Implementing the 1993-SNA Recommendation on Valuation in Canadian Input-Output Accounts

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Abstract *Valuation is a pivotal concept for input-output accounting. A valuation system can affect the statistical quality of the accounts, the timeliness of the accounts, and how effectively it serves its role in audit and quality control of economic statistics. While Statistics Canada's SNA implemented most of the recommendations of the International System of National Accounts (1993), it decided to leave its existing valuation of products and services unchanged for both current and constant price accounts. The paper examines basic price and other valuation standards used in Canada, their strengths and weaknesses for data compilation and analysis, and the factors that led to the decision not to implement this recommendation as part of the latest historical revision of the Canadian System of National Accounts.*

Introduction

Statistics Canada recently completed the historical revision of all modules of the National Accounts for the 1961-1993 period. This historical revision, the first in nearly 10 years, was undertaken with four principal objectives:

1. to render the Accounts more internationally comparable by implementing the concepts and methods recommended by the 1993-SNA;

2. to enhance the Canadian System of National Accounts (CSNA) by making the Input-Output (I/O) Accounts more fully integrated with other components, like the Income and Expenditure Accounts, the Balance of Payments and the financial flows;

3. to incorporate new sources or revised data, such as the restructured public sector and the revised Balance of Payments, which were not previously used; and finally;

4. to transform these tables into constant prices and rebase the series to 1992 prices.

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As part of this revision, the standards recommended by the 1993 International System of National Accounts (1993-SNA) were largely adopted in the Canadian Input-Output Accounts. However, it was decided that a number of recommended standards would not be adopted as part of this historical revision. These included the recommendation that the accounting system adopt *basic prices* as the preferred method of valuation of output (an analogous price concept would be used for imports). Other recommendations, such as the call for regular publication of chain-linked constant price series, were not accepted. This paper focuses on the valuation used in the Canadian I/O Accounts in contrast to the recommended basic price, and on the factors that were considered in internal deliberations by CSNA committees charged with historical revision of all CSNA series.

Definitions

Canadian I/O Accounts have traditionally valued output at what may be called *modified basic prices*[1]. This valuation system differs from the recommended basic price in the treatment of subsidies, but also differs from the concept of producer price described in the 1993-SNA in the treatment of taxes on products. The 1993-SNA (paragraph 6.205) specifies basic price as

> "the amount receivable by the producer from the purchaser for a unit of a good or service produced as output *minus any tax payable*, and *plus any subsidy receivable*, on that unit as a consequence of its production or sale. It excludes any transport charges invoiced separately by the producer".

By contrast, the 1993-SNA defines producer price as

> "the amount receivable by the producer from the purchaser for a unit of a good or service produced as output *minus any VAT*, or similar deductible tax, invoiced to the purchaser. It excludes any transport charges invoiced separately by the producer".

The modified basic price concept used in the Canadian I/O Accounts is a hybrid of the basic price and producer price valuations. Specifically, the Canadian modified basic price accords with the basic price defined above, but excludes subsidies on products receivable by producers (i.e., is lower than the compara-

[1] In the CSNA, the term "producer price", in quotation marks, is used to refer to this valuation system, even though it differs from the producer price concept specified by the SNA. In this paper, we use the term "modified basic price" to differentiate it from both producer price and basic price concepts.

ble basic price). In this system, subsidies are recorded as revenues of the industries receiving them. Hence, a negative entry in the amount of the subsidy appears in the accounts of the receiving industry. Under the basic price scheme, subsidies would be treated as the converse of indirect taxes (negative taxes). Thus, "any subsidy on products is treated as if it were received directly by the purchaser, not the producer" (paragraph 6.206). Accordingly, subsidies would be shown as negative 'inputs' for industries using subsidized commodities as intermediate input, or as a negative expenditure by final demand transactors who purchase subsidized commodities. Equivalently, the modified basic price is consistent with producer price as defined by the 1993-SNA, except that *all taxes* on products (VAT as well as other taxes such as excise taxes on output) are excluded. The key difference between Canada's modified basic price concept and the 1993-SNA's producer price is excise and other taxes. In Canada, excise taxes apply notably to petroleum and tobacco products and constitute a significant source of tax revenue. Like the recommended basic price, all tax "actually payable on output is treated as if it were paid by the purchaser directly to the government instead of being an integral part of the price paid to the producer" (paragraph 6.206) in the Canadian system.

