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# GOODS FOR PROCESSING (FOLLOW-UP DISCUSSION)

## THE TREATMENT OF GOODS SENT ABROAD FOR PROCESSING IN THE CONTEXT OF THE INPUT-OUTPUT FRAMEWORK

Note by Statistics Canada

*Summary*

Producers are trying to optimize each step of the production processes, often taking advantages of efficient production processes of other firms. However, the practice of sending goods for processing represents a challenge for statistical agencies. This paper outlines the impacts of the existing and proposed treatments on industry and trade statistics and how they affect the measures derived from them such as input-output models, multifactor productivity indices, and other structural indicators. In addition, it presents a summary of changes that need to be implemented at both the data-collection level and statistical estimation stage. The paper also suggests some of the benefits and drawbacks that can be expected for supply-use tables and outlines how the new treatment impacts the analytical roles that are traditionally associated with input-output tables.

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## I. INTRODUCTION

1. The Conference of European Statisticians decided at its 2007 plenary session that a Group of Experts on the Impact of Globalisation on National Accounts be created to review the main distortions in the compilation of national accounts caused by the growing globalisation of economies and to develop recommendations on how to deal with these distortions. The election of the Group of Experts was approved by the Executive Committee of the United Nations Economic Commission for Europe (UNECE) at its twentieth session (27 February 2008). The Group of Experts will work in cooperation with Eurostat and the Organisation for Economic Co-operation and Development (OECD). The present document contains an input for the preparation of the Recommendations.

2. The international organization of production has been increasing for a long time. The great leap forward in communication and transportation technologies, trade liberalization, greater movement of capital and the presence of economies capable of offering reliable production infrastructure at low costs have all accelerated the internationalization of production.

3. It used to be the case that when goods would move from one country to another, there would almost always be a change of ownership. With the internalization of production this is no longer true. Under the current international standards, in the absence of a change of ownership, a transaction must be imputed when measuring economic activity. As firms are increasingly sending material abroad for further processing, many have raised concerns about the meaning of international transactions as recorded in the balance of payments and the system of national accounts since the statistics are less and less a reflecting financial transactions.

4. The need to impute a value for goods sent for processing was extensively discussed during the updates of the System of National Accounts (SNA) 2008 and the sixth edition of the Balance of Payments Manual (BPM6). The discussion led to a recommendation and a decision to no longer impute a value for goods sent for processing. The decision has the advantage to better reflect the size of international transactions and the type of transaction, a service instead of a good.

5. The decision also includes a provision to standardize the treatment of goods sent for processing in the SNA and Balance of Payments (BOP). The SNA 1993 records gross flows (imputation) only in case where processing is substantial while it is always assumed substantial in BOP. Also, in SNA 1993, domestic processing is recorded without imputing a change of ownership unless the establishment is part of the same enterprise as that supplying the goods. Under SNA 2008, this difference in treatment is eliminated i.e. no transaction are imputed ever.

6. The decision to stop imputing transactions for goods sent for processing has an impact on a series of SNA accounts. The most affected is the production account, notably the input-output accounts where the relationship between material and production is central. Under the new concept, emphasis is put on the contribution of each unit to the production process rather than on the physical technology.

7. This paper outlines the impacts of the existing and proposed treatments on industry and trade statistics and how they affect the measures derived from them such as input-output models,

multifactor productivity indices, and other structural indicators. Second, it presents a summary of changes that need to be implemented at both the data-collection level and statistical estimation stage. The paper also suggests some of the benefits and some of the drawbacks that can be expected for supply-use tables (SUT). Finally, the paper outlines how the new treatment impacts the analytical roles that are traditionally associated with input-output tables.

## II. BACKGROUND

8. Firms are no longer only competing against other firms to sell their products but they also devote a lot of efforts to fulfil demand through the most efficient use of resources, including distribution, inventory and labour. Firms are adopting a supply chain management strategy to conduct their business. Various aspects of optimizing the supply chain include liaising with suppliers to eliminate bottlenecks; outsourcing strategically to strike a balance between the lowest material cost and transportation; implementing just-in-time techniques in order to optimize manufacturing flow; maintaining the right mix of location of factories and warehouses to serve customer markets, etc.

9. In this kind of environment, producers are trying to optimize each step of the production processes, often taking advantages of efficient production processes of other firms. Large firms, often multinationals, are regularly providing material or semi-processed goods and specifications to other firms mandated to process or assemble goods for them.

10. There are many advantages and benefits of having materials processed by another firm. A firm can rely on other firms that have efficient production infrastructure in place while not having to invest large amounts of money to put one in place. It allows firms not to have to undertake maintenance of a large infrastructure while benefiting from the expertise of the other firm. It is often a way to bridge the gap between product development, commercial scale production and growth of market share.

11. The practice of sending goods for processing represents a challenge for statistical agencies. Toll processing arrangements allow companies to move goods around without transferring legal ownership. When goods are moved between two units of the same group, difficulties may arise in setting a value for tolling fees due to the non-market nature of the transaction. For tax purposes companies are required to report precisely the value of such transactions since they have a direct impact on profits. However, because of the sensitivity around profit, companies may be reluctant to report information about processing fees, making work of statistical institutions more difficult. The fact that the value of toll processing is often embedded in the value of the goods exported or imported ads to the measurement challenge.

12. This trend of sending goods abroad to be further processed has far-reaching implications for the pattern of international trade and production, and far-reaching impacts on statistical systems that attempt to properly capture and measure the emerging pattern. These factors impact the configuration of domestic production and trade, but the international case is a more urgent and problematic issue, and this is why it received particular attention in the revisions

recommended by the Advisory Expert Group on the update of the 1993 System of National Accounts (SNA)[1].

13. At this point in time, it is difficult to measure the size of goods sent abroad for processing. In many countries merchandise trade statistics record goods when they cross the border, not when they change ownership. Consequently, goods sent abroad for processing are included in the merchandise trade statistics. This implies that a change in ownership is always assumed (imputed).

