the Canadian SNA. Examples of the latter include annual provincial GDP by industry (produced by Industry Measures and Analysis Division) and provincial income and expenditure accounts (produced by National Accounts and Environment Division).

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national estimates[4]. A summary of the components of provincial GDP derived from the tables is shown in appendix table A1.

2. THE ACCOUNTING FRAMEWORK

The accounting framework of the 1990 interregional (or interprovincial, as they are known in Canada) input-output tables is an extension of the framework of the national input-output accounts. The interregional framework consists of two sets of tables: 1) an input-output table for each region and 2) an interregional trade flows table that interlinks regional import and regional export columns of final demand matrices of regions by commodity. The format of a regional input-output table differs from that of a national table in one essential feature: the final expenditure categories include regional import and regional export columns in addition to foreign export and foreign import columns which exist in national tables.

The Canadian national input-output tables follow closely the commodity-by-industry framework recommended by the United Nations as its international standard (UN, 1968, 1993). A distinguishing feature of the input-output tables for Canada is their rectangular format, permitting the articulation of many commodities per industry, be it as outputs or as inputs. Similarly, a commodity may be produced by many industries as well as used by many. This feature also permits input-output impacts to be obtained in either the commodity space or the industry space. The national and the interregional tables distinguish 216 industries and 627 commodities. There are 136 categories of final demand at the national level, while regional tables have 138, allowing for regional exports and regional imports. The 1990 regional tables distinguish 12 regions: ten provinces and two territories.

The System of Classification

Following the national tables, regional input-output tables have been built around three classification systems: one for industries, one for commodities, and one for

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[4] . It should be noted that provincial income and expenditure accounts, which have been compiled and published by Statistics Canada for some time, were not fully reconciled with the 1990 interprovincial accounts because of the time

categories of final demand. The industry classification is based on the Canadian Standard Industrial Classification (Statistics Canada Catalogue 12-501). The commodity classification is specifically designed for the input-output system and reflects the structure of the input-output classification of industries. For goods, the commodity classification is based on the international Harmonized System of Classification and is fully concorded to other classification schemes used in various Statistics Canada surveys and the classification systems used in the administrative data received from the three levels of government. As there is yet no Canadian standard classification for services, the tables use a classification which defines service classes in terms of the product characteristics of the relevant industries. However, work is underway at Statistics Canada to produce a standard classification of services.

Since production accounts in the CSNA are integrated, the Canadian input-output accounts follow the same classification of transactors as used in the income and expenditure accounts. The latter divides transactors into business, government, personal and non-resident sectors[5]. Accordingly, the accounts for transactors in the business sector, classified by industry, appear in the output (**V**) and intermediate use (**U**) matrices. The accounts of transactors in the government sector, the personal sector and the non-resident sector are all contained in the final demand matrix. In the regional context, non-residents refer to all economic agents located outside the boundaries of a region, be they in other regions or abroad. Effecting such a demarcation gives rise to a number of special problems which are dealt with later in the paper.

The tables contain two sets of interrelated accounts, the Commodity Accounts and the Industry Accounts. The Commodity Accounts detail the supply and disposition of individual goods and non-factor services. The Industry Accounts detail the commodity composition of the output of industries as well as the complete costs of production,

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constraints. These differences are outlined in a note attached to the 1990 interprovincial input-output tables.

[5]. An input-output industry may not correspond totally to an industry in the Standard Industrial Classification (SIC). Some SIC industries contain establishments which belong to the personal sector such as churches; other SIC industries have establishments in the business sector and in one or both of the government and personal sectors, which means that the SIC industry is split between business and final demand. For instance, the SIC industry "Homes for Personal and Nursing Care" includes the non-profit institutions which are classified to the personal sector.

including taxes, subsidies, royalties, the remuneration of labour and the operating surplus of industries. The dimensions and the relationships between the matrices making up the national input-output accounts are presented in Chart 1.

The Commodity Accounts

The V matrix displays the production of each commodity by each industry valued at *producers' prices* or approximate basic value in the UN-SNA terminology, defined as selling prices at the boundary of producing establishments, excluding sales and excise taxes which may apply after the final stage of production. In addition to production by domestic industry, commodities are also supplied by three of the categories in the final demand matrix: foreign imports, withdrawals from inventories, and through government sales of goods and services. Since input-output analysis is concerned with technological relationships of production processes, the accounting framework relates inputs of industries to production, rather than to shipments. Production values are obtained by adjusting shipments for withdrawals or additions to the producers' inventories of both goods-in-process and finished goods. This is discussed more extensively later in the description of final demand categories.