For imports, the 1993-SNA recommends that total imports be valued at the exporter's frontier while detailed imports be valued at C.I.F. The 1993-SNA defines a C.I.F. price for imports as equivalent to the basic price of a good or service produced by resident producers: "The C.I.F. price is the price of a good delivered at the frontier of the importing country, or the price of a service delivered to a resident, before the payment of import duties or other taxes on imports or trade and transport margins within the country". In Canada, however, the C.I.F. valuation of imports includes import duties.

Attributes of Basic Price vs. Canada's Modified Basic Price

In recommending that transactions be valued at basic prices, the 1993-SNA points to three attributes which presumably render it superior to the producer price concept (Para.15.33). These are:

1. Basic prices provide the most homogeneous valuation of products across users;
2. Basic prices are found most useful when a system of VAT or similar deductible tax is in operation; and,
3. Basic prices record the income available to the producer from each transaction.

The first point is in fact the most important analytical property of the basic price system of valuation. Both basic price and Canada's modified basic price ex-

clude commodity taxes and margins, rendering valuations more homogeneous. The difference between the two systems' valuation of intermediate and final use is in the treatment of subsidies[2]. Under the recommended standard, subsidies would be reflected in the output of the producing industries (increasing their magnitude) and, to keep supply-disposition of a commodity balanced, they would be included in the value of purchases in the intermediate and final use tables, raising these values above observed transactions. As pointed out in the 1993-SNA, this applies a homogeneous valuation to all users, with all unit prices reflecting the producer's output price plus subsidies, with expenditure by users' (e.g., domestic industries versus exports) remaining invariant to how each benefited from product subsidies. This carries the important advantage of reflecting the correct relative social costs of commodities across the accounts, and would be particularly useful when these costs need to be known, e.g., for policy analysis purposes[3].

By contrast, the Canadian system would only show such subsidies as a negative cost entry for the producing industry. They would not appear in the purchases of intermediate or final users, the latter remaining at observable transaction levels (before taxes and margins). The distinct analytical advantage of this approach is that observable (and verifiable) transaction values—the relative costs actually faced by users—are not modified in the accounts. As discussed in the following section, attributing subsidies to beneficiaries (individual industries, final users, exports, etc.) to arrive at basic prices is inevitably a modeling exercise guided by crude information, because reported intermediate and final use do not specify what proportion of these purchases are from non-subsidized imports. In this context, calculating basic prices entails a diminution in the quality of estimates for intermediate and final use tables.

On the second point, basic price does present an advantage, because removing all taxes is a more complete stripping of cost elements from the purchaser price valuation, rendering transaction values more consistent. The modified basic price concept used in Canada also presents the same advantages by removing all taxes.

Finally, as the 1993-SNA pointed out, basic prices do reflect the total (gross) amount captured by producers when subsidies are paid for the production or sale of specific products. However, estimation of the required subsidy detail presents drawbacks that may severely compromise the quality of basic price

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[2] In the Canadian accounts, the latter tables are compiled both in purchaser and modified basic prices.

[3] However, with basic price valuation, subsidies tied to inputs and non-commodity subsidies are not reflected in the price paid by users, so the latter do not show all relative social costs but only what is related to output subsidies.

estimates. Basic price valuation also leads to problems when deflating current price estimates to obtain constant prices. These issues are discussed in the following section.

Statistical Implementation Problems

Statistical implementation of the recommended basic price raises two sets of problems: 1)-estimating transactions at basic prices; and 2) deflating the basic price data to compile constant price input-output tables. These are discussed in turn.

By and large, survey and non-survey data are collected exclusive of subsidies. To estimate output subsidies by product, a range of government subsidy programs must be analysed each year to discover the products and services to which they pertain. Next, subsidies must be allocated to particular users of subsidized products: industries and final users. This requires identification of the commodities involved as well as purchasing industries and final users who benefit from subsidy programs. This second step poses a particular estimation difficulty, since basic records do not contain information on who benefits from subsidy programs. Computing these estimates based on subsidy rates by commodity involves an additional drawback because entries in the Canadian intermediate and final use tables are composites of domestically produced and imported commodities, while their precise proportion is not known from source data. This significant data gap necessitates using allocation techniques and models, thus severely limiting the reliability of intermediate and final use data. Furthermore, it is difficult to precisely assess the quality of estimates based on subsidy models and allocators because of the qualitative nature of the information they use.