14. A special study prepared by the Hong Kong Census and Statistics Department suggest that goods for processing is sizeable between Hong Kong and the Mainland of China. The study shows that imports and exports are adjusted by 30% and 17% respectively when adjusted for goods for processing. The overall impact on the balance of trade in goods and services is zero since the value of goods for processing is the same in imports and exports. However, the balance of trade in goods after removing goods for processing would translate in a trade surplus for goods instead of a deficit while the balance of trade in services would be revised from a surplus to a deficit.

## III. INTERNATIONAL STANDARDS

### A. Change of ownership

15. Contrary to SNA 1993, SNA 2008 no longer requires imputing a change of ownership to goods exported for processing. This paper examines this change of treatment on the input-output framework (IO) from the vantage point of a country with a large international trade sector, where outsourcing and offshoring is most likely present in both directions but difficult to measure, and where IO statistics serve both as benchmarks to its Gross Domestic Product (GDP) in current and constant prices and as the basis for widely-used analytical models, productivity measures and other structural indicators.

16. It is becoming common practice for firms to send their material to an affiliate or non affiliate for processing. Sometime the material[2] is sent to firms within the domestic economy; sometime the material is sent abroad. The process of sending material for processing is called “goods send for processing”. This process is very common among processing industries such as chemical, electronic and metallic manufacturing. In the industry, the process is often referred to as toll manufacturing, toll processing or custom manufacturing.

17. There is a particular variation of this process that is of particular interest for the SNA and the Balance of Payment, goods sent abroad for processing. For SNA and Balance of Payments purposes, “goods sent abroad for processing” refers to a well specified situation, namely, when

[1] See “The Recommendations Made by the Advisory Expert Group for the Update of the System of National Accounts, 1993” by the Intersecretariat Working Group on National Accounts, United Nations Statistical Commission, 2007.
[2] Raw or semi-processed goods.

raw or semi-processed goods are sent by a unit in country A (principal[3]) to a unit in country B (contractor), where they are transformed in a substantive way. Over the course of the transformation process, the principal maintains legal ownership of the raw and semi-processed as well as the processed goods. The principal pays the contractor a fee for the processing or assembly.

18. Other similar patterns also pose issues for SNA, but do not fall under the "goods sent abroad for processing" definition, and are not discussed here. For instance, the unit in country A may have its goods processed by a unit in B, but then sells the goods to another unit in the same country (B) without repatriating them back to A. Similarly, if the processed goods were sold to another unit in a third country, C, without returning to country A, the practice would not fall under "goods sent abroad for processing".

19. In the System of National Accounts (SNA 1993), a transaction may or may not be recorded between two firms, depending of the situation[4]:

(a) Domestic processing is recorded without imputing a change of ownership unless the establishment is part of the same enterprise as that supplying the goods;

(b) When goods are sent abroad for processing, a change of ownership is assumed and a transaction is imputed between the two firms, resulting in an international transaction.

20. However, international processing is recorded without imputing a change of ownership if the goods remain in the processing country or go on to a third country unless the establishment is part of the same enterprise as that supplying the goods or is a direct investment enterprise of the owner.

21. As well, according to SNA 1993, a transaction should only be imputed when the amount of processing is considered significant. In fact, according to SNA 1993, goods should be treated as being processed when the goods from abroad have to be classified in a different group (3-digit level)[5] of the Central Product Classification (CPC) from the goods sent abroad out of which they have been processed. In the Balance of Payment, the treatment is much clearer cut. The Balance of Payment Manual (BPM5) suggests, by convention, that all processing be assumed substantial and therefore be recorded on a gross basis, as if a change of ownership occurred.

22. In reviewing the concept of imputation currently in place, it was concluded that this process was not consistent with one of the basic principles of the balance of payments that a transaction should involve a change of ownership. As a result it was decided that under BPM6 and SNA 2008, the value of goods for processing would no longer be recorded in the goods

[3] The principal is a unit that enters in a contractual relationship with another unit – the contractor- to carry out part or all of the production process. The contractor is a unit that carries out a specific production process based on a contractual relationship with a principal. The activities performed by the contractor are denominated on a fee or contract basis.
[4] Paragraph 14.61 to 14.64 of the SNA 1993 manual provides detail on how to deal with goods send for processing.
[5] Minor transformation of goods such as repair and packaging are not regarded as processing and are excluded from this consideration.

account. As well, under the new standard, the payment of processing fees by an outward processing economy would be recorded as imports of services. According to SNA 2008 the new treatment is also applying to goods sent for processing domestically. The new standard has the advantage of being more in line with records found in the accounting books of firms while meeting a desire to avoid imputing by many national accountants. To the extent it is desirable to have international trade statistics on goods and services that reflect economic transaction; the implementation of the new standards represents an improvement from an analytical point of view.

## B. Treatment

23. The current treatment of goods send abroad for processing affects three parts of the SNA:

(a) The current account of the balance of payments;

(b) The production account of the SNA;

(c) The accumulation account of the BOP and SNA.

## C. Balance of Payments current account

24. For a country involved in “processing”, a value is imputed for raw or semi-processed goods entering the country. The value of the material is recorded as an import of goods. After processing, the processed goods are exported back to the supplying country and a value is again imputed and recorded as export of goods. The difference between the two values is equal to the processing fee paid. In practice, it is possible that the difference will not be equal to the processing fee. This will be the case if price changes over the processing period, notably if processing takes place over two accounting periods.

25. Under the new treatment, the imports and the exports of material and processed goods will no longer be recorded. Processing fees will however be recorded, but as a service. Overall, the current account balance will not be affected. However, net trade on goods will diminish while those on services will increase by the same amount.

