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**Accounting for global production and consumption within a national context****Measuring the Manufacturing Services on the physical inputs  
of others - Canada****Prepared by Statistics Canada***Summary*

This paper outlines recent work by Statistics Canada to measure the value of manufacturing services on the physical inputs owned by others as recommended by the 2008 SNA and BPM6. The main challenge Statistics Canada faces centers around acquiring data sources to properly implement this concept. This paper first defines the concept of manufacturing services on the physical inputs owned by others. It then looks at the type of data sources a statistical agency needs to acquire or collect in order to measure the concept. The paper concludes by outlining the data Statistics Canada has been able to acquire up to this point and how these data can be used to adjust Statistics Canada's current estimates of imports and exports to align with the international recommendations.

## I. Background

1. Over the last 35 years firms have fundamentally altered how they produce and distribute goods. There is now a rich literature and set of case studies outlining the various types of global production arrangements carried out by an increasing number of global firms. Not only are more and more firms engaging in some form of global production activities, the structure and type of arrangements are continuously changing.
2. The latest revisions to the macroeconomic accounting standards Statistics Canada use to produce the Canadian national economic accounts and balance of payments (the 2008 System of National Accounts (2008 SNA) and the Balance of Payments Manual (6) (BPM6)) recognized these changes and adopted the concept that imports and exports of goods should only be recorded when there is a change in ownership. This allows users of national accounts and balance of payments statistics to better understand the role and evolution of global value chains in their national economies.
3. In 2012 Statistics Canada adopted the 2008 SNA and BPM6 macroeconomic accounting standards. While Statistics Canada implemented most of the recommendations outlined in these manuals it did not implement the recommendation related to the recording of *manufacturing services on the physical inputs owned by others*. Currently Statistics Canada records imports and exports regardless as to whether there is a change in ownership. As major trading partners begin to record manufacturing services on the physical inputs owned by others in their national accounts and balance of payments statistics there is the potential for increasing asymmetries between the national accounts and balance of payments statistics reported by Statistics Canada and the data reported by Canada's key trading partners.

## II. Change of Ownership Concept – Imports and Exports of Goods

4. The 2008 System of National Accounts and the Balance of Payments Manual version 6, recommend that when a resident firm supplies a foreign contractor with goods, free of charge, for the purposes of processing, that the materials supplied should not be recorded as an export. While this may seem like a straightforward recommendation, it creates several challenges. The complexity of this recommendation is best illustrated using an example,
  - Assume that company X in country A sends parts worth \$100 for assembly to company Y in country B.
  - Assume that company X retains ownership of the goods (i.e. company Y does not pay company X for the imported goods).
  - Assume that company Y uses these parts and produces goods valued at \$200 and sends the goods back to company X.
  - Finally, assume that company Y charges company X a processing fee of \$100.
5. Under BPM5 and 1993 SNA conventions (the former accounting standards used by Statistics Canada prior to the 2012 comprehensive revision) this 'transaction' would be recorded by country B as an import of goods of \$100 and an export of goods of \$200. Conversely, for country A the transaction would be recorded as an export of goods of \$100 and an import of goods of \$200. Under the new BPM6 and 2008 SNA standards the recording of imports and exports of goods only occurs when there is a change in ownership. Since, in our example, company Y does not own the parts, the 2008 SNA and BPM6 both recommend that neither an import of a good nor an export of a good gets recorded. The standards recommend that country A records an import of a processing service and country B records the export of a processing service. There is no change in the trade balance but there is a change in the composition of trade (from goods to services) and the aggregate gross flows.

6. While analytically important, this new recommendation means that the balance of payments and national account compilers not only need to observe the flow of goods but they need to understand the nature of the relationship between the parties involved in the transaction. A statistical agency's ability to obtain this information in a timely manner at a fine level of detail poses a significant implementation challenge. For this reason, Statistics Canada has not yet been able to fully implement the recommended BPM6 and 2008 SNA changes in the Canadian National Accounts and Canadian Balance of Payments. As other countries adopt these recommendations important differences between Canadian estimates of its Balance of Payments and gross domestic product are occurring.

7. For Statistics Canada to implement these changes it needs to acquire data that will allow the agency to trace all the flows associated with these global production arrangements. The agency launched three main initiatives to collect the necessary information. First the agency updated several of its annual business surveys to try and capture this information. Second the agency explored the Canadian and US customs forms to determine if there were any forms or processing codes that could be used to measure global production. Finally, Statistics Canada launched a survey of the largest firms in Canada to see if they could provide detailed information regarding their global production arrangements.