The U matrix shows use of each commodity by each industry as intermediate inputs for the purpose of production of other commodities on a current basis. Consistent with the production concept, the entries refer to amounts of commodities used in the production process and not to purchases. The value of commodities purchased but not yet used are shown as additions to inventories of raw materials. In order to have a uniform basis of valuation, entries in the use matrix do not usually represent actual transaction values but estimates of producers' values of transactions. The full cost of a commodity to the using establishment--the purchasers' price value of the commodity--often includes wholesale and retail trade margins, the cost of for-hire transportation (transport margin), and commodity taxes such as sales and excise taxes. These margins, which together

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Chart 1

The Accounting Framework of Canadian
National Input-Output Tables

	COMMODITIES	INDUSTRIES	FINAL DEMAND CATEGORIES									TOTAL
			PE	FCF	VPC W	VPC A	GCE	GR	X_D	X_R	M	
COMMODITIES		U	F									q
INDUSTRIES	V											g
Commodity Indirect Taxes Other Indirect Taxes Less Subsidies Wages & Salaries Supplem. Labour Income Other Operating Surplus	YI		YF									n
TOTAL	q'	g'	e'									

Notation

Matrices

V   outputs of business industries
U   intermediate inputs of business industries
F   expenditure on commodities by final demand category
YI primary input used by business industries
YF primary inputs associated with final demand

Vectors

q   intermediate commodity outputs vector (1 x 620)
g   total industry outputs vector (1 x 216)
e   total final demand—intermediate plus primary factors—row vector (627 X 1)
n   total primary inputs—industries plus final demand categories—vector (1 x 7)

Final Demand Categories

PE   personal expenditure on goods and services
FCF   fixed capital formation, business and government
VPC_W Value of physical change in inventories, withdrawals
VPC_A Value of physical change in inventories, additions
GCE   government gross current expenditure on goods and services
GR   government production of goods and services
X_D Domestic exports
X_R Re-exports
M   Imports

account for the difference between the producers' price and the purchasers' price valuation, are treated as separate commodity inputs. In the use matrix, industries are shown as purchasing each margin separately from the producers of those margins (and as remitting a tax margin)[6]. Taxes which are levied on commodities after the final production stage over and above the producers' price are shown as inputs into the purchasing industry as a tax margin purchased by that industry.

The **F** matrix shows the final demand for each commodity by each category. Final demand categories are: personal expenditure, fixed capital formation, additions to (the value of physical change in) inventories, gross government expenditure (on goods and services) and foreign exports; three other categories, imports, withdrawals from (the value of physical change in) inventories and government sales of goods and services constitute sources of supply additional to domestic business industries in the current period[7]. Both the **U** and the **F** matrices include the use of commodities originating as imports, as withdrawals from inventories or as government production. Thus, three negative adjustments are required to maintain equality between the output of domestic industries: one for imports, because they are extraneous to the production by Canadian industries; one for inventory withdrawals since the production occurred in an earlier period; and one for government sales of goods and services because the related production costs are already accounted for in the government gross expenditure column.

The **F** matrix and its constituent final expenditure categories are more fully outlined in Appendix 1.

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[6]. This treatment, with each margin showing purchases of appropriate amounts by each using entity from the supplier of each margin is identically applied to purchases of final demand transactors discussed below.

[7]. The relatively small values of goods and services produced by the government sector are treated in the final demand matrix since the producing entities are not classified as business sector industries in the Canadian System of National Accounts. The costs incurred in producing these goods and services are included in the gross government expenditure column of this matrix. An additional source of supply in the final demand matrix is sales of used machinery and equipment (e.g., used vehicles) and incomes of some non-profit organizations.

The Industry Accounts

The business sector[8] industry accounts are shown in matrices **V**, **U** and **YI**. The total output of each industry, classified by commodity, is shown in the industry's row in matrix **V**. The intermediate inputs of each industry are shown in the industry's column in the **U** matrix while its uses of primary inputs are shown in the **YI** matrix. Primary inputs in the **YI** matrix consist of the following: net indirect taxes (divided into commodity indirect taxes, other indirect taxes, and subsidies which are negative entries), wages and salaries, supplementary labour income (which include employers' contributions toward employee pension plans, unemployment insurance plan, health care plans, etc.), net income of unincorporated businesses and operating surplus (in the case of incorporated businesses).

Commodity indirect taxes represent the sum of commodity taxes levied beyond the producers' price valuation level. While those paid by industries are shown in the **YI** matrix, those paid by final demand categories are shown in the **YF** matrix. The principal taxes represented here are the Federal Manufacturers Sales Tax, excise taxes and duties, motor fuel duties imposed by provincial governments, sales taxes imposed by provinces and municipalities, and the profits of provincial liquor control commissions. Customs import duties are not included as they are part of the producers' price value. The "other indirect taxes" include property taxes and certain fees and licensing charges which are treated as indirect taxes in the CSNA. Under the present treatment, government subsidies received by industries are treated as revenues and are shown as negative entries in the receiving industry's input vector.

For each and every industry, total output equals total input, both intermediate and primary.

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[8]. The present accounting framework of the Canadian System of National Accounts treats establishments belonging to the business sector and those in the non-business sector differently. Presently, explicit industry accounts are developed only for the business sector, although an explicit treatment is planned for many such entities in the non-business sector.

Gross Domestic Product by Industry

The derivation of industry GDP is an integral part of the input-output accounts. The industry distribution of the Gross Domestic Product at factor cost (or their components) is explicitly shown in matrix YI, in the case of the business sector. In the case of the non-business sector, however, it does not come out of the present accounting framework, but it can be obtained by recasting the data in matrix YF. At the aggregate level, Gross Domestic Product at market price, the sum of all elements of primary inputs in matrices YI and YF, is equal to final demand expenditures on domestic products, the sum of all elements of matrices F and YF.