## D. System of National Accounts production account

26. Under the current treatment, the value of goods sent for processing entering the country of the contractor are allocated to intermediate inputs of the receiving industry. The value of gross output of that industry is equal to the value of the material and the value added to them by the contractor (processing fee). Under the new standard, on the output side, processing fees only will be reported, as a service, while no value will be imputed for intermediate inputs. In theory, value added will remain the same under both treatments. In practice, because of economies of scale, higher efficiency reasons etc, the amount of value added may be higher. Since risk is lower, it is possible that the processor will accept a lower rate of return.

### E. Accumulation account

27. Having assumed a change of ownership in favour of the processor, it is necessary to record a change in inventories for that processor if processing is unfinished at the end of the accounting period. Under the current standard, the changes in inventories must be recorded in the capital account and the balance sheet. Since the capital account and the balance sheet of the country providing the material will also be adjusted for inventories, it is necessary to impute an entry in the financial account of both countries to show that there is no call on the foreign exchange of the processing country for the value of the goods processed. Under the new treatment, changes in inventories will no longer be necessary since the ownership of the material will no longer be imputed to the contractor.

28. The remaining of this document reviews the various implications on the production account (the input-output framework) of the new standard, focussing on the international aspect of this issue. The practice of "goods sent for processing" gives rise to two specific situations that will be dealt with separately in the paper: the client case (the principal) and the processor case (the contractor). In the client case, the principal sends goods that it owns to another unit (contractor) abroad to be processed. In the most general case, these are semi-processed goods of the principal's own manufacture. Once the goods are processed, they are returned to the principal, where they may be further processed or sold by the principal. The client pays a fee to the processor for the services provided. In the processor case, a contractor receives goods belonging to the principal and, in return for a processing fee, transforms the goods using its own primary inputs before sending them back to the principal for further processing and sale by the latter.

## IV. MEASUREMENT ISSUES

### A. Goods for processing and the input-output framework

29. This section deals with the impacts of the existing and proposed standards on the industry account and the commodity account of the IO framework. The input-output accounting framework contains two sets of accounts, the industry accounts and the commodity accounts. The former provides details about the commodity composition of output of industries and the complete costs structure of production. The latter details the supply and use of individual commodities. The impacts are described in the context of the existing and proposed standards in order to better evaluate the consequences of each standard.

30. The case examined involves a principal unit in Country A sending its semi-processed goods for further processing to a contractor unit in Country B. The contractor never purchases the material it receives from the principal unit. The value of the goods sent for processing is valued at 100 while the value of the goods after processing is estimated at 160. Processing fees are equal to 60.

### B. Industry account

31. Under the current treatment, when the goods sent for processing enter Country B, a change of ownership is assumed and a transaction is imputed between the principal and the contractor,

resulting in an international transaction. In the Balance of Payments, Country B is shown as importing 100. The contractor is shown as buying 100 of semi-processed goods and this amount is recorded under intermediate inputs like all other purchases of goods and services. Gross output would be equal to intermediate inputs and the value added by the contractor, 160 in this case. The nature of the goods produced would be quite different from the goods supplied by the principal. Gross output would be classified as a good.

**Table 1. Industry account under the current standard**

| | Contractor (Country B) | Principal (Country A) |
|---|---|---|
| Gross output | | |
| • Goods (manufacturing) | 160 | 100 |
| • Services (wholesaling) | | 80 |
| Intermediate inputs | | |
| • Goods for processing | 100 | |
| • All other goods | 20 | 50 |
| • Processing fees services | | 60 |
| • All other services | 10 | 20 |
| Value added | 30 | 50 |

32. By imputing a change of ownership of the semi-processed goods (to the contractor), this allows compiling the industry account in Country B in a traditional way, i.e. the full transformation of the commodity inputs into processed goods.

33. In Country A, the principal unit is currently shown as having manufactured 100 of semi-processed goods using its own intermediate inputs, labour and capital. As well, as processed goods return from Country B, they are treated as goods purchased for resale (GPRS) resulting in margins of 80 in the example above. In this particular case, it is assumed that processing fees of 60 are recovered on (net) sales plus another margin of 20. The production of semi-processed goods and wholesaling activities remain secondary activities for the principal unit. Even though it does not appear in the production account, the main activity of the principal unit remains the production of a certain type of processed goods[6]. As a result, the unit is coded to the industry that mainly produces that type of processed goods.

34. The current standard creates an interesting inconsistency between Country A and Country B. Under the current practice, processing fees paid by the principal are not recorded per se in the contractor input-output structure. They are embedded in the value of the processed goods.

[6] If only part of the production process is outsourced, the principal is classified to the class that corresponds to the activity representing the complete production process, i.e., it is classified as if it were carrying out the complete process, including the contracted work, itself. See International Standard Industrial Classification (ISIC) of all economic activities, Revision 4.

35. Under the new treatment, the industry structure in Country B will change significantly. In the processing country, gross output will only reflect the value of the processing since no imputation will be made to value the semi-processed goods received from Country A. More, any production will produce a service, not a good. Value added will remain the same at 30. However, the relationship between GDP and gross output will change. In this case the GDP to gross output ratio would go from 19% under the existing standard to 50% under the new standard, even though the amount of labour and capital has remained the same.

**Table 2. Industry account under the new standard**

| | Contractor (Country B) | Principal (Country A) |
|---|---|---|
| Gross Output: | | |
| • Goods | | 160+100: 260 |
| • Services | 60 | 20 |
| Intermediate inputs | | |
| • Goods for processing | | |
| • All other goods | 20 | 50+100: 150 |
| • Processing fees services | | 60 |
| • All other services | 10 | 20 |
| Value added | 30 | 50 |

36. The presentation of the production in Country A will also change with most production recorded under goods. The principal will be attributed the production of semi-processed[7] goods as well as processed goods. Since the semi-processed goods are further processed by the principal, they also appear under its intermediate inputs. Under the new standard, the principal will show an unusual amount of capital and labour in relation to production. The relationship of capital and labour to gross output will look somewhat strange compare to other units of the industry since its was the labour and the capital of the unit in Country B that was used to produce part of the goods now reported by the principal.

