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Goods sent abroad for processing

Extract from the UNECE guide "The Impact of Globalization on National Accounts": Chapter 5

I. INTRODUCTION

1. The international organization of production has grown considerably in recent years, reflecting improved and cheaper communication and transport, trade liberalization, freer movement of capital and the presence of economies capable of offering reliable production infrastructure at low cost.

2. It used to be the case that a movement of goods from one country to another almost always involved a change of ownership, and this underlying reality was reflected in the position of the 1993 SNA. Increasingly, however, with the internationalization of production, this is no longer the case, and in response the 2008 SNA recommends a change in treatment.

3. The 1993 SNA took the position (in most cases) that there was a change of ownership when goods were sent abroad for further processing, even if the related financial transactions covered only processing fees, and so required national accounts compilers to impute transactions for the value of the goods when they were exported and subsequently returned to the legal owner. However, the growing practice of sending material abroad for further processing has raised many concerns about this treatment, which, as the size of the imputed transactions grows, has the effect of inflating international trade statistics and separating them from the related financial transactions.

4. These concerns have led to the recommendation in the 2008 SNA and BPM6 that imputations for changes in ownership are no longer to be made when goods are sent abroad for processing.

5. Other concerns also argued for a change. The 1993 SNA does not treat all flows of goods for processing in the same way: while the concept requires an imputed change of ownership when transactions take place between two affiliated establishments, whether the goods are sent abroad or not, no imputation is required when the transactions involve non-affiliated domestic establishments. Moreover, if the goods are sent abroad and then sold on without returning to the economy of the owner, no imputation is recorded. The need to harmonize the treatment related to goods sent for processing was central to the decision to change the 1993 SNA treatment. The new position was also influenced by the fact that the value imputed may not always be reliable. Though customs data attempt to capture the value of the goods for administrative reasons, that value may not reflect their market price, notably when goods are returned to their owner. Even if the imputed value is accurate, identifying the goods that have been processed presents a challenge since they are likely to be missed in production surveys, making it difficult to identify the flows in the production accounts.

6. The difficulty is not confined to the production accounts. Where processing is unfinished at the end of a period, it is necessary to record a change in inventories held by the processor (not the owner) in the capital account and the balance sheet; any related holding gains or losses, as well as risk associated with holding inventories, are attributed to the processor, whereas in reality they should be attributed to the owner.

7. Moreover the 1993 SNA imputes gross flows only where processing is substantial, while BPM5 requires gross flows always to be imputed. The recommendation in the new standards means that the treatment of goods sent for processing will be consistent in the national accounts and balance of payments.

8. The new recommendation also removes an anomaly in the 1993 SNA related to the treatment of goods sent for processing within the same economy and goods sent for processing abroad, since no transactions are imputed in the latter case.

9. The decision to stop imputing transactions for goods sent for processing also implies a change in how the accounts should be viewed. The production account, notably the input-output (IO) account, where the relationship between material inputs and production is central, will be less about physical technology and more about the contribution of each entity to the production process (or economic process). If the accounts are to reflect the economic process, it is important to distinguish between goods acquired for processing and goods bought at arm's length to be used in a production process the output of which will ultimately be sold at a price determined by the producer. This will help the behaviour of economic agents and the structuring of economic activity to be better understood. For example, goods crossing the border for processing only reflect the price of a service produced by the domestic economy, and the service producer plays no role in setting the price and marketing the final product. Increasing globalization makes it more important to focus on economic process for a fuller and more coherent picture of the production and flows of goods and services.

10. The new standard also affects the compilation and interpretation of trade in goods and services statistics, as illustrated in the case of Hong Kong (see annex 6.4) (the annex is placed after Chapter 6 because it relates to merchanting as well as processing). Implementation of the new standard on goods sent for processing will change Hong Kong's balance of trade in goods from deficit to surplus, while the balance of trade in services will go from surplus to deficit. Even though the external balance on current account is unaffected by adoption of the new standard, recording only the processing fees rather than the full value of the goods processed gives a better sense of the extent to which domestic financial resources are required to fund imports or are augmented by export receipts.

11. This chapter outlines the impact of the 1993 SNA and 2008 SNA treatments on IO statistics and how they affect the measures derived from them, such as IO models, multifactor productivity indices, and other structural indicators. It then summarizes the necessary changes in data collection and statistical estimation. The chapter also suggests some of the benefits and drawbacks that can be expected for supply and use (SU) tables. Finally, the chapter outlines how the 2008 SNA treatment affects the interpretation of IO tables.