8. The basic concept outlined in both the 2008 SNA and BPM6 is that if a country exports material components to a foreign firm while retaining ownership of the material components and pays the foreign company a fee to assemble the goods then the country should not record an export and subsequent import of goods but rather only record the import of a processing service. In the language of the BPM6 this represents imports and exports of *manufacturing services on the physical inputs owned by others*.

9. Table 1 presents the basic challenge presented to the national account and balance of payments compiler for countries that use customs data as the main source of data to measure imports and exports (as is the case in Canada). The first three columns of the table present Canadian in imports and exports grouped into primary products, secondary products and tertiary or finished products. The next four columns show the adjustments that need to be made to the trade data in order to align with current change in ownership concept. First, countries need to estimate the share of their exports that are sent abroad for processing and for which they retain ownership (referred to as owned materials exported in the table). Next countries need to identify the value of imported processed goods that contain some or all of their material inputs (referred to as owned finished goods imported). Next countries need to identify the value of goods imported in their country for which ownership of the goods remains with non-resident institutional units (referred to as owned materials of others imported). Countries then need to identify the value of exports sent abroad that contain material components from abroad and for which the goods are owned by non-residents (referred to as processed finished goods exported). Finally countries need to record and processing fees received from non-residents as exports of manufacturing services on the physical inputs of others and any processing fees paid to non-residents as imports of manufacturing services on the physical inputs of others.

Table 1  
**Illustrative example of recording manufacturing services on the physical inputs owned by others**

Product (Goods in billions)	<i>Before ownership adjustments</i>			Owned Materials Exported	Owned Finished Goods Imported	Processed Finished Goods Exported	Owned Materials of others Imported	<i>After ownership adjustments</i>		
	X	M	B					X	M	B
Primary	290	175					5	290	170	
Secondary	182	265	20				5	162	260	
Tertiary	67	124			40	20		47	84	
Other BoP	11	11						11	11	
<b>Total</b>	<b>549</b>	<b>579</b>	<b>-30</b>					<b>509</b>	<b>529</b>	<b>-20</b>

  

<i>Product</i>	<i>Exports</i>	<i>Imports</i>	<i>Balance</i>
Manufacturing services on the physical inputs of others	10	20	-10

10. In the above table it is assumed that Canada exports \$20 billion in material components abroad for processing and imports \$40 billion of goods which contain the material components that they own. Similarly, the above example assumes that Canadian firms receive \$10 billion of component parts from abroad for the purposes of providing processing services. The value of the finished products that Canada sends back to the supplying country is \$20 billion. As a result, total exports of goods are reduced from 549 billion to 509 billion and imports are reduced from 579 billion to 529 billion. The trade in goods balance improves slightly from a deficit of 30 to a deficit of 20.

11. In addition to the adjustments to the trade in goods data, adjustments are also made to the imports and exports of services. Statistics Canada records an import of manufacturing services on the physical inputs of others valued at \$20 billion and an export of manufacturing services on the physical inputs of others valued at \$10 billion.

12. In the real world, the transaction are far more complicated than the proceeding illustrative example. For example, there could be cases where a domestic firms sends material inputs abroad, the foreign contractor uses the supplied material inputs along with its own material inputs, and charges a processing fee that includes the cost of its own material inputs. These goods could then be sold to directly abroad to a host of clients in a number of different countries without the goods ever returning to Canada. .

13. As table 1 shows, the mechanics of the adjustment are relatively straight-forward. What is not straight-forward is acquiring the data to make these adjustments.

14. In an ideal world, Statistics Canada would be able to update the Canadian import and export customs forms in order to obtain the necessary information. A stylized version of the type of updates to the form that would be required are identified in table 2 (B13 Export Declaration form) and table 3 (B3 Import Declaration form). The export form would need to collect information related to whether the export transaction represents goods for which the Canadian exporter retains ownership or for which the goods being exported are owned by a non-resident and contain material inputs owned by the non-resident firm.

Table 2

**Illustrative example of potential updates to Canadian customs documentation required to capture information related to manufacturing services on the physical inputs owned by others**

<i>Exporter (B13)</i>	<i>Product (Goods)</i>	<i>Country of Destination</i>	<i>Value</i>	<i>Are you retaining ownership of these goods? (1=Yes, 0=No)</i>	<i>Are these processed goods you are returning to the owner?</i>	<i>What was the value of the processing fees charged?</i>
ABC Company	Tertiary	CN	10	1		
XYZ Company	Tertiary	CN	10	1		
MNO Company	Secondary	US	20	0	1	10

15. Similarly, the import form would need to be updated to obtain information on whether or not the materials being imported are being supplied to a processing firm with the intention of returning the finished goods to the foreign contractor. A stylized set of questions are outlined in table 3.