A related implementation problem arises with the estimation of imports. Under the recommendations relating to basic price, imports should be valued C.I.F. (inclusive of cost, insurance and freight) exclusive of duties[4]. Duties, like other taxes, would be recorded as a margin rather than as part of the value of the commodity. This treatment would necessitate estimating a margin for import duties by commodity and by user. This allocation requires that we know the

[4] The 1993-SNA also recommends that total imports are valued at F.O.B. (free on board) prices, while detailed imports are valued at C.I.F. prices. To reconcile the different valuations used for total imports and components of the total, a global C.I.F./F.O.B. adjustment on imports is added. This adjustment involves 1) deducting all transport and insurance services on C.I.F. imports (provided both by residents and non-residents) from the total value of imports and, 2) recording only the transport and insurance services provided by non-residents under imports of services. This treatment would result in the C.I.F./F.O.B. adjustment column showing two negative entries and the import row showing one negative entry in the import column. The Canadian SNA has not found this recommendation appealing because it is excessively complex for users of the Accounts. Instead it has opted to maintain the valuation of imports at C.I.F. price and to eliminate the over-valuation due to inclusion of transport services provided by residents. The overestimation of imports is adjusted by making an offsetting entry in exports.

proportion of imports versus domestically produced commodities (for intermediate and final users). Thus, the quality and reliability concerns just alluded to would also apply to imports at basic prices. To allay these concerns, Canadian the SNA decided to maintain the 1968-SNA treatment which defines imports inclusive of duties.

Basic prices also pose a difficulty for estimating margins. For some commodities such as petroleum products, margins are calculated through a price-spread method. A margin spread is calculated as the difference between the purchaser and producer prices multiplied by the quantity sold. Using a basic price valuation scheme would pose an additional burden by requiring that we identify the amount of subsidies included in the commodity. By contrast, the modified basic price used in Canada lends itself easily to the calculation and analysis of margins.

A second set of problems arises in deflating current price data valued at basic prices. In Canada, input-output tables are also estimated annually in base-year prices as exact counterparts of the current price tables. Input-output tables in constant prices are obtained by first deflating all three current price tables at the modified basic price, because this is the most homogeneous valuation of commodities that can be implemented, covering all producers and users. Commodities in modified basic price are deflated by a large number of surveyed price indices and many of non-survey price indices or unit-value data. At this stage, subsidies pertaining to specific commodities and those of a general nature are separately deflated. In a subsequent step, trade (wholesale and retail) margins, transport margins, and commodity indirect taxes are estimated in constant prices using a variety of techniques. Most of the final demand, such as personal consumption expenditure, can be estimated in purchaser prices by deflating purchaser price values by the appropriate consumer price index[5]. This allows much of the margins in constant prices to be estimated residually as the difference between the modified basic price and purchaser price values (in constant prices of the base year).

Price information is obtained at the level of the consumer (Consumer Price Indices for several hundred goods and services), at the business producer level (Industrial Product Price Indices, IPPI), for machinery and equipment destined for fixed capital formation (Machinery and Equipment Price Indices), from observable market prices which prevail in commodities markets such as for agricultural products (Raw Material Price Indices), and from prices paid by farm operators (Farm Input Price Indices). These price indices are calculated from

[5]. Consumer price indices are generally consistent with the purchaser price concept of the SNA.

observable values of transactions in goods and services. In the case of the CPI, prices also include federal and provincial sales taxes. However, in all cases, observed prices exclude subsidies (i.e., do not include subsidy incomes for producers). This situation lends itself well to deflation of purchaser prices, since prices are those actually paid by users. To deflate modified basic price values, price indices (based on transaction values including sales taxes) are transformed by adjusting them for changes in tax rates between the base year and the reference year. This is a straightforward process since sales taxes in Canada are uniform across taxable commodities (though they differ by province), and non-taxable commodities are easily identified by reference to tax legislation.

While these price indices are suitable for deflation of data in either purchaser prices or modified basic prices adjusted for sales taxes, it is evident that they are not consistent with transactions at basic prices. In particular, to deflate personal consumer expenditure in basic prices, subsidies (or rates) for affected consumer prices must be known so that the relevant CPI can be adjusted. Similarly, deflation of intermediate expenditures by businesses is straightforward when IPPI's are consistent with observed (reported) data on operating expenditure by businesses. Deflation of expenditure in basic prices by commodity would require data on subsidy rates by commodity and by user. Estimating subsidies is further complicated by the fact that, unlike tax rates, subsidies tend to increase or decrease over time as governments modify policies to better achieve social and industrial policy objectives as economic circumstances change.

The Canadian formulation of modified basic price contributes to an efficient approach to deflation of I/O Accounts because it allows all I/O cells to be expressed at the same valuation basis. Deflating I/O tables in purchaser prices would require that we estimate, for each commodity, as many price indices as there are intermediate and final users, since each use of a commodity would have a different margin mix.

Valuation and the Role of Input-Output Tables

Another important consideration in assessing the merits of basic prices over the existing valuation is whether a particular valuation scheme facilitates or hinders the broader objectives served by the compilation of I/O Accounts.