II. Background

12. In conducting their business, firms liaise with suppliers to eliminate bottlenecks; outsource to strike a balance between the lowest material and processing costs and transport costs; implement just-in-time techniques to optimize manufacturing flow; locate factories and warehouses to best serve their markets, etc.

13. As a result, it is becoming common practice for firms to send their material to an affiliate or non-affiliate for processing. Sometimes the material (raw materials or semi-processed goods) is sent to firms within the domestic economy; sometimes the material is sent abroad. The process of sending material for processing is called "goods sent for processing". This practice is very common in industries such as chemicals and manufacturing of electronic and metal goods. The process is often referred to as toll manufacturing, toll processing or custom manufacturing.

14. One variant of particular interest for the national accounts and balance of payments is goods sent abroad for processing, where a unit in country A (the principal) makes a contract with a unit in country B (the contractor) under which B transforms in a substantive way raw materials or semi-processed goods sent by A. The principal maintains legal ownership of the raw materials and semi-processed goods throughout, as well as of the processed goods. The principal pays the contractor a fee for the processing or assembly.

15. Similar arrangements also pose issues for the national accounts, but do not fall under the definition of goods sent abroad for processing and are not discussed in detail here. For instance, a unit in country A may have its goods processed by a unit in country B, but then sells the goods to another unit in the same country (B) without bringing them back to A. Here the treatment is not that of goods sent abroad for processing, as BPM6 makes clear in paragraphs 10.17(g) and 10.22(f): a first transaction will show a processing fee paid by country A to country B, and a second the export of the processed goods from A to B, because ownership has changed. Similarly, if the processed goods are sold to another unit in a third country, C, without returning to country A, the recording does not fall under goods sent abroad for processing: rather, a processing fee (part of trade in services) is paid by country A to country B, while an export of the processed goods will be recorded from A to C. Another possibility is that a unit in country A arranges the processing, but the goods do not come from country A – this is akin to the examples of global manufacturing discussed in Chapter 8.

16. In the 1993 SNA a transaction may or may not be recorded between two firms, depending on the situation (paragraphs 14.61-14.64 provide details on how to deal with goods sent for processing).

17. The fact that not all processing is treated the same way in the 1993 SNA and in BPM5 presents a challenge for IO compilers. Domestic processing is recorded without imputing a change of ownership to the processing establishment unless the processor is part of the same enterprise as that supplying the goods. Equally, in international processing where the goods remain in the processing country or go to a third country, a change of ownership is imputed if the establishment is part of the same enterprise that supplied the goods or if it is a direct investment enterprise of the supplier of the goods. So imputations are made when goods are sent for processing between affiliates, but when goods are sent for processing between non-affiliated establishments, imputations are made only if the goods cross borders and then return to the owner, and not if the goods remain abroad. It is unlikely that analysts are aware of these fine distinctions and can see what changes are taking place in industries subject to growth in outsourcing without close investigation of how many goods are subject to each recording treatment. Nor does the different treatment assist the IO compilers.

18. According to the 1993 SNA a transaction should only be imputed when the amount of processing is significant - in practice when the goods sent abroad are classified after processing to a different group (3-digit level) of the Central Product Classification. Minor operations on goods such as repair and packaging are not regarded as processing. The BPM5 requires all processing to be recorded on a gross basis, as if a change of ownership has occurred. This lead to possible mismatches between national and b.o.p. accounts.

19. A review of the concept of imputation concluded that the current treatment is not consistent with one of the basic principles of the balance of payments, that a transaction should involve a change of ownership. Accordingly under the 2008 SNA and BPM6 the value of goods for processing ceases to be recorded in the goods account: under the new standard, the payment of processing fees by the owner of the goods will be

recorded as an import of services. This recommendation extends to goods sent for processing domestically. The new standard has the advantage of being more in line with company accounts, while meeting a desire to avoid imputations; it also better accords with financial transactions.

20. It is however difficult to measure the size of goods sent abroad for processing. In many countries merchandise trade statistics record goods when they cross the border, whether or not there has been a change of ownership. Consequently, goods sent abroad for processing are included indistinguishably in the merchandise trade statistics.