The Trade Flows

It is evident from a comparison of Charts 1 and 2A how the framework of the interregional input-output tables has evolved from that of the national tables' framework while maintaining its essential features. While the concept of an international import and export is part of the existing framework, introduction of interregional trade into the existing framework requires that we clarify the concept of an interregional trade flow. A trade flow is constituted by the sale of commodities from a region or abroad to another region or abroad. Exports can originate from a region if the goods or services are produced in that region, or are withdrawn from inventories of establishments in that region. A regional export also occurs when goods or services (e.g., hotel accommodation, meals or entertainment) are purchased within a region by a non-resident while staying in that region. Similarly, imports are defined for a region if the goods or services are destined for the region's current expenditure, for capital formation in the region, are used as intermediate inputs by establishments in that region or make up additions to inventories.

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As Chart 2B shows, interregional final demand tables have two additional columns: regional exports and regional imports[9]. The extension of the national framework to an interregional level requires that we impose two additional constraints in the form of identities. First, across regions, total regional imports equal total regional exports or, to put it another way, the net (interregional) trade balance of regions sum to zero. Furthermore, the sum of foreign exports (foreign imports) of regions equal total national exports (imports). Second, across regions, total supply equals total disposition for each commodity. Furthermore, for each commodity the sum of supplies across all regions is equal to total national supply and the sum of dispositions across all regions is equal to total national disposition. The constraints imposed by the rectangular accounting framework are particularly important for the development of interregional accounts. This is because although several sources exist that *indicate* trade flows (e.g., survey of manufacturers destination of shipments, wholesale origin and destination survey, transportation origin and destination surveys) they are very often not adequate for developing a complete matrix of regional input-output values or interregional trade flows.

Finally, it should be noted that, as in the national framework, goods and services are valued at approximate basic prices. This makes the interregional imports and exports more complex, since a good imported from another region may precipitate imports of various margins from other regions as well as from abroad.

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[9]. The interregional trade flows tables provide a further regional breakdown for each column of regional export and import, i.e., a matrix which identifies the exporting and importing regions for each commodity. The subscript i in Chart 2B refers to the second (regional) dimension of these matrices.

CHART 2A

The Accounting Framework of Canadian Regional Input-Output Tables

	COMMODITIES	INDUSTRIES	FINAL DEMAND CATEGORIES										TOTAL
			PE	FCF	VPC W	VPC A	GCE	GR	FX	PX	FM	PM	
COMMODITIES		U	F										q
INDUSTRIES	V		YF										g
Commodity Indirect Taxes Other Indirect Taxes Less Subsidies Wages & Salaries Supplem. Labour Income Other Operating Surplus	YI		e'										n
TOTAL	q'	g'											

Region # 1

Region # 2

Region # 3

Region # 13

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Chart 2B

Interregional Trade Matrix

Other Operating Surplus
Supplem. Labour Income
Wages & Salaries
Less Subsidies
Other Indirect Taxes
Commodity Indirect Taxes
Commodity # 620

Commodity # 3

Commodity # 2

Commodity # 2

Commodity # 1

REGION (Province or Territory)	EXPORTS		IMPORTS	
Newfoundland				
Prince Edward Island				
Nova Scotia				
New Brunswick				
Quebec				
Ontario				
Manitoba	**FX**	**PX$_i$**	**FM**	**PM$_i$**
Saskatchewan				
Alberta				
British Columbia				
Yukon Territories				
North West Territories				
Government Abroad				

3. REGIONALIZATION ISSUES

In a discussion of regional accounts, the 1993 United Nations SNA (UN, 1993, Par. 19.90) identifies three types of institutional units requiring different treatments for regionalization of accounts: regional units, multi-regional units and national units. There are no notable problems in dealing with regional units, since most or all of their activities by definition fall into a single region. It finds the regionalization of multi-regional and the national units, on the other hand, to entail significant difficulties. Multi-regionals are institutional units whose centre of interest is in more than one region but does not pertain to the entire country. On the other hand, national units, such as national governments or national railway corporations, are those whose centre of interest is not geographically located. It points out that there are conceptual issues that preclude a total regionalization of the accounts for multi-regional and particularly national units (UN, 1993, Par. 19.91, 19.93), although no guidance is offered on how to approach some of the difficult issues should a country need to undertake regionalization of its production accounts. It foresees, however, that

> "In most cases, regional accounts are limited to recording production activities (with conceptual problems arising for locating some of them, like transportation and communication) by industry... Establishing accounts for goods and services and input-output tables by region does not raise unsolvable conceptual issues, deliveries to and from other regions being, of course, treated as exports and imports. However, the practical difficulties are very important in the absence of a sophisticated system of transportation statistics" (UN, 1993, Par. 19.95)

The UN SNA's reference to regionalization issues provides a candid indication that, apart from statistical problems, there are serious conceptual challenges that require sensible and practicable solutions if a satisfactory regional framework were to be devised. It is clear from the foregoing that, in the case of multi-regionals and nationals, regionalization issues as well as individual units had to be examined on their own merits and a satisfactory allocation convention had to be established. As the following discussion

shows, these conventions do not contradict the notion that there are certain supra-regional concepts which cannot have valid regional counterparts, but that in most cases, units can be regionalized in a way that serves the intended purpose of regional input-output tables. Interestingly, the project described in this paper also found that a few Canadian units were truly indivisible and needed to be classified in an extra "sub-national region" as discussed below.