In Canada, Input-Output Accounts serve two key purposes. First, the annual compilation of the accounts serves as an on-going audit of survey and administrative data sources supplied by the Bureau's feeder divisions. This audit is implicit in the data integration function entrusted with the I/O Accounts and is a major contribution of this program to the broader System of National Accounts of which it is a central component. The tables contribute to the integrity of the

overall statistical system by providing feedback to subject-matter areas, from a detailed industry/commodity perspective, on data inconsistencies, gaps, timing and classification problems as the system evolves and attempts to improve itself. As data are brought together from numerous surveyed and non-surveyed sources with varying statistical strengths and weaknesses, they must convey a consistent and meaningful picture: Supplies must equal dispositions for each commodity, while, at the same time, industries must show production and GDP values consistent with wages and profits data available from other sources. It is evident that this audit process, involving some 650 commodities, some 220 industries and more than 140 classes of final users, can be performed in a more timely fashion, and with a greater degree of reliability, when a practical and efficient valuation concept is used across the entire accounts. An example of problems revealed and rectified by this audit is inconsistencies between shipments data and export values, and inconsistent coding between shipments and intermediate inputs. Conducting such an audit would be more onerous, and less timely, if subsidy values are included on the supply side while beneficiaries of those subsidies are not known when dispositions are being estimated.

A second function of Input-Output Accounts is to be a complete and consistent source of production statistics. To serve this important role, outputs and inputs must be on a consistent valuation basis. The 1993-SNA recommends that "Expenditure of goods and services intended to be used for intermediate consumption should be valued at purchaser's prices" (paragraph 6.220). Valuing output at basic price while valuing uses at purchasers prices would present a dichotomy that would hinder the calculation of a income-based and expenditure-based GDP. This is because output at basic price less the intermediate consumption at purchaser price will not equal expenditure-based GDP. In order to balance income-based and expenditure-based GDP, net taxes would have to be added to income–based GDP to achieve the equality. In the Canadian Accounts, both output and use matrices are valued at modified basic prices and the equality of income-based and expenditure based GDP is assured. This feature is critical for a data source used extensively by government departments and businesses to conduct economic and market analysis to assess, for instance, changes in industry dynamics, market share, and production technology. Furthermore, when the Accounts are used for monitoring and analytical purposes, users often assume—and demand—that data entries relate to observable transactions rather than valuations appropriate for other purposes. Working with accounts in basic prices would complicate clients' tasks by obscuring transaction values with production-related subsidies.

As these attributes of basic price and the Canadian formulation of *modified* basic price were critically examined, the committee charged with the implementation of the historical revision and the 1993-SNA concluded that the latter is a

superior valuation, particularly for a system where a consistent valuation of products is critical. Some of the most important roles of the I/O Accounts in the Canadian SNA—including audit-feedback, quality control, and serving as a source of current and constant price integrated statistics—depend on a consistent valuation system.

Summary and Concluding Remarks

In the latest historical revision of its SNA, revised input-output tables for Canada (in current and constant prices) incorporated most of the recommended standards of the International SNA, known as the 1993-SNA, with the notable exception of basic price as the basis of valuation of products and services. This paper discussed the background and the operational and conceptual rationale for opting to maintain Canada's system of valuation known as modified basic price. The valuation used in Canada's I/O Accounts is the revenue actually received by a producer, without the trade, transport or tax margins, and without the added subsidies that may be forthcoming to the producer. The 1993-SNA calls for the inclusion of these subsidies to arrive at the basic price concept.

As part of the program to implement the historical revision of the CSNA, a broad range of issues involved in fully implementing the standards of the 1993-SNA were examined. It was found that, in the context of the Canadian I/O Accounts, basic price presents shortcomings that would weaken the statistical properties, and potentially affect the timeliness, of I/O tables. First, it required a subsidy database, consisting of both producer and user detail by commodity. In the absence of a survey or other satisfactory data source, such a subsidy database would be of poor statistical quality and would adversely affect the quality of existing I/O estimates. Second, deflation of basic price estimates to arrive at constant price I/O Accounts presented serious difficulties as the valuation used in collecting and compiling price indices is not compatible with the basic price concept.

It was also found that implementing a basic price system would lessen the effectiveness of input-output accounting as an auditing and quality-control tool for the CSNA by making inconsistencies in diverse data sources less transparent, and by rendering I/O commodity balancing a more onerous and time-consuming task. Furthermore, input-output data in basic prices seemed less useful and unnecessarily complicated to some important clients, such as government and business users of the Accounts, because entries would differ from transaction values reflected in business records.