21. A special study prepared by the Hong Kong Census and Statistics Department shows that trading activities related to goods for processing and merchanting are quite significant for Hong Kong. Estimates based on earlier data suggest that the new standard will reduce Hong Kong's exports of goods by (US) $20 billion and its imports of goods by $69 billion, turning a deficit of $23 billion into a surplus of $27 billion. Conversely imports of services may rise by $27 billion while exports of services may decrease by $23 billion, turning a surplus of $45 billion into a deficit of $5 billion. Trade in goods is reduced under the 2008 SNA because a value is no longer imputed for goods sent for processing; the increase in imports of services reflects the processing fee which was embedded in the imputed value of the goods under 1993 SNA, while the reduction in exports of services reflects the new treatment of merchanting.

III. International standards

A. The 1993 SNA and 2008 SNA treatments

22. The 1993 SNA treatment of goods sent abroad for processing affects the current, production and accumulation accounts.

1. Current account

23. Under the 1993 SNA, a value is imputed for raw materials or semi-processed goods entering a country for processing, as an import of goods. The processed goods are then returned to the supplying country and a value is again imputed and recorded as an export of goods. The difference between the two values is assumed to be equal to the processing fee paid. In practice, it is likely that the difference will not be equal to the processing fee: this may be because prices have changed over the processing period, or because part of the increase in the value of the processed goods reflects the embodiment of intellectual property or trademarks (brand) owned by the principal.

24. Under the 2008 SNA, the imports and the exports of goods sent for processing are no longer recorded. Processing fees are recorded, as a service. In principle, the overall current account balance is not affected. However, trade in goods diminishes while trade in services increases by the same amount. In practice, the current account balance may be affected, if some value added properly attributable to the entity sending the goods for processing, which under the 1993 SNA treatment was reflected in their value after the processing, is not included in the processing fee.

2. Production account of the SNA

25. Under the 1993 SNA, the value of goods sent for processing entering the country of the contractor is 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 processing fee. In the 2008 SNA, the value of the goods to be processed is not included in intermediate consumption. Value added in the processing economy should be unaffected.

3. Accumulation accounts in the national accounts and balance of payments

26. The 1993 SNA imputation of a change of ownership in favour of the processor implies a need to record a change in inventories in the capital account and balance sheet of the processor if processing is unfinished at the end of the accounting period. Since the capital account and the balance sheet of the country providing the material will also be adjusted for inventories, imputations will be necessary in the financial account of both

countries to prevent errors and omissions in the balance of payments equal to the value of the goods sent for processing. Under the 2008 SNA, no imputations will be necessary, though better information on business practices related to trade in goods will be needed.

27. The following sections deal with the various implications of the changes related to goods for processing in the 2008 SNA on the industry and commodity accounts of the IO framework, viewed from the perspective of the client (the principal) and the processor (the contractor).

IV. Measurement and analytical problems

A. Measurement problems

1. Goods for processing and the input-output framework

28. The IO accounting framework contains two sets of accounts, the industry account and the commodity account. The industry account reflects the entries of columns in the SU framework. The commodity account reflects the entries of the rows in the framework. The former provides details about the output of industries and the cost structures of production. The latter details the supply and use of individual commodities. The impacts are described in the context of the 1993 SNA and the 2008 SNA.

29. In the example, a principal unit in country A sends semi-processed goods for further processing to a contractor unit in country B. The contractor does not pay for the material received from the principal unit. The value of the goods sent for processing is 100. The value of the goods after processing, assumed to be finished goods requiring no further processing, is estimated at 160. Processing fees in this example are for simplicity set at 60 (but in practice, as described above, such equivalence between the value of goods before and after processing and the processing fee is unlikely).

Industry account

30. Under the 1993 SNA treatment (table 1), 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 is equal to intermediate inputs and the value added by the contractor, 160 in this case. The nature of the goods produced is different from that of the goods supplied by the principal. Gross output is classified as a good.

Table 1
Industry account under the 1993 SNA

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

31. 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. Processed goods return from country B, and (because they are assumed to be finished goods) are treated as goods purchased for resale, with the principal adding margins of 20 in the example above (if the processed goods required further processing by the principal, an additional entry of 160 in the intermediate consumption column of the principal would be necessary). 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 specific type of processed goods. If only part of the production process is outsourced, the principal is classified according to the activity representing the complete production process, i.e., it is classified as if it was carrying out the complete process, including the contracted work, itself. As a result, the unit is classified in the industry that mainly produces that type of processed good.