Territorial Enclaves

It is helpful to begin revisiting the concept of Gross Domestic Product (GDP) in the context of the regional accounts. As we know, GDP is a measure of unduplicated production originating within the economic territory of Canada. The economic territory includes Canada's territorial enclaves such as embassies, consulates, military bases and the like, in the rest of the world. Similarly, the economic territory of a country *excludes* the territorial enclaves used by foreign governments or international organizations which are physically located within the geographical boundaries of that country (UN, 1993, Par. 14.9, 14.11, P. 319). Geographically, Canada consists of ten provinces and two federally administered territories. As with the national expenditure-based GDP, government expenditures include expenditures of the entire federal government, whether they relate to operations "within Canada" or "Out of Canada" (i.e., in territorial enclaves outside the geographical boundary of Canada). Thus the "Out of Canada" operations of the federal government are simply an extension of its main responsibility centres stationed within its geographic territory. It would follow that, for the regional accounts, any production occurring within the economic territory of Canada should be allocated back to the regions: Government expenditures in the enclaves must be allocated back to the ten provinces and two territories. However, from the regional perspective, the transactions in the territorial enclaves, although part of Canadian GDP, have *no economic impact* on a region where the main responsibility centre happens to be located.

To deal with the issue of territorial enclaves, two alternatives were considered: The first envisaged allocating these expenditures back to the regional location of the main responsibility centres (decision-making units responsible for activities within territorial

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enclaves). With this option, all such expenditures would be accounted for within Canada's ten provinces and two territories. The second alternative involved creating a "thirteenth region" in addition to those located within the geographical boundary of Canada to accommodate the expenditures in the territorial enclaves.

The first alternative has an advantage because it is additive in the sense that the associated GDP would be shown in the ten provinces and two territories only and provincial GDP would be additive to the aggregate economy GDP. However, this approach would distort the GDP of the region where the responsibility centre is located. Therefore, for the expenditure-based GDP, it was decided that the second approach would be taken and a "thirteenth region", to cover the "enclaves," was created for the regional accounts. This thirteenth region, depicted in Chart 2B as Government Abroad, would be part of the Canadian economy much like the ten provinces and two territories. For the income-based GDP, however, the aggregate GDP was allocated to ten provinces and two territories. This asymmetrical treatment was adopted for two reasons: First, the amount of wages and salaries paid abroad by the business sector is small and can easily be allocated back to the region where the industries are located. Second, the creation of a thirteenth region in the business sector would create an unwieldy problem, as this region would potentially produce a wide range of output but would be too small to have any analytical value for purposes of regional input-output tables.

Government Expenditures

The second issue is current expenditures by governments on goods and services. This item consists of defense expenditures, education, hospitals, other federal expenditures, other provincial expenditures and local government expenditures[10]. Local and provincial governments are the residents of their respective regions and therefore present no difficulty in the regional allocation of expenditures. However, the federal government is linked to all provinces and territories and therefore the allocation of its expenditures presents some difficulties.

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[10] Although both schools and hospitals are areas of provincial jurisdiction in Canada, the federal government directly incurs some expenditures to support the provision of health and education services, and these are items which must be allocated to provinces and territories.

Two alternative views were considered in connection with federal expenditures. One view sees federal government activities conducted in a region as a result of decisions taken mainly outside the region. Accordingly, the federal government would be classified to a non-resident sector from the viewpoint of provinces and territories. The second view is that the federal government is a *resident of every province and territory*. This view is supported by the observation that the federal government incurs expenditures in provinces and territories and is a provider of services (and goods) to their residents. As such, activities of the federal government make up part of the economic activity of provinces and territories and, much like provincial or local governments, would be important to a meaningful regional GDP measure. Based on these considerations, the second view was adopted in the present study.

The next question was how to allocate these expenditures to provinces and territories. Once again, two alternative criteria were considered. First, it can be argued that a "service benefit criterion" should be used, whereby federal government expenditures should be allocated on a per capita basis regardless of the province or the territory where the expenditures were actually incurred. This criterion assumes that such expenditures generate services that benefit every Canadian. The second criterion is allocation on the basis of the "region of activity" of the federal government. Accordingly, allocation would be based on the region of residence of individual federal government operations which, in most cases, translates into the region of consumption of the services[11]. Whereas the service benefit criterion is intuitively appealing, it was decided that the region where the economic transaction actually occurs presents a criterion relevant to national accounting concepts, which suggest that it is the economic impact of government activities on the regional economy that is of direct relevance for measuring production and in presenting economic policy choices to policy makers. This approach, however, gives rise to the problem of government expenditures in the "territorial enclaves" which, as discussed earlier, is dealt with through devising a thirteenth region.