## C. Commodity account

37. The new treatment, which emphasizes transactions instead of focussing on the production process, will also affect the commodity account. This section deals with the commodity account or the supply-use tables (SUT). These commodities are examined under the old and new treatment. The first commodity account deals with the goods sent for processing; the second one deals with the goods processed; the last one deals with processing fees.

38. Under the current standard, when goods send for processing enter the processing country a value is imputed for import on the Supply side. The SUT are balanced by imputing a similar amount in intermediate inputs on the Use side. Goods processed are recorded under production on the Supply side and exports on the Use side. No processing fees need to be recorded since

[7] To the extent the principal is effectively producing the semi-processed goods.

they are embedded in the value of the processed goods. However, a statistical problem could occur if processing fees paid by the principal were captured in exports of services (trade in services).

**Table 3. Commodity account under the current standard**

| **Country B** | **Supply** | | **Use** | | | |
|---|---|---|---|---|---|---|
| | **Production** | **Imports** | **Intermediate inputs** | **Exports** | **Inventories** | **Other final demand** |
| **Before** | | | | | | |
| Goods for processing | | 100 | 100 | | | |
| Goods Processed | 160 | | | 160 | | |
| Processing fees | NA | | | NA | | |
| **After** | | | | | | |
| Goods for processing | | | | | | |
| Goods Processed | | | | | | |
| Processing fees | 60 | | | 60 | | |

39. Under the new treatment, the commodity account will be quite different in the processing country. Semi-processed goods and processed goods will no longer appear in the commodity account. Processing fees will appear as under production and export of services. This will result in a disconnect between production and exports of commodities. For example, each year, a fair amount of crude oil is send to Canada for processing and then exported back to the country of origin. Analyst will have difficulty establishing a relationship between the production of refined petroleum products and exports as only exports of services (related to pretroleum) will be recorded under the new standard.

40. In country A, the commodity account will also be affected significantly under the new standard. Under the old treatment, in the owning country, in order to balance the supply-use tables, it was necessary to make the semi-processed goods disappear as exports (100) and reappear as imports of another good at a higher value (160). In this example, goods processed returning to Country A are consumed as intermediate inputs, by final users while some goes to inventories.

41. Under the new standard, semi-processed goods and processed goods will appear as being produced in the country (A) while only processing fees will appear in international trade, under services.

**Table 4. Commodity account under the new standard**

| Country A | Supply | | Use | | | |
|---|---|---|---|---|---|---|
| | **Production** | **Imports** | **Intermediate inputs** | **Exports** | **Inventories** | **Other final demand** |
| **Before** | | | | | | |
| Goods for processing | 100 | | | 100 | | |
| Goods Processed | | 160 | X | | Y | Z |
| Processing fees | | 60 | 60 | | | |
| **After** | | | | | | |
| Goods for processing | 100 | | 100 | | | |
| Goods Processed | 160[8] | | X | | Y | Z |
| Processing fees | | 60 | 60 | | | |

## D. Measurement problems in compiling input-output accounts in the presence of goods send for processing

42. The implementation of the new standard will affect the compilation of the industry and commodity accounts and subsequently there analytical uses. However, it should be recognized that the IO accounts in many countries are already affected by the phenomena because of deficiencies of the data available to compute the IO accounts. The next two sections focuses on compilation issues related to the two accounts.

## E. Industry account

43. In principle, the existing and the proposed treatment under SNA 2008 lead to exactly the same GDP for the industry and for the economy in the processing country. Under the current treatment, the value of goods processed will appear as an intermediate input and the same value will appear, implicitly, in the value of output, the difference between the two values being the processing fees. Under the new treatment, only processing fee will appear in the industry accounts. Processing fees will appear on the output side as a service and no costs will be imputed on the intermediate input side.

44. In practice, differences will arise for many reasons, including:

(a) Inconsistent reporting between the gross flows obtained from customs sources and the service flows obtained from production-related surveys;

[8] Excluding profit margin.

(b) Data gaps on international transactions of commercial services;

(c) The fact that groups of industries are composed of traditional producers and contractor/principal type of producers (non-homogeneity of the producers).

45. Table 5 below shows a situation where a traditional processing industry is now composed of traditional producers as well as contractors. In order to simplify the example, principal-type producers are not considered.

**Table 5. Mixing traditional producers with contractors**

| **Industry**<br><br>**Period** | **Traditional producer #1**<br>**t** | **Traditional producer #2**<br>**t** | **Traditional producers**<br>**t** | **Traditional producer**<br>**t+1** | **Contractor type**<br>**t+1** | **Total**<br>**t+1** |
|---|---|---|---|---|---|---|
| **Gross output** | 125 | 75 | 200 | 100 | 50 | 150 |
| **Intermediate inputs** | 78 | 47 | 125 | 62.5 | 12.5 | 75 |
| **Value added** | 47 | 28 | 75 | 37.5 | 37.5 | 75 |
| **IO coefficient** | 62.4% | 62.7% | 62.5% | | | 50.0% |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

46. Table 5 above shows what an IO analyst would normally see when analysing its industry account. In period t, the analyst would see column 4 where a value of 75 was added to the value of material to produce a gross output of 200, resulting in an IO coefficient of 62.5%. In period t+1, we assume the only information available to that same IO analyst is equivalent to column 7. The analyst does not know the industry is now composed of traditional producers and contractor-type producers. Looking at the historical IO coefficient, the analyst will no doubt be tempted to adjust the industry structure since unless there is a huge change in price relative, the IO coefficient of an industry rarely change by more than a few percentage points annually. Without information on the mix of producers, it is much more difficult for national accountants to assess the quality of the industry account. It is the case under the current treatment; it will be the same under the new treatment. The point here is in the absence of proper information on the mix of producers; it is difficult to produce industry accounts that are consistent over time.

47. The solution could be to compute within each industry a traditional component as well as contractor and principal components. From an analytical point of view, it would have the advantage of comparing production structures that are homogeneous. The solution could also be to regroup all contractors and all principal type contractors in industries of their own. In both cases, from a compilation point of view, it would make the production of the IO accounts very tedious. Another solution may be to add an adjusting entry in the commodity account to simulate the current treatment. This aspect is covered later in this paper.