32. Under the 1993 SNA, an incoherence will occur in preparing the production account of country A if processing fees embedded in imports of goods processed abroad are not removed from the operating expenses reported (in a survey) by the principal in country A.

33. Under the 2008 SNA (table 2), the industry structure in country B will change significantly. In the processing country, gross output will reflect only the value of the processing (60) since no imputation will be made to value the semi-processed goods received from country A. Moreover, production will be classified as a service, not a good. Value added will remain the same, 30. However, the relationship between GDP and gross output will change: in this case the GDP to gross output ratio rises from 19 per cent under the 1993 SNA to 50 per cent under the 2008 SNA, even though the amount of labour and capital provided by country B remains the same.

Table 2
Industry account under the 2008 SNA

	Contractor (Country B)	***Principal (Country A)***
Gross output		
Goods		180
Services	60	
Intermediate inputs		
Goods for processing		
All other goods	20	50
Processing fees (services)		60
All other services	10	20
Value added	**30**	**50**

34. Under the 2008 SNA, the link between the production (gross output) of domestic goods and domestic employment, as well as the link between gross output and the use of fixed capital, will change for both the contractor and the principal. For the contractor, value added to output ratios will be higher. For the principal, the ratios of value added to gross output in the 2008 SNA will lie between the ratios obtained under the 1993 SNA - with the lower bound ratio of the 1993 SNA being the ratio that would be observed if the goods processed by B required further processing by A, and the higher bound ratio being the ratio that would be observed if no further processing was required. The relationships between value added and employment and fixed capital are the same in the 1993 SNA and the 2008 SNA. Relationships involving production will however differ.

35. Production in country A under the 2008 SNA records 180 under goods, comprising the value of the semi-processed goods (100), the processing costs (60) and a return on sales (20). Both the contractor and the principal will be classified in the industry related to the processed goods (assuming that the processed goods are not subject to further processing by the principal). Under the 2008 SNA, the principal will show a smaller amount of capital and labour in relation to production. For the principal, the relationship between capital and labour and gross output will be different from that of other units in the industry, since it was the labour and the capital of the unit in country B that was used to produce part of the goods now recorded as the output of the principal.

Commodity account

36. Implementation of the 2008 SNA, which emphasizes recording transactions and not the production process as such, will also affect the commodity account.

37. Under the 1993 SNA, when goods sent for processing enter the processing country, a value is imputed under imports on the supply side of SU tables. The SU tables are balanced by imputing a similar amount under intermediate inputs on the use side. The processed goods are recorded under production on the supply side and exports on the use side. Processing fees are not separately recorded since their value is embedded in the value of the processed goods (table 3). 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 accounts under the 1993 SNA and 2008 SNA: country of the contractor

Country B	*Supply*		*Use*			
	Production	*Imports*	*Intermediate inputs*	*Exports*	*Inventories*	*Other final demand*
1993 SNA						
Goods for processing		100	100			
Goods processed	160			160		
Processing fees	NA			NA		
2008 SNA						
Goods for processing						
Goods processed						
Processing fees	60			60		

38. Under the 2008 SNA, 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 under production of services and exports of services. This may create some difficulties when it comes to interpreting the accounts. For example, for a country receiving crude oil for processing which is then exported back to the country of origin, analysts may have some difficulty establishing relationships between the volume of production of refined petroleum products and exports, as only exports of services (related to petroleum) will be recorded under the 2008 SNA.

39. In the country of the principal (country A), the commodity account will also be affected significantly under the 2008 SNA (table 4). Under the 1993 SNA, in the country of the principal, in order to balance the SU tables, it was necessary to make the semi-processed goods disappear as exports (100) and reappear statistically as imports of another good at a higher value (160). In the example in table 5.4, some of the goods returning to country A after processing are consumed as intermediate inputs, some are exported or consumed by other final users, while some go into inventories.

Table 4
Commodity accounts under the 1993 SNA and 2008 SNA: country of the principal

Country A	*Supply*			*Use*			
	Production	*Imports*	*Trade margin*	*Intermediate inputs*	*Exports*	*Inventories*	*Other final demand*
1993 SNA							
Goods for processing	100				100		
Goods processed		160	20	W	X	Y	Z
Processing fees							
2008 SNA							
Goods for processing							
Goods processed	180			W	X	Y	Z
Processing fees		60		60			

40. Under the 2008 SNA, production of semi-processed goods (goods for processing) disappears and processed goods will appear as being produced in the country (A). Only processing fees will appear in international trade, under services.