[11.] When the region where services are consumed cannot be identified, a treatment is used to approximate the actual flow of goods and services. For example, the expenditures related to a coast guard vessel which patrols several provinces are assigned to the province of the home port of the vessel.

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Head Offices

The treatment of the head office of multi-establishment corporations presents difficulties in the context of the sub-national accounts. Statistics Canada's 1980 Standard Industrial Classification recognizes the need for surveys which provide a regional data base:

> "Establishments may have activities in more than one province. Since Statistics Canada must provide aggregate measures of economic production for individual provinces, this situation calls for subdividing the establishment and its value added by a suitable means of allocation or estimation. Thus, for purposes of geographical statistics, a special provincial establishment created by dividing regular establishments, is recognized" Statistics Canada (1980)

Accordingly, most of the establishment data are produced by region. However, for multi-establishment enterprises, a particular treatment is needed for head offices. The head office is an integral part of the principal or secondary activities of the establishments. "By definition, an ancillary activity is not undertaken for its own sake but purely in order to provide supporting services for the principal or secondary activities with which it is associated. All inputs consumed by an ancillary--materials, labour, consumption of fixed capital, etc., are treated as inputs into the principal or secondary activity which it supports. As a result, the output of an ancillary activity is not explicitly recognized " (UN, 1993, P. 115). Clearly, an approach must be devised to regionally allocate head office expenses in a way that is appropriate for regional accounts. If the head office is located in the same region where all its constituent establishments are located, the expenses of the head office can be readily allocated to the constituent establishments whether they are classified to the same industry or different industries. However, the UN SNA provides no guideline on how to deal with a case in which a head office is located in one geographical region while some or all of its constituent establishments are located in another region[12].

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[12] Regionalizing production accounts raises another statistical issue which is highlighted by the head office problem (when head office and some constituent units are located in different regions). Compilation of accounts on a regional basis requires that gross output is measured for all establishments of a vertically integrated industry, rather than only for the final unit (in general, the greater the extent of disaggregation—regions, industrial classifications, etc.—the more gross production would be registered in a production account). This leads to a difference between existing national control totals and the sum of gross production estimated for regions which must be reconciled. In the Canadian case, a procedure is used to maintain existing CSNA control totals by making adjustments to regional values such that value-added relationships are maintained.

In Canada, head offices and their geographic locations are separately identified on the Business Register and are given the industry code of the constituent establishment which accounts for most of the value-added. "If the ancillary activity is conducted at the same place as the production of goods or services, the activities are simply incorporated into the delineation and definition of the establishments" (Nijhowne, 1995).

Head office expenses to be allocated consist of two components: head office expenses proper and services purchased on behalf of itself or constituent establishments. The value of purchased services does not present any geographic allocation problem, because the constituent establishments could have bought these services directly. In the Canadian regional input-output tables these services (in manufacturing industries, for example) were allocated to the constituent establishments using proxies such as gross output or value added. The more important problem is the allocation of head office expenses proper.

It is helpful to examine three possible configurations. In the first two, the head office and the constituent establishments are located in the same region, although there are two possibilities: the constituent establishments are classified to a single industry or they are classified to different industries. If the constituent establishments are classified to the same industry, the head office would be coded to the industry class of its establishments. If the constituent establishments are classified to different industries, some proxy such as gross output or value added of constituent establishments may be used to distribute head office expenses between industries. In these instances, the regional distribution of expenses is not affected by these distribution rules. The third possibility, with implications for regional distribution, occurs when the head office is located in one region and some or all of its establishments are located in another region. In this case, if head office expenses were allocated to all constituent establishments in different regions (by analogy to the industrial classification rule discussed above), the head office would be effectively "moved" from one region to others. Consequently, the actual host region's GDP would be reduced or understated while those of other regions would be overstated. It was felt that a better allocation procedure was needed. In order to preserve the GDP associated with the head office in the region of its actual residence, an output imputation was made

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for the head office activity proper, i.e., that of rendering services to the constituent establishments. This imputed output of head office services proper is taken as equal to the sum of intermediate inputs and factor costs required to perform the head office function proper. This imputed service would be charged to constituent establishments in other regions, thereby reducing the GDP in other regions by an amount identical to the increase in GDP in the host region of the head office. Therefore, the income originating in the head offices is measured only by the known factor cost of labour or any operating surplus earned by the head office on its own account. To avoid arbitrariness, no estimate of head office operating surplus was included since the cost of non-labour factors cannot be isolated from other components of operating surplus[13].

Financial Services

Another set of issues concerns the regional distribution of financial services, consisting of banks (and other similar financial institutions), insurance carriers and other financial service providers. These industries present particularly difficult problems since there remain many unresolved conceptual as well as measurement issues in estimating gross output measures at the national level.