## F. Commodity account

48. The revisions to the SNA 1993 and BPM5 revolve around the question of whether a change of ownership of the goods should be attributed to the processing unit in country B when goods move there from the unit in Country A, and once again attributed to the processed goods when they are shipped back to the original unit in Country A. The revisions were, at least in part, motivated by the fact that attributing change of ownership introduces inconsistencies between financial accounts which record payments for services and the BOP which records the gross flows of goods underlying those services. When SNA 1993 and BPM5 were formulated, they adopted a coordinated treatment that was appropriate at the time.[9] SNA 1993 recommended that, when processing is substantial,[10] statistical agencies attribute a change of ownership every time the goods moved across borders for processing, even though the goods always remain the legal property of the principal unit. In the BOP, this would register an export of the gross value of pre-processed goods from A to B, and an import of the gross value of processed goods from B to A involving the same two economic units.

49. It is helpful to describe at this point how transactions recorded under the existing or "imputed" treatment would appear in a statistical system such as Canada's System of National Accounts where the production accounts are fully integrated with the balance of payments account. This is outlined below separately for Canadian contractors and principals.

50. Presently, respondents acting as a contractor in Canada would report their inputs and outputs on a net basis, meaning that they would report as custom work the processing fee they receive for processing goods coming in from domestic principals or from abroad and report only their own intermediate inputs. They would not report the value of semi-processed goods provided by the principal from abroad. At the same time, the imports of semi-processed goods and the exports of processed goods from Canada would appear in the system's input-output tables' imports and exports, consistent with the Balance of Payments data obtained from customs sources. In order to arrive at a balance between the supply and use of these two commodities, IO analysts must enter in the system a series of adjustments. This amounts to replacing custom work with the value of gross production (equal to the export amount), and raising the industry's inputs by the value of semi-processed goods (the import amount). This exercise retains the industry's balance of outputs and inputs (since the processing fee is, in principle, equal to the difference between the two gross values) and the level of GDP while making the industry accounts compatible with the balance of payments.[11] This imputation procedure describes the actual compilation practice in Canada when analysts have had evidence of significant cases and had sufficient data to confidently improve the quality of industry statistics.

51. In case where information is not available, statistical errors could be introduced when compiling the supply-use tables. Even though several countries agreed with the proposal to never

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[9] Prior to SNA 1993 and BPM5, the gross flows were excluded from exports and imports when presented on a BOP basis and the difference between the gross flows shown in merchandise trade were shown as service exports by the processing country.

[10] The criterion suggested for identifying substantial processing was that the good would be reclassified at the three-digit level of CPC.

[11] When production occurs over multiple periods, inventories are also adjusted.

impute a transaction when material is sent for processing, many expressed their concern about the availability of data. This is a serious issue but an issue that already exist for many countries including Canada. In many countries, when a good cross the border, free of charge, custom staff is asked to ensure the good is valued before it crosses the border. For administration reasons, exports and imports are always valued at some “market price equivalent”.

52. Manufacturers normally provide the following type of information:

(a) Shipments (turnovers) and inventories;

(b) Revenues from custom work;

(c) Cost of own material;

(d) Sub-contracting expenses.

53. The manufacturer is not asked to estimate a value for the material he would have received for processing. He is probably not in a position to do so. As a result, IO analysts must deal with international trade data that have been adjusted for the value of goods send for processing and with manufacturing data where no imputation has been made for the value of goods received and processed. This creates difficulty when balancing the supply-use tables. The table below shows how.

**Table 6. Supply-use tables and the contractor**

| **Balancing Supply-Use Tables – Contractor case** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Step 1:<br>Material is sent for processing from the principal in country A to the contractor in country B | | | | | | | |
| Production | Imports | = | Inputs | Final use | Exports | Inventories | |
| | 75 | | 0 | | | | Imbalance |
| Step 2 : Production of a good | | | | | | | |
| Production | Imports | = | Inputs | Final use | Exports | Inventories | |
| 0 | | | | | 100 | | Imbalance |
| Step 3: Payment stage – Processing fee | | | | | | | |
| Production | Imports | = | Inputs | Final use | Exports | Inventories | |
| 25 | | | | | 25? | | Imbalance |

54. In step 1 of the production process, semi-processed goods are imported in country B (75). Since they were not paid from by the contractor, a first imbalance will appear in the SUTs. The Use of the commodity will be lower than its Supply. To the extent the IO analyst is able to verify the robustness of the various data of its SUT, the analyst will hopefully adjust inputs to balance the system, implicitly imputing a value for the material that enter the country, a value that was not captured during the collection process.

55. In step 2, production takes place and the finish good is sent back to its owner in country A. An export is recorded at say 100. However, on the collection side, no value would have been

collected except the amount the contractor in country B would have received for processing the material. As a result, a second imbalance could occur. Unless production is adjusted, the SUT would not have been balanced properly.

56. Finally, in step 3, since the processing fee would have been embedded in the value of the exported finish product, it is not clear to what extent national accountants are able to deal the double-counting of processing fees which are, in theory, embedded in the value of production and exports.

57. Table 7 shows similar imbalances that could also occur in a principal case.

**Table 7. Supply-use tables and the principal**

| **Balancing Supply-Use Tables – Principal case** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Step 1:<br>Material is sent for processing from the principal in country A to the contractor in country B | | | | | | | |
| Production | Imports | = | Inputs | Final use | Exports | Inventories | |
| 75 | | | 75 | | 75 | | Imbalance |
| Step 2 : Production of a good | | | | | | | |
| Production | Imports | = | Inputs | Final use | Exports | Inventories | |
| 100 | 100 | | X1 | X2 | X3 | | Imbalance |
| Step 3: Payment stage – Processing fee | | | | | | | |
| Production | Imports | = | Inputs | Final use | Exports | Inventories | |
| | ? | | 25 | | | | Imbalance |

58. In this case a manufacturer in country A would have produced material for a value of 75. That material would have been purchased by a unit in country A at a value of 75 and exported to a country B for processing. Assuming that for administrative reasons the export was valued at 75 by custom staff, this would have translated in a first imbalance in the SU tables in excess of use.