41. The processing may not be completed within the period. Under the 2008 SNA - unlike under the 1993 SNA, which assumes that the inventories are the property of the contractor, requiring an imputation - the material to be processed remains the property of the principal and should be recorded as part of the principal's inventories. The 2008 SNA may require some modifications to surveys to ensure that they do not incorrectly include inventories owned by the principal in the balance sheet of the contractor.

2. Measurement problems in compiling input-output accounts in the presence of goods sent for processing

42. The implementation of the 2008 SNA will affect the compilation of the industry and commodity accounts and the way in which these relationships are interpreted. The next two sections focus on compilation issues related to the two accounts. It is clear that the change related to goods for processing will potentially lead to larger variations in input-output coefficients. However, it is important not to overstate this argument, at least in relation to 1993 SNA. It is worth noting that the new concept was partially in place in 1993 SNA for goods sent for processing to a non-affiliated resident enterprise. It is also important to recognize that any given industry grouping will probably include establishments with different production functions and, at the margin, different products. Some firms will be capital intensive and others labour intensive. Some will outsource service activities while some will have retained them in-house. Some will be responsible for the entire production and others will purchase semi-finished products before producing the final goods. All these factors are also sources of variability of the IO coefficients, in both nominal and volume terms.

Industry account

43. In principle, the 1993 SNA and 2008 SNA treatments of goods sent for processing lead to exactly the same GDP for the industries and economies of all countries.

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

- Inconsistent reporting between the gross flows obtained from customs sources and the service flows obtained from production-related surveys.
- Data gaps about international transactions in commercial services.

45. There is however a further practical consideration. Compilers usually attempt to preserve some stability in IO coefficients (such as ratios of value added to output) as a way of dealing with volatile data, focusing on production technology coefficients in compiling IO tables. The 2008 SNA will cause problems for this approach, since the emphasis is on the transactions and not the technologies. If for example a conventional manufacturer begins to operate also as a processor, in addition to its normal output, its ratio of value added to output will change in the 2008 SNA, whereas in the 1993 SNA its ratio would be broadly unaffected. It is important however to put this into perspective. In the 1993 SNA, such a change already occurs if the goods are sent for processing to a non-affiliated domestic processor. Moreover, IO ratios change for a number of reasons, for example improvements in productivity, or changes in the type of goods produced by the main industry, in the shares of output produced by companies in a particular industry classification, or from outsourcing of services. The 2008 SNA merely adds goods sent for processing abroad to the many reasons why IO coefficients may change.

46. However, that is not to say that improvements for IO compilers are not worth pursuing. Compilers focus on IO coefficients because within a particular industry the ratios of value added to output of all companies tend to be similar. In the 2008 SNA it is evident that this is not so for enterprises which process goods sent from abroad and producers in the same industry which own the goods they use in production. But if the IO accounts distinguished between the output of processors and conventional producers (who own the goods used in intermediate consumption), the problems posed to compilers by changes to IO coefficients because of the 2008 SNA treatment of goods sent abroad for processing would be resolved – as would be the

problems in the 1993 SNA caused by goods sent to non-affiliated domestic processors. However this would increase the reporting and compilation burden. Another solution would be to add an adjusting entry in the commodity account to simulate the 1993 SNA. This possibility is covered later in this chapter.

Commodity account

47. As explained earlier, the revisions to the 1993 SNA and BPM5 concern the question of whether a change of ownership of the goods is attributed to the processing unit in country B when material inputs move there from the unit in country A, and then again when the processed goods are shipped back to the original unit in country A.

48. It is helpful to describe at this point how transactions recorded under the 1993 SNA or "imputed" treatment appear in a statistical system where the production accounts are fully integrated with the balance of payments account. Under the 1993 SNA, respondents acting as a contractor report their inputs and outputs on a net basis, meaning that they report as output the fee they receive for processing goods for principals, and report only their own intermediate inputs. They do not report the value of semi-processed goods provided by the principal from abroad. At the same time, their imports of semi-processed goods and exports of processed goods appear as imports and exports in the IO tables on a gross basis, consistently with the balance of payments data obtained from customs sources. In order to arrive at a balance between the supply and use of output and input commodities, IO analysts must enter a series of adjustments. This amounts to increasing the value of output such that it is equal to the value of exports recorded in the customs statistics, and raising the industry's inputs by the value of semi-processed goods (the import amount).