A. Banking

In the national accounts, interest and dividends are treated as a transfer and are not included as part of the operating revenue of businesses. For banks and other deposit accepting financial intermediaries, a major part of revenue and expenses takes the form of interest. The standard treatment of excluding interest revenues from income would thus confine the operating revenue of banks to those services for which customers are explicitly charged, such as fees for operating chequing accounts and usage of automated tellers. This procedure would ignore their principal income source and result in a small, or perhaps negative, GDP for the industry. In the CSNA, the value of these financial intermediation services is obtained by an imputation equal to "the total property income

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[13] This allocation procedure is used to regionalize head office expenses when the required establishment data, as described above, are available for allocation. However, in many instances such as finance and services industries, the required detail is not available and the head office expenses (and output) remain in the host region.

receivable by financial intermediaries minus total interest payable, excluding the value of any property income receivable from the investment of their own funds..."(UN, 1993, Par. 6.125). The value of this imputed service is known as "financial intermediation services indirectly measured" or "FISIM" in the 1993 SNA. The rationalization for this treatment is that the difference between the interest paid to depositors and the pure (service-free) cost of funds constitutes the value of services produced and sold to depositors. Similarly, the difference between the same cost of funds and the interest earned from lending makes up the production of intermediation services rendered to borrowers. The sum of these two imputations, the net interest margin, is considered to be equivalent to services for which the institution did not explicitly charge its customers. It follows that production in a region is equal to the margins earned on deposits booked in that region plus the margins earned on funds loaned in that region. This reasoning assumes that aggregate borrowing and lending are balanced for each region. In order to allocate the total production of FISIM among regions, the borrower portion is allocated by the regional distribution of loans booked and the depositors portion by the distribution of deposits booked. The assumption behind this allocation procedure is that the average interest rate charged on lending is the same across regions, and similarly, that the average interest paid on deposits is regionally uniform. A second, but sizable, portion of operating revenue of banks is fees for various services for which customers are explicitly charged. Since these services are mostly related to depositors, they are allocated regionally based on the proportion of deposit holdings in regions.

B. Insurance

Data on premiums and claims are not available by region of residence of insurance companies, rather they are available by the location of the policy holders. The output and operating surplus for the multi-regional companies were therefore allocated on the basis of wages and salaries in each region assuming that (1) the ratio of gross premium to net premium is the same across all regions and (2) the operating surplus is proportional to the net premium.

Fixed Capital Formation

A. Construction

In the Canadian input-output accounts, the construction industry is defined on an activity basis, encompassing both contract and own-account construction activity. The separation[14] of own-account construction activities from other industries, although representing a departure from a "total activity" establishment basis, was adopted because there are no complete details on values of materials and services separately for construction contractors and for own-account producers. It is more reliable to assign a commodity such as ready-mix concrete, for example, to a *total* construction activity than it is to distribute it among contract and own-account producers. This implies a shift of materials and labour compensation from industries producing own-account construction to the construction industry. Another feature of the Canadian input-output accounts is that the representation of the construction industry does not follow the SIC classification. Input-output industries are defined in terms of seven structure-types (e.g., residential construction, non-residential construction, road, highway and airstrip construction, etc.) and one repair construction industry. Hence, the sub-contract sales of special trades to general contractors are netted out of production and intermediate inputs, materials, services and primary factors are routed directly to the construction industry. This approach was also followed in developing interregional input-output tables.

For the CSNA regional economic accounts, construction is deemed to be produced wherever the work is put in place. Construction activity conducted on an own-account basis is classified to the region where it is put in place, but would appear in the Construction industry rather than the industry conducting it as mentioned above. Similarly, for contract construction, the production is classified to the region where the work is put in place, regardless of the regional residency of the contractor. Thus if a contractor is a resident of one region and conducts construction activity in another region, the work put in place would be measured in the latter region, rather than an import of

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[14] · The removal of the own-account production of new and repair construction from each industry also required removal of the corresponding inputs of materials and labour compensation from them, to be added to the input-output construction industry. Thus there is a shift of materials and labour compensation from industries producing own-account construction to the construction industry. However, this did not include an estimate for depreciation and interest paid as they are not available in the basic data.

goods from the former region. Although there are no suggestions regarding regionalization of accounts in the 1993 UN-SNA, these methods are fully consistent with the basic concept therein[15]. This practice effectively creates a quasi-corporation, a resident of the region where work has been put in place, that pays labour income to residents of that region and generates an operating surplus, both of which enters into the region's gross domestic product.

B. Machinery and Equipment

The regional allocation of mobile capital equipment, such as ships is relatively straight forward, since respondents provide this information in the survey of capital expenditures. It may be mentioned that although the purchase and sale of used assets among regions cancel out, the foreign import of used assets is included in capital formation estimates made from such surveys. Following this rule, used machinery bought from another region should be included in the gross capital formation of the purchasing region and shown as a revenue in the exporting region. In the absence of information on interregional transactions in used assets, an assumption had to be made that no purchases or sales of used equipment occurs among regions.