Table 3

**Illustrative example of potential updates to Canadian customs documentation required to capture information related to manufacturing services on the physical inputs owned by others**

<i>Importer (B13)</i>	<i>Product (Goods)</i>	<i>Country of Origin</i>	<i>Value</i>	<i>Do you own these goods? (1=Yes, 0=No)</i>	<i>Are these goods that you own, for which your materials were used as inputs and for which you paid a processing fee? (1=Yes, 0=No)</i>	<i>What was the value of the processing fees that you paid?</i>
ABC Company	Primary	CN	5	0		
XYZ Company	Secondary	CN	5	0		
MNO Company	Tertiary	US	40	1	1	20

16. Unfortunately, Statistics Canada needs to negotiate updates to customs forms with Customs authorities which often have competing demands with that of the statistical agency. Up to this point Statistics Canada has not been able to update Canadian customs declarations to collect processing information from import and export declaration forms.

17. Instead, Statistics Canada has explored the use of business surveys to measure the imports and exports of manufacturing services on the physical inputs of others as well as acquire the necessary data to adjust its trade in goods flows.

18. Over the last number of years Statistics Canada has tested several different survey vehicles with the purpose of obtaining data related to global production activities. The high-

level information requirements are presented in table 4. Statistics Canada needs to collect information related to the processing fees, the type of products processed, and the material inputs supplied by foreign firms or supplied to foreign firms. Unfortunately, while it appears respondents to Statistics Canada's annual survey of manufactures can identify the value of customs work undertaken on behalf of foreign clients they are unable to identify the value of the clients material inputs (by input) as well as the value of the output (by product) that would be required to make adjustments to the customs based imports and exports statistics.

Table 4

**Illustrative example of the type of information required from manufactures in order to record exports of manufacturing services on the physical inputs owned by others**

<i>Collection Entity (Establishment?)</i>	<i>Account</i>	<i>Product</i>	<i>Value</i>
ABC Company	Total Revenue – Domestic Clients		
	Total Revenue – International Clients		
	Custom Work Revenue – Domestic Clients		
	Custom Work Revenue – International Clients		5
	Materials owned by and received from international clients used when undertaking the custom work	Primary	5
	Value of custom work goods exported to the foreign client	Tertiary	10

19. The annual survey of manufactures was also tested to determine the capacity of Canadian manufactures to provide information related to sub-contracting fees paid to foreign entities using material inputs they supplied. The testing demonstrated that most respondents could only identify the sub-contracting fees paid to foreign clients. They were unable to report the value of their material components used in the assembly of the good or any of the product detail required to adjust the customs based import and export statistics.

Table 5

**Illustrative example of the type of information required from manufactures in order to record imports of manufacturing services on the physical inputs owned by others**

<i>Collection Entity (Establishment?)</i>	<i>Account</i>	<i>Product</i>	<i>Value</i>
XYZ Company	Total Expenses – Domestic Clients		
	Total Expenses – International Clients		
	Subcontracting – Domestic Clients		
	Subcontracting – International Clients		5
	Materials owned by this firm and provided to foreign processors, assembling goods on behalf of this firm.	Secondary	5
	Value of processing services paid to the foreign processor	Tertiary	10

20. Given the restricted information respondents are able to provide, Statistics Canada was only able to make limited updates to its annual survey of manufactures. In the revenue section of the annual survey of manufactures Statistics Canada now requires Canadian manufacturers to provide a break out of their customs work revenue between revenue received from domestic firms and revenue from non-residents. The question used in the latest cycle of the annual survey of manufactures is shown below.

Table 6  
Customs work revenue questions annual survey of manufactures

	CANS '000
Sales of goods manufactured	
Sales of goods purchased for resale, as is	
Revenue from repair work	
Revenue from manufacturing service fees and/or custom work	
Other	
Total sales of goods and services	

4. Of the [amount] reported in Revenue from manufacturing service fees and/or custom work, please provide the percentage breakdown for the following.

	Percentage
From Canadian clients	
From clients in other countries	
Total breakdown	

21. Statistics Canada also updated the expense section of the questionnaire to include a question on payments to non-resident subcontractors. The question used in the latest cycle of the annual survey of manufactures is shown below.

Table 7  
Subcontracting expense questions annual survey of manufactures

#### c. Subcontracts

Subcontract expense refers to the purchasing of services from outside of the company rather than providing them in-house. In such cases, business units provide materials to other business units or individuals for the production of outputs on a so-called 'custom basis'. Subcontract expense only refers to work hired out for production towards the company's outputs.