49. This exercise retains the industry's balance of outputs and inputs (since the processing fee is assumed to be 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. When processing continues over more than one period, inventories are also adjusted. This imputation procedure describes the actual compilation practice in countries where processing is significant and there are sufficient data for the adjustments to be made with reasonable confidence of improving industry statistics.

50. Unfortunately information about goods sent for processing is often missing, affecting compilation of the SU tables. In many countries, goods crossing the border free of charge are valued for administrative reasons at some approximation to market price.

51. In many countries, manufacturers provide in surveys information on:

- Turnover and inventories.
- Receipts for doing work to the order of others.
- Cost of own material.
- Sub-contracting expenses.

52. The manufacturer is not asked to estimate a value for the material he receives for processing, and may not be able to do so. As a result, IO analysts must deal with international trade data that contain the value of goods sent for processing and with manufacturing data where no imputation has been made for the value of goods received and processed. Table 5 shows the difficulty of balancing the SU tables.

Table 5
Supply and use tables and the contractor

Balancing supply and use tables – the contractor case							
Step 1: 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							Imbalance

53. In step 1 of the production process, semi-processed goods are imported into country B (75). Since they were not paid for by the contractor, a first imbalance appears in the SU tables: the use of the commodity will be lower than its supply. Based on his assessment of the reliability of the various data in the SU table, the IO compiler may adjust inputs to balance the system, implicitly imputing a value, following the 1993 SNA approach, for the material that enters the country but was not captured in business surveys.

54. In step 2, production takes place and the processed good is sent back to its owner in country A. An export of 100 is recorded. However, no value will have been collected in business surveys except the amount the contractor in country B receives for processing the material. As a result, a second imbalance could occur. In the 1993 SNA, the imbalance is dealt with by adjusting production.

55. Finally, in step 3, since the processing fee would have been embedded in the value of the exported processed goods, it is not clear to what extent national accountants are able to deal with the double counting of processing fees which are, in theory, reported by the contractor and included indistinguishably in the value of exports.

56. Table 6 shows that similar imbalances may also occur in the case of the principal. In this case, the principal unit that has produced the semi-processed goods sends the goods to country B; they are recorded in customs statistics and the 1993 SNA as an export of 75. No output is recorded by the principal (unless the business survey relates to a period in which the semi-processed goods are in the hands of the processor, in which case output and a change in inventories of 75 are recorded).

Table 6
Supply and use tables and the principal

Balancing supply and use tables – the principal case							
Step 1: 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		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

57. Another imbalance occurs after the contractor delivers the goods to the principal. The goods are imported into country A at a value of 100. But their owner (the principal) would have reported output of 100 in the manufacturing survey, creating an imbalance.

58. Finally, another imbalance arises since the manufacturer (principal) in country A reports a processing fee (expense) of 25, an amount hidden in the value of the goods imported.

59. The lack of coherence between international trade data and domestic surveys potentially creates imbalances in the commodity accounts in the absence of explicit information on the value of goods sent for processing. This will change with the implementation of the 2008 SNA, provided trade statistics are consistent with the corresponding financial transactions. Nevertheless in practice the problems illustrated above may remain after implementation of the 2008 SNA. It is likely that many customs authorities will continue to measure exports and imports on a gross basis. However, whereas currently compilers must estimate the imputations made by customs officials and then allocate them to industries, corrections will instead focus on the original trade data.

3. Transportation margins

60. With the implementation of the 2008 SNA, transportation services will replace transportation margins in the IO account.