Transportation

A. Air Transportation

For the air transport industry, the regional location of mobile capital assets such as aircraft does not present a problem, as discussed earlier. However, the regionalization issue was to delineate regional establishments and estimate production for such establishments. The usual configuration is for corporations to generate sales, hire employees and hold fixed capital assets in all regions, while the head office is located in a single region. For main carriers, data are available on passenger revenue for each region

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[15] In connection with regional accounts, the 1993 UN-SNA recommends that "A full system of accounts at the regional level implies treating each region as a different economic entity" (UN, 1993, Par. 19.89) And in connection with residency of corporations or quasi-corporations, it maintains that "An institutional unit is then said to be a resident unit when it has a centre of economic interest in the economic territory of the country in question. (UN, 1993, Par. 14.8) "An institutional unit is said to have a centre of economic interest within a country when there exists some location—dwelling, place of production, or other premises—within the economic territory of the country on, or from, which it engages, and intends to continue to engage, in economic activities and transactions on a significant scale, either indefinitely or over a finite but long period of time." (UN, 1993, Par. 14.12)

based on the point of sale. Although this point of sale may represent consumption, it does not represent production of transport services in that region. For some large airlines, there are also data on revenues by origin and destination of flights, but again this does not correspond to actual utilization of factors of production. Since none of the airline revenue data could be used to adequately infer the region in which production took place, it was decided to adopt a top-down approach. In this approach, the gross domestic product originating in a region is determined as the sum of labour compensation, depreciation and operating surplus. The values of the first two items are readily available. However, the regional distribution of operating surplus of air transport is not known. This is known, however, to be closely related to the depreciation of capital equipment (e.g., aircraft) since revenues representing production are roughly proportional to the utilization of equipment. The regional distribution of operating surplus is thus estimated by that of depreciation. In this way, total production is regionally distributed based on the regions' GDP.

B. Rail Transport

Regional allocation of the rail output presented the same kind of difficulties. An approach very similar to that for air transportation was used to develop first the regional GDP by industry and, subsequently, gross output values consistent with them. A special problem for rail transport related to federal subsidies for transportation of agricultural products between points in eastern and western Canada. These are discussed under Subsidies below.

Exports and Imports

Determining the regional distribution of foreign trade presents a unique problem. For exports, the originating region is identifiable for most commodities. Manufactured goods destined for export are identified in the survey of origin and destination and exports of major service commodities are captured by service industry surveys. However, when goods produced in one region are exported by wholesale or retail firms to another region, the identity of the producing region is concealed. Additionally, reports of service exports by head offices of multi-regional companies do not necessarily indicate that they were

produced in the region hosting the head office. Imports present a more difficult problem since surveys of users do not distinguish between domestic and imported purchases. Furthermore, information on imports is only available by the region where the port of customs clearance is located, rather than by region of destination. Once again, intermediation by wholesalers and retailers makes it more difficult to identify the region where the imports are destined. Similar problems, and some of the approaches used to deal with them, are elaborated in Messinger, *et. al.* (1995).

Taxes and Subsidies

A. Taxes on products

Taxes on products is one of the elements in the spread between producers' (approximate basic) prices and purchasers' prices. In Canada, taxes on products are levied by all three levels of government: federal, provincial and municipal. The regional allocation of provincial and municipal sales taxes presents no difficulties, because the tax liability in any region, by definition, is equal to tax collections in that region for both provincial and municipal governments. However, federal taxes are applicable to, and are collected in, all provinces and territories. As taxes on products do not accrue to producers but are part of the purchasers' price, they were allocated to the regions where the taxable commodities were consumed as an intermediate use or purchased by the final demand categories. Similarly, other federal commodity taxes such as excise duties, excise taxes and import duties are distributed based on the regional consumption of the relevant commodities.

B. Subsidies on products[17]

According to the 1993 UN-SNA

"Subsidies are current unrequited payments that government units, including non-resident government units, make to enterprises on the basis of the levels of their production activities or the quantities or values of the goods or services which they produce, sell or import. They are receivable by resident producers or importers..." (UN, 1993, Par. 7.7).

In the interregional accounts subsidies are allocated to regions based on the location of the recipient industries. For subsidies paid by provincial and local governments, it is assumed that the recipients of subsidies reside within the boundaries of the region making the disbursement. For federal subsidies, the underlying purpose of individual subsidy programs were examined to determine their regional allocation. Difficulties arose in the regional allocation of subsidies to transportation companies such as the Canadian railways who are recipients of important subsidies for the transportation of grain. Subsidies paid under the Western Grain Transportation Act were allocated to the region of production of the transport services. Data were obtained from the National Transportation Agency that provided a breakdown of the subsidy by the point of origin and destination of the grain transportation. This amount was apportioned to the regions based on grain mileage traveled in each of the regions.

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[17]. In the commodity valuation of output, the Canadian and the UN systems differ in the treatment of subsidies. In the UN system, subsidies on products are treated as the converse of taxes on products (as a negative tax) while in the Canadian SNA they are treated as revenue to industries. Therefore in the CSNA, subsidies are shown as a negative input into the industries who received subsidies while, in the UN-SNA, a subsidy on a product is shown as a negative input into the industry using the subsidized product as an intermediate input and as a negative expenditure of the final demand transactors who purchase the commodity. It should be noted that either treatment produces identical estimates of industry GDP at factor cost.