2. Of the [amount] reported in Subcontracts, please provide the percentage breakdown for the following.

	Percentage
From Canadian sources	
From sources in other countries	
Total breakdown	

22. In 2017, the as reported on the annual survey of manufacturers, total value of custom work revenue received from non-residents was \$6 billion. The total value of processing fees paid to non-residents was \$1 billion. For now, we will assume that 100% of this processing (both imports and exports) used material components from the contracting firm. Using this assumption, we can now make some of the adjustments outlined in table 1 – notably we can record an estimate of the imports and exports of manufacturing services using the physical inputs of others. We are still unable to adjust the customs-based import and export statistics

because we do not have any information about the value of the material inputs that were used in the processing of the goods. In order to obtain this information, we examined existing information on the Canada Border Service Agency import and export declaration forms.

23. All Canadian exporters are required to complete a B13 customs declaration form when they export goods to non-US destinations. When completing the code, they are asked to fill out a "Reason for export" field. One of the possible codes they can chose for this field is a code related to 'processing'. It is therefore possible to identify the value of Canadian exports that are being exported for the purposes of processing by foreign processors. The value of processing exports in 2017 was 400 million. Unfortunately, the same field is not part of the US import declaration form (which is used to record Canada's exports to the US). Given US exports represent 75% of total exports a rough estimate of the value of processing exports to the US could approximate \$1.2 billion. This information, combined with the information obtained from the annual survey of manufacturing, can be used to make aggregate adjustments to Canadian exports of goods to align the flows with the recommended change in ownership concept. If we assume that \$1.6 billion needs to be removed from exports and the value of imported goods includes the \$1.6 material components exported as well as the \$1 billion processing services, then \$2.6 billion should be removed from imports. These adjustments are shown in table 4, assuming that customs information and survey information are fully aligned.

24. Several years ago the Canadian Border Services Agency established the Exporter of Processing Services Program (EOPS). This program allows for the tax-free import of goods by Canadian firms for the purpose of processing the goods in Canada and for which the goods are subsequently exported. In order to qualify for this program, the firm can have no ownership interest in the good. The firm cannot be closely related to the non-resident person / entity on whose behalf the Canadian firm is doing the processing. In 2017, there were \$5 billion of goods imported under the EOPS program. The value of customs work revenue received from foreign firms is 6 billion as reported on the annual survey of manufacture. If we assume that the imports identified as part of the EOPS program align with the processing revenue recorded on the annual survey of manufacturing then \$5 billion + \$6 billion = \$11 billion need to be removed from Canadian exports of goods along with the \$5 billion import of goods.

25. Adding these adjustments to table 1 permits a very rough and modeled estimates of manufacturing services using the physical inputs of others as well as the adjustments required to Canada's merchandise trade statistics to report them on a change in ownership basis.

Product (Goods in billions)	X	M	B	Owned Materials Exported	Owned Finished Goods Imported	Processed Finished Goods Exported	Owned Materials of others Imported	X	M	B
<b>Primary</b>	290	175						290	175	
<b>Secondary</b>	182	265						182	265	
<b>Tertiary</b>	67	124						67	124	
<b>Other BoP</b>	11	11		.4	1.6	11	5	-.4	4.4	
<b>Total</b>	549	579	- 30	.4	1.6	11	5	537.6	572.4	-34.8

### III. Survey on Global Supply, Production and Distribution Chain Activities

26. While this the above estimates provide some idea of the magnitude of manufacturing services on the physical inputs of others additional information is required in order to improve / validate the estimates. In order to address these quality concerns Statistics Canada initiated the *Survey on global supply, production and distribution chain activities*. The purpose of the survey is to measure the extent of Canadian businesses' activities related to global production.

27. The survey collected information related to the purchase, production, and sale of goods abroad by Canadian businesses. It also gathered information on whether Canadian businesses performed manufacturing or processing work for other Canadian or foreign clients, and whether Canadian businesses hired other Canadian or foreign firms to perform the same type of work. Currently, the survey is an ad-hoc survey and collects annual data. This first iteration occurred in 2018. Data were collected for the year 2017 with collection occurring between April 16, 2018 and November 30, 2018. The survey achieved a response rate of 70%, which was a significant achievement given the complexity of the survey.

28. The questionnaire was developed following a series of rounds of questionnaire testing that occurred between 2014 and 2016. Given the complexity of the subject, questionnaire design specialists were required to test various versions of the questionnaire with a variety of respondents in order to establish a workable questionnaire.