59. If it was the principal unit that had produced the semi-processed goods, the situation would have been different. Principal A would have recorded a production of 75 which would have translated into an export of 75 to Country B.

60. Another imbalance would have occurred after the contractor delivers the goods to the owner of the material. The goods would be imported back to country A at a value of 100. The owner would have reported shipments (turnovers) of 100 in the manufacturing survey, creating an imbalance.

61. Finally, since the manufacturer (principal) in country A would have reported a processing fee (expense) of 25, an amount hidden in the value of the good imported, this would have created another imbalance.

62. The lack of coherence between the international trade data and the domestic surveys is potentially creating undesirable imbalances in the commodity accounts in the absence of explicit information on the value of goods send for processing. This will change with the implementation

of the new concept, provided the trade statistics on reflect financial transactions. Several countries, even those in favour of not imputing a value for goods send for processing, have expressed concerns on this issue. Many countries have indicated that it would be difficult for their custom authorities to identify goods for processing from other merchandise trade. If it was the case, balancing the SUTs in the context of goods send for processing will remain a challenge under the new standard.

### G. Transportation margins

63. By not imputing a value for goods send for processing, the link between transport margins and commodities will no longer exist. It would not be very useful to associate transportation margins with processing fees. With the implementation of the new standards, transportation services will replace transportation margins.

### H. Input-Output Accounts

64. The implementation of the new standard should facilitate the balancing process of the commodity account. It is not so clear in the case of the industry account where homogeneity of the structure is an important element. Mixing traditional producers with contractors in a given industry will complicate the compilation process. One of the solutions could be to regroup contractors and principal type producers in separate industries. However, since in every industry, some units will be a blend of traditional producers and contractors, it would be difficult to implement such a strategy. The real solution may be to expand the commodity account to include adjusting entries. These adjusting entries would be equivalent to the value currently imputed. In the case of a contractor, output and intermediate inputs would contain an adjusting entry of the same value while processing fees would be reported in a separate service commodity. The implementation of adjusting entries in the IO framework would help alleviate some of the analytical issues the new concept will create to analysts focussing on structural analysis.

65. Adjusting entries could be stored separately in a file of the same dimension as the one containing the IO accounts data. The data could be added to the initial set of data which would exclude goods for processing. This type of information would be very useful to IO compilers in interpreting structural changes. This type of decomposition has been implemented in the compilation process of the Canadian IO tables where a series of conceptual adjustments are kept separate in the IO database. Conceptual adjustments consist of items such as the capitalisation of software, financial intermediation services indirectly measured (FISIM) or head offices. The database also contains another series of adjustments, adjustment entries. Adjustments entries are adjustments to source data necessary to calibrate the IO accounts.

## V. ANALYTICAL CONCERNS

### A. Input-Output account

66. A significant analytical disadvantage posed by not imputing a financial transaction for goods sent for processing is that supply and use tables will no longer serve as the data source for exports and imports of goods that have been involved in the goods for processing phenomenon.

Under the current treatment, on the other hand, supply and use tables facilitate the analysis of a variety of outsourcing questions by preserving the link between commodity flows, their producing industries as well as intermediate and final users.

67. One such significant consequence is that the forward and backward linkages articulated under the existing treatment for processing industries would disappear under the new treatment. In particular, when studies look at the linkage of goods with other goods used to produce them, the processing units will be absent since the processed goods will not appear in the inputs or outputs of the industries concerned. For instance, if we need to answer a question, such as how much upstream production or employment is associated with petroleum by-products, input-output tables can address this question when they have linkages between upstream and downstream industries: chemical manufacturers producing petroleum by-products, petroleum refiners, and crude petroleum extraction. However if, in a hypothetical situation, the refining of petroleum was done by a contract contractor whose output in the system appears as "refining services", input-output linkages between upstream and downstream processes would be severed, preventing such a calculation.[12]

## B. Regional Input-Output tables

68. A key implication of the impact of the not imputing a change of ownership on input-output linkages discussed above is for multi-regional supply and use tables, such as the Canadian interprovincial input-output tables. In such an integrated national-regional table, linkages between goods and services exist not only across production processes in different industries, but also across regions (Canadian provinces). The Canadian tables show the linkages between processes in different regions through an inter-regional trade flow matrix. These regional tables are routinely used to assess the upstream or downstream values related to a given commodity or industry across all regions of the domestic economy. However, this is subject to an important exception in the case of goods sent for processing. Since surveys of Canadian goods processing industries ask for the revenues and the cost related to contract processing or "custom work", a net treatment is built into the compilation of regional supply and use tables. As in the petroleum example presented above, by not imputing a change of ownership would result in severing linkages when goods are sent to other regions for processing, thus limiting the ability of input-output tables in documenting and analysing technological dependencies between industries and between regions. In this particular case, an imputation was made and added to the interprovincial tables to effectively permit the technological linkages to be maintained for petroleum products.

## C. International trade

69. The current treatment calls for reflecting gross values of imports and exports when goods are sent abroad for processing. The most clear and intuitive drawback of this treatment is that it exaggerates the highly visible and widely used measures of import intensity and export performance for goods producing industries generally and for the individual manufacturing

[12] If only a fraction of petroleum processing is done by contractor and the rest retain the traditional pattern of production, the new treatment would result in an understatement of the values calculated.

industries in particular. Trade ratios such as exports/gross output and imports/production overstate true export and import intensities and make the industry appear more financially vulnerable to external trade. In addition, by subsuming the value of processing services in the gross values of traded goods, the treatment understates the values of international trade in services. To get a better sense of how much exports really matter to the economy's GDP, studies often net out the import content of exports (or vice versa) in order to correct the exaggerated effect of outsourcing, including the cases of "goods sent abroad for processing". Such overstated ratios in turn embellish the influence of factors such as exchange rates and the strength of foreign demand for exports on the domestic economy generally and goods producing industries in particular.