B. Analytical challenges

1. Input-output linkages

61. A potential analytical disadvantage of not imputing a financial transaction for goods sent for processing, depending on the way in which IO tables are interpreted, relates to estimates of forward and backward linkages, which would change significantly under the 2008 SNA treatment. For example IO tables in the 1993 SNA address a question about how much upstream production or employment is associated with petroleum by-products by recognizing that the petroleum refiner requires oil as an input, and so in calculating the upstream impact of petroleum production take into account the employment of labour and capital and the use of other goods and services in extracting the crude oil. However with the 2008 SNA the explicit link that reflects the use of imported crude oil in petroleum refining will not be present, and so the calculation of upstream impacts will differ. Whether this is a good or a bad thing depends on the perspective. For example the same break occurs when services are outsourced, even if those services require some intermediate input from the principal. Moreover calculations measuring what employment, etc. was created in upstream industries as a result of the output in the relevant industry typically focus on the impact on other domestic industries; the imported products used in production are not relevant for this purpose, meaning that the 1993 SNA and 2008 SNA will show the same upstream impacts. It is important to note in this context therefore that, in practice, the problem of measuring upstream impacts is more affected by domestic processing; and in this context the 1993 and 2008 SNAs are equally affected. A further question can be asked: should it be the activity of the contractor whose services are being purchased that is taken into account, since the catalyst for the activity is the principal, who determines the output of the contractor? Seen in this way, the 2008 SNA approach may be a better basis for measuring the impact on upstream activities.

2. Regional input-output tables

62. A key impact of not imputing a change of ownership on IO linkages as discussed above concerns regional SU tables. Integrated national-regional tables show links not only across production processes in different industries, but also across regions through an interregional trade flow matrix. Regional tables are often 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 production industries normally collect information on revenues and costs related to contract processing or "custom work", a net treatment is built into the compilation of regional SU tables. As

in the petroleum refining example, not imputing a change of ownership would result in changes to the estimates of upstream impacts, severing linkages when goods are sent to other regions for processing, thus limiting the value of IO tables for assessing technological dependencies between industries and regions. In this particular case, an imputation would be necessary in the regional tables to maintain the technological links for petroleum products.

3. International trade

63. The 1993 SNA requires gross values of imports and exports to be recorded when goods are sent abroad for processing. The clearest drawback of this treatment is that it exaggerates the highly visible and widely used measures of import intensity and export performance for production industries generally and for individual manufacturing industries. Trade ratios such as exports/gross output and imports/production overstate true export and import intensities and exaggerate the dependence of industries on external trade. In addition, by hiding the value of processing services in the gross value of traded goods, the treatment understates the value 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 avoid the distortive effect of outsourcing, including the cases of goods sent abroad for processing.

64. Under the 2008 SNA treatment, only imports and exports of services related to goods sent abroad for processing will be recorded in the final demand section of IO tables. As a result, the analysis will produce a lower estimate of imports associated with (or used in the production of) exports because it will be restricted to imports where ownership changes. In this case, the 2008 SNA treatment effectively changes the answer to an IO inquiry, and it would be important to explain to IO users how the 2008 SNA treatment affects the data.

4. Input-output models

65. IO determination models 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 starting from equilibrium. To the extent that an industry uses the outputs of other industries in its own production, it has a backward linkage to them. Similarly, an industry that supplies the intermediate inputs of others through its own production has a forward linkage to them. 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 to the production of the rest of the system. Under the 1993 SNA 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 lower impact coefficients in the output determination model, thereby reducing the total impact of any exogenous change on gross domestic output, though not on value added.

66. On the other hand, a large number of industries could be involved in processing. For each of them, it would be ideal to identify the component of processing fees received from other industries. If processing could not be associated with a specific industry, allocating the demand for processing services to producing industries based on market shares would spread the gross output to all producers involved in processing. For modelling purposes, the 2008 SNA treatment requires much detail on processing by industry in order to properly calculate IO impacts related to processing. Again, it should be recalled that under the 1993 SNA the same challenges occur for contractors providing processing services to domestic principals.

5. Productivity measures

67. Where a production industry consists of one segment that operates on a traditional business plan and another segment that engages in contract processing, the implication for productivity of the increasing prevalence of goods for processing deserves a mention. When processing goods for a principal (as opposed to traditional own-account processing) becomes more prevalent in an industry, the industry's contribution to GDP (and GDP growth) is unaffected whether the imputing treatment is followed or not. It follows that the growth of productivity in the industry 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 productivity may rise, because the contractor is likely to make better use of capacity.)

68. Under the 1993 SNA and 2008 SNA, the GDP derived from the operations of the principal will be the same and will have no impact on productivity estimates. However, as indicated in tables 5.1 and 5.2, the output and intermediate inputs structure will change, as for the contractor. Consequently, productivity measures could be affected depending of the coherence of the deflators used under the two concepts.

69. Because of the change in the input-output structure, under both concepts the derivation of multifactor productivity estimates, where the result is a function of gross output and intermediate inputs, is more difficult to predict and will require further work.