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4. CONCLUDING REMARKS

This paper presented a brief discussion of some of the more noteworthy issues encountered in regionalizing the Canadian input-output tables that provide benchmarks for other sub-systems of the Canadian System of National Accounts (CSNA). Parallel with the regionalizing exercise discussed in this paper, interregional trade flows of goods and services by commodity were also developed in another project undertaken by Input-Output Division of Statistics Canada. These projects have demonstrated that it is feasible to successfully extend the national input-output framework, which has long been central to the CSNA, to a regional input-output framework in a fully integrated fashion. For the reference year 1990, this has already been accomplished and the results were released in 1995.

Although Canada is a modern and diversified economy, it is a highly regional one with many regions (provinces or territories) depending on intense specialization for their economic strength. The regions are highly dependent on trade with one another as well as with foreign countries. Interregional trade has further been reinforced and intensified by regional development and trade policies of successive federal governments. Against this backdrop, efforts to provide statistical support to monitor regional economic conditions that facilitate informed policy discussions have a considerable history in Canada.

The regionalization exercise brought to light a number of conceptual and statistical implementation issues that required solutions consistent with the overall framework of the Canadian SNA and within the limitations imposed by available resources. Although some of the problems discussed here are unique to the Canadian SNA and its rectangular input-output framework, many are quite generic and may be useful for broader discussions of regionalization of accounts. For example, issues involved in dealing with head offices of multi-regional corporations, operations of interregional air transport carriers and financial institutions are all likely to be relevant to regionalization of accounts in other countries.

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Table A1

GROSS DOMESTIC PRODUCT
FROM CANADIAN INTERPROVINCIAL INPUT-OUTPUT TABLES--1990
Billions of Dollars

Region (Province or Territory)	Gross Output-- Business Industries	Intermediate inputs-- Business Industries	GDP at Factor Cost, Business Sector	GDP at Factor Cost, Non-Business Sector	Net Indirect Taxes, Business Sector	Net Indirect Taxes, Non-Business Sector	GDP at Factor Cost, Total Economy	GDP at Market Prices, Total Economy
	1	2	3	4	5	6	7	8
			1 - 2				3 + 4	5 + 6 + 7
NEWFOUNDLAND	11.80	6.30	5.50	2.35	0.39	0.81	7.85	9.05
PRINCE EDWARD ISLAND	2.78	1.44	1.35	0.57	0.04	0.18	1.92	2.14
NOVA SCOTIA	22.48	11.83	10.65	4.22	0.80	1.42	14.87	17.10
NEW BRUNSWICK	20.34	11.55	8.79	2.90	0.59	1.09	11.69	13.38
QUEBEC	227.51	120.14	107.37	27.02	8.68	9.46	134.39	152.54
ONTARIO	435.04	236.19	198.85	42.13	17.69	15.76	240.98	274.43
MANITOBA	33.09	16.86	16.23	4.65	1.32	1.38	20.89	23.59
SASKATCHEWAN	30.95	15.30	15.66	3.81	0.57	1.25	19.47	21.29
ALBERTA	119.08	62.39	56.70	10.26	2.56	2.82	66.96	72.33
BRITISH COLUMBIA	122.84	64.43	58.40	11.63	4.81	4.94	70.03	79.78
YUKON	1.47	0.66	0.81	0.24	0.02	0.04	1.05	1.12
NORTHWEST TERRITORIES	2.80	1.34	1.46	0.58	-0.08	0.06	2.05	2.03
GOVERNMENT ABROAD				0.66	0.01	0.03	0.66	0.71
TOTAL	1030.18	548.40	481.78	111.03	37.41	39.25	592.81	669.47

Table A2

INTERREGIONAL AND INTERNATIONAL TRADE
FROM CANADIAN INPUT-OUTPUT TABLES--1990
Billions of Dollars

Region (Province or Territory)	GDP at Factor Cost, Business Sector	Inter-regional Export	Inter-regional Import	Foreign Export	Foreign Import
		PX	PM	FX	FM
NEWFOUNDLAND	5.50	0.94	3.66	2.58	1.96
PRINCE EDWARD ISLAND	1.35	0.55	1.06	0.26	0.26
NOVA SCOTIA	10.65	3.40	6.46	2.62	4.31
NEW BRUNSWICK	8.79	3.61	5.46	3.53	3.71
QUEBEC	107.37	33.26	30.65	29.72	37.27
ONTARIO	198.85	57.48	37.24	75.46	82.93
MANITOBA	16.23	6.38	7.18	4.20	4.14
SASKATCHEWAN	15.66	4.74	8.16	5.36	3.37
ALBERTA	56.70	18.85	20.25	16.69	12.54
BRITISH COLUMBIA	58.40	10.88	18.91	19.51	16.15
YUKON	0.81	0.12	0.51	0.57	0.11
NORTHWEST TERRITORIES	1.46	0.51	1.01	0.49	0.22
GOVERNMENT ABROAD		0.00	0.18	0.04	1.26
TOTAL	481.78	140.73	140.73	161.03	168.22

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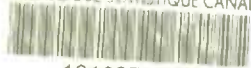
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