70. Under the new treatment, only imports and exports of services will be recorded in the final demand table of input-output tables. As a result, the analysis would produce a lower estimate of imports associated with (or used in the production of) exports because it would be restricted to imports with ownership transfer. In this case, the new treatment effectively alters the answer that the analyst would receive from performing a common input-output inquiry and it would be important to clearly explain to principals how the new treatment affects the conclusions reached in the analysis.

## D. Input-Output models

71. Open output-determination models, such as those estimated from the Canadian input-output tables, depend critically on market shares and input cost shares of goods and services to compute the impact of an exogenous change or "shock" to a system of inter-industry linkages beginning from an equilibrium position. To the extent that an industry uses the outputs of other industries as its intermediate use it has a backward linkage to all those industries. And, to the extent that a given industry supplies the intermediate inputs of others through its own production it has a forward linkage to those industries. When the chain of inter-industry commodity flows is interrupted because products are imported from abroad, there is a "leakage" from the domestic economy. A larger leakage (a larger proportion of the supply of a commodity coming from imports) implies a smaller feedback from a demand shock on the production of the rest of the system. Under the existing treatment, the import coefficient of a contractor industry is larger than under a no imputation treatment because intermediate inputs include the gross value of goods received from the principal for processing. The larger import coefficient leads to an understatement in impact coefficients of the output-determination model, thereby understating the total impact of any exogenous change on domestic production not necessarily in terms of value added.

72. On the other hand, a large number of industries could be involved in processing. For each of these industries, it would be ideal to identify separately the processing fees component separately from other industries. If processing could not be associated with a specific industry, allocating the demand for processing services to the proper producing industries based on market shares would spread the gross output to all producers involved in processing. For modelling purposes the new treatment requires a fair amount of detail on processing by industry in order to properly calculate IO impacts related to processing.

## E. Productivity

73. The implications of the increasing prevalence of "goods for processing" for productivity deserve a mention when a goods-producing industry consists of one segment that operates on a traditional business plan and another segment that uses contract processing. When processing goods for a principal becomes more prevalent in a given industry over the traditional own-account processing, the industry's measured GDP (and GDP growth) remains unaffected (imputing or not). It is clear in this case that the industry's productivity growth measured as the difference between real GDP growth and the growth in an index of labour inputs remains unaffected, as the same real GDP is produced with the same set of primary factors of production. However, in practice, one could expect higher efficiency from the contractor making better use of the capacity of its firm.

74. Looking at the principal side, when more producers in an industry make use of contract processing abroad in place of own-account goods processing, one would expect the overall industry's productivity growth to increase. Under a no imputation treatment, the measured input and output sets of the industry will not change as a result of the use of contract processing. However, when producers find it cost effective to send goods abroad for processing, the implication should lead to a reduction in unit costs of output compared to a traditional arrangement of production. Under competitive conditions, this means that, in real terms, more outputs are produced per combined unit of inputs for the producer in question. In nominal terms, while it is clear that contract processing abroad lead to greater profits for the industry, this may or may not be offset by the lower wage costs under contract processing so that it is not clear whether nominal GDP will be higher or lower.

75. For the calculation of multifactor productivity where the result is a function of gross output and intermediate inputs (KLEMS database), the impact of the new standard is unclear and will require researching.

# VI. DATA COLLECTION ISSUES

## A. Trade data

76. Input-output tables provide benchmarks for GDP in both current and constant prices. In addition, they are the sole source of data on gross output and GDP by industry in both price bases. The supply and use tables of the Canadian IO accounts have a rectangular format, providing for many outputs per industry. For each commodity (good or service) articulated in the IO accounts, supply from domestic production and imports are balanced with disposition. The latter consist of intermediate use, final domestic use (e.g., consumption, investment, and government expenditure), inventory change and exports. Elements that make up this commodity-balance are estimated within a framework where, in addition to equating supply and disposition, outputs of industries are equated with their total inputs and GDP components. Import and export data used to construct this commodity balance originate from the system's balance of payments. For goods, the balance of payments depends on merchandise trade data obtained from customs, adjusted to accord with BOP concepts and classification. For services, the data is obtained from the survey of International Transactions in Commercial Services. The latter encompasses some 3,200 firms, mostly large corporations, with significant involvement in

imports or exports of services. The survey covers the entire spectrum of internationally traded services including "contract production abroad".

77. One possible approach to removing goods send for processing values from merchandise trade is to identify goods that are declared as "for processing" when they are clearing customs and use the tagged information to adjust merchandise trade when it is estimated on BOP basis. Goods going into Free Trade Zones (FTZ), and those originating from them back into Canada, could be documented and tagged for treatment. Specific measures must be taken to distinguish the qualified goods—those which go into FTZ and come back to the same unit in Canada—from other goods. For goods processed outside these zones—as is the case in Canada's contract processing industry—this requires international agreements between customs authorities of major trading partners that specifically deal with the terms and conditions of identification, evaluation and reporting of 'goods for processing'. The tagged information on exports and imports must be collected at the lowest level of the Harmonized System of commodity classification in order to make it possible to link them with commodity categories of the supply and use tables. This will allow analysts to compare the net values of tagged exports and imports with processing costs from principal units and revenue data from processing units obtained from industry sources.