29. The survey is a sample survey of business establishments classified both geographically and according to the North American Industry Classification System (NAICS) 2017, with a cross-sectional design. There were 300 enterprises in the sample. The sample consisted of a pre-determined set of firms who have been determined to most likely engage in global production activities. Various data sources were used to identify the sample. These sources provided signals related to the nature of global production activities in which businesses are involved.

30. Responding to this survey was mandatory and data were collected directly from survey respondents. Data were collected primarily through electronic questionnaire. Follow-up for non-response and for data validation was conducted by email, telephone or fax.

The survey collected information related to four themes:

- Global activities – work done based on specifications provided by clients
- Global activities – merchanting
- Global activities – work done by other business entities based on this business's specifications
- Global activities – inventories outside of Canada

31. The main use of the survey was to collect information that was not available or could not be collected via the annual survey of manufactures or obtained from Canadian customs declarations. For the purposes of producing estimates of the imports and exports of manufacturing services two key pieces of information are available from the survey.

32. With respect to estimating imports and exports of manufacturing services on the physical inputs of others the survey provided valuable information related to the amount and type of inputs received from foreign contractors or provided to foreign processors. At this point we have assumed that all of the processing fees received by Canadian firms and paid by Canadian firms involved the exchange of materials without charge. The Survey of Global Supply, production and distributions was used to confirm this assumption.

33. One of the key components of the survey was to ask Canadian firms whether they received material inputs from foreign firms when engaging in manufacturing activities. The

survey results indicate that only 20% of the time processing activities are carried out using material inputs (without charge) supplied by foreign contractors. In addition, Canadian firms indicated that they only provide material inputs free of charge to foreign processors 25% of the time.

**Shares:**

Of the selected Canadian businesses **who performed** manufacturing, processing, or assembly work for foreign clients (84),

- nearly one-third (13%+19%) received at least some of the material inputs from non-Canadian clients
- more than one-fifth (18/84) received material inputs from non-Canadian clients **without charge** (didn't pay)

**Shares :**

Of the selected Canadian businesses **who hired** foreign entities to perform manufacturing, processing, or assembly work (49),

- nearly half (27%+22%) supplied at least some of the material inputs for production abroad
- more than one-quarter (13/49) supplied material inputs to production abroad **without charge**

34. Using this information, we can adjust our estimates of both the imports and exports of manufacturing services on the physical inputs of others as well as the adjustments that were made to the Canadian import and export of goods data. The total value of imports of manufacturing services on the physical inputs of others falls to \$.2 billion and exports fall to \$1.6 billion. The total value of exports that are removed from exports of goods is now \$7 billion and the total value of imports that are removed from imports of goods is \$5.4 billion. The final estimates, using a combination of customs data, annual survey of manufacturing data and the ad hoc survey of global production, are shown in the following table.

Product (Goods in billions)	X	M	B	Owned Materials Exported	Owned Finished Goods Imported	Processed Finished Goods Exported	Owned Materials of others Imported	X	M	B
Primary	290	175						290	175	
Secondary	182	265						182	265	
Tertiary	67	124						67	124	
Other BoP	11	11		.4	.6	6.6	5			
<b>Total</b>	<b>549</b>	<b>579</b>	<b>-30</b>	<b>.4</b>	<b>.6</b>	<b>6.6</b>	<b>5</b>	<b>542</b>	<b>573.4</b>	<b>-31.4</b>

Product (Service)	Exports	Imports	Balance
Manufacturing services on the physical inputs owned by others	1.6	.2	1.4

## IV. Conclusion

35. The paper highlights some of the data developments undertaken by Statistics Canada over the last number of years in order to measure manufacturing services using the physical inputs of others. The paper demonstrated that it is possible to work with these data sources in order to develop estimates for both imports and exports as well as make the necessary adjustments to the merchandise trade-based balance of payments estimates of goods.

36. While an estimate was produced, the potential mis-measurement is high. At this point it is not apparent how and where Statistics Canada could obtain additional information to improve these estimates. It appears that, at least in the case of Canada, there exists a concept in 2008 SNA and BPM6 for which an adequate data source permitting for a detailed robust estimate does not exist. Statistics Canada also needs to undertake more work to better understand the alignment of customs reporting with the information received via business surveys. Once this work is complete, Statistics Canada will, for the immediate future, begin publishing estimates of manufacturing services on the physical inputs owned by others as a memo item to its balance of payments statistics. Once the data sources and methods mature Statistics Canada will consider integrating this into its core national accounts and balance of payments statistics. Regularly publishing these data as a memo item will allow users to understand the significance of this activity and it will ensure the agency continues to refine the data sources and methods used to measure this activity.

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