78. An alternative data source for both principal units and contractor units in Canada is to refine and improve the existing survey of International Transaction of Commercial Services. This survey is used to provide data on the services components of imports and exports in the balance of payments. At the present time, a major redesign project is in progress at Statistics Canada that will see the survey frames of the latter survey revamped and linked to the Agency's Business Register—the most comprehensive list of businesses in Canada from which samples are obtained for Statistics Canada's business surveys. A complete link between the two frames will allow data collected through this survey to be used in conjunction with the Annual Survey of Manufactures which is the principal source of data on inputs and outputs of goods producing industries. The survey presently collects data on contract production services from large Canadian plants that export and import commercial services. Further refinements to the questionnaire would permit an estimate of 'goods for processing' from other contract processing originating from or destined to abroad. Revenues and expenses related to 'goods for processing' from this source would then be used as a check on the difference between the gross values of exports and imports of goods identified in merchandise trade that meet the definition of goods sent abroad for processing.

## B. Sampling

79. The existing treatment exposes the data collection process to a sampling problem when it treats contract contractors and other (traditional) contractors which make up the majority of units in an industry class as homogeneous. Surveys in Canada proceed by identifying a "take-all" portion of the industry's universe—those which are either multinational or account for a large proportion of the industry's shipments. Other smaller establishments (the "take-some" portion) are sampled and used in an estimation procedure that infers values for non-sampled units from those that were selected to be in the sample. When units are not classified to different industries or treated as units of different sampling strata, they share the same probability of being selected to represent units with similar statistical attributes. This may lead to a situation where contract

processing units are selected for a sample and their production statistics are used to make inferences about traditional units in the sample (and vice versa). A sampling error may arise when contract contractors report their statistics in net terms (they produce a service), whereas traditional establishments report their gross production and gross intermediate cost values. Estimates for some periods would overestimate, and others underestimate, the true values depending on which type of manufacturing unit is actually sampled. This introduces excess variability into time-series of basic industry statistics even when a simple random sampling procedure is used.

## C. Sub-annual surveys

80. Several countries are collecting sub-annually data on shipments (turnovers) and inventories in order to monitor production in the manufacturing sector. To the extent the goods sent abroad for processing phenomena is important, surveys which are not explicitly differentiating between shipments and processing fees will undoubtedly give wrong signals. Finally, since the price of goods processed and the price for processing fees will most likely differ, price deflators for processing fees needs to be developed.

## D. Survey questionnaires

81. Given the difficulties that can be foreseen in obtaining satisfactory data from this source, existing industry surveys can be used as a second and complementary source to obtain estimates of exports and imports of "for processing" goods. For a principal unit, new questions in the Canadian Annual Survey of Manufactures can ask for information on the value of goods of own manufacture that are sent abroad for processing, the post-processing value upon return to the unit, and the fees paid to foreign contractors that, adjusted for timing and transaction costs, would make up the difference between the two values. The two gross values, summed across all industries, can be compared with the tagged data obtained from customs sources to enhance data quality and consistency of a given class of goods.

82. An element required for implementing the new treatment is data on costs of processing services when goods are processed abroad, and the revenues earned by Canadian contractors from foreign principals. For principal units located in Canada, revenues earned from processing principal goods are presently reported as a separate item in the Annual Survey of Manufactures. The survey does not specify, however, whether the principal is a foreign resident affiliate or subsidiary of the same enterprise or whether the goods are returned to the principal after processing or shipped to a third party or country. A more specific wording and a separate question that allows a separate estimate for 'goods for processing' from other outsourcing costs needs to be added to the existing survey. Once a specific estimate is obtained from this survey, the costs of 'goods for processing' can be compared to the net value of gross trade data for this activity from customs sources to ensure data quality and consistency.

83. Processing units in Canada similarly report their gross income from contracting fees to the Annual Survey of Manufacturers as revenues from "custom work". Once again, the reported revenue would include processing for domestic and foreign principals and include processing that meet the conditions of 'goods for processing' as well as other activities. More specific wording and a separate question in this survey will be needed in order to isolate income from

‘goods in processing’ for foreign principals in order to allow comparison with the net values of trade data obtained from customs.

## VII. CONCLUDING REMARKS

84. With the advent of the globalization, there is a need to portray production activities in a different way. In the context of globalization, the focus is more on how the production process is spread (organized) than on the technology required for the production process to take place.

85. A better understanding of goods send for processing is certainly a step towards a better understanding of globalization. It gives a much better idea of the size of international trade in overall economy. In many ways, the new treatment would be simpler to apply compared to the current standard since it would no longer be necessary to impute values in various places of the IO framework. The recording of goods for processing has been discussed extensively during the updates of the SNA 1993 and BPM6 and a consensus has been reached to not impute a value for these kinds of transactions. The new treatment has been accepted while recognizing its implementation could be difficult due to data gaps. However, the data gaps issue is no different than the one SNA analysts currently face. Imputing for good for processing requires adjusting annual surveys on production to custom data while not imputing requires removing goods for processing from custom data to align them with annual surveys on production. Consequently, national statistical institutes will most likely need to continue to gather a significant amount of information on goods send for processing. Above all, there is a need to ensure they are removed from custom trade data where required for administrative reason.

86. While the international community reached a consensus on no longer imputing a value for goods sent for processing, it is recognized the organization of data required for the new treatment limits the structural relationships that are shown within the current IO framework. Without structural linkages, the tables cannot be effectively used, for instance, to study outsourcing phenomenon. This is a key feature of supply and use tables and has often been their “raison d’être”.

87. One conclusion suggested by this analysis could be that both the “imputation” and the “no imputation” treatments could be maintained to ensure the traditional usefulness of supply and use tables. Compiling and presenting the data on both bases and appropriately informing data users could preserve the advantages of both treatments without taking away the well-established and traditional application of supply and use tables. The fact that statistics on goods for processing are necessary to implement or not the concept make this possibility very attractive.

88. Supply and use tables are the only statistical framework that explicitly shows the combination of goods and services that enter into the production of other goods and services. How this relationship or ‘production technology’ is represented is critically important to the types of questions that supply and use tables can accommodate and the kind of answers they would provide. It is important to ask whether the new ‘net’ representation of production technology—compared to one that is gross of inputs not owned by the producer—is capable of addressing questions traditionally dealt with by input-output tables and whether the answers will be different in some way.

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