C. Operational treatment

1. Adjusting entries

70. The implementation of the 2008 SNA should make it easier to balance the commodity account. It is not so clear in the case of the industry account, where assumptions about homogeneity of the industry structure are often used. One solution 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. An alternative may be to start by balancing IO tables using the 1993 SNA approach to goods sent abroad for processing, with entries that impute changes in ownership subsequently removed to arrive at 2008 SNA IO tables. Such an approach would mean that complementary IO tables would be available for conventional analyses of production technologies. The approach could be extended so that any goods sent for processing to domestic processors could also be imputed.

71. The adjusting entries should be viewed as a valuation adjustment allowing the production accounts to be converted according to various concepts. In this case, an adjusting entry would allow the physical or technological process of the production accounts to be shown while permitting viewing that same set of accounts by emphasizing financial transactions. This approach is no different from the decomposition of, say, intermediate inputs into their basic costs and various margins. It can be extended to include conceptual and statistical adjustments to source data when the industry and commodity accounts are compiled. Adjustments 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 that would exclude goods for processing. This type of information would be very useful to IO compilers in interpreting structural changes.

72. Though goods sent for processing are mostly discussed in an international context, the phenomenon also occurs on domestic markets. When goods move between affiliates (establishments of the same firm), there is no change of ownership since the entities have the same owner. It will be easy to implement 2008 SNA in such a case. However, where goods move from A to its affiliate B and then B sells the processed goods on the open market, a change of ownership must be recorded. In such a case, according to the 2008 SNA, establishment A is viewed as taking the risks related to production, determining the price of the processed goods and finding buyers for them.

73. When establishments belong to different enterprises, the determining factor remains economic ownership. According to the 2008 SNA *"if an establishment has no discretion about the level of production, the price to be charged for the good or the destination of the good, there is evidence that the establishment has not taken economic ownership of the goods being processed and the value of the output should be treated as the processing element only"* (paragraph 6.85).

74. The approach proposed to record international activities of principals and contractors can be used to record activities of principals and contractors engaged in transactions between domestic firms in the same set of accounts. When the focus is on physical transactions, an imputation must be made to value goods sent for processing, but the imputation must be removed when the focus is financial transactions (2008 SNA).

2. Trade data

75. The compilation of balance of payments statistics on imports and exports of goods starts with merchandise trade statistics, which record all goods which add to or subtract from the stock of material resources of a country by entering (imports) or leaving (exports) its economic territory. No distinction is made as whether the material is owned by residents or non-residents. With the implementation of the 2008 SNA and BPM6, a large conceptual gap will open with merchandise trade statistics, since the ownership principle will be used for national accounts and balance of payments statistics while the physical movement of goods will remain the focus of the merchandise trade data (in accordance with International Merchandise Trade Statistics, 2010 (IMTS 2010)). The IMTS conceptual framework gives priority to statistics reflecting physical cross-border movements of goods. The IMTS aim at satisfying the information needs of various groups such as international trade policy makers and commodity market analysts. IMTS data will naturally remain a prime source of information to national accounts and balance of payments compilers. For their benefit, IMTS data could usefully be coded to identify goods for processing as well as goods resulting from such processing. One possible approach to removing goods sent for processing values from merchandise trade is to identify goods that are declared as "for processing" when they clear customs, and use the information to adjust merchandise trade estimated on a balance of payments basis. Goods going into and leaving free trade zones (FTZs) could be tagged for this treatment. Specific measures would need to be taken to distinguish the goods subject to this treatment - those which go into FTZs and come back to the same unit in the country - from other goods. For goods processed outside these zones, international agreement between customs authorities of major trading partners would be needed specifically dealing with the terms and conditions of identification, evaluation and reporting of goods for processing. The tagged information on exports and imports would need to be collected at the most detailed level of the harmonized commodity classification in order to make it possible to link them with commodity categories in the SU tables, allowing analysts to compare the net values of tagged exports and imports with processing costs incurred by principal units and revenue data from processing units obtained from industry sources.

76. An alternative data source for both principal units and contractor units is linked to surveys related to international transactions in commercial services. This type of survey is used to provide data on the services components of imports and exports in the balance of payments. Ideally, such a survey should be linked to a complete business register, allowing data collected through the survey to be linked with data obtained from surveys supporting the compilation of the production accounts, such as a survey on production by manufacturers which is the main source of data on inputs and outputs of production industries. The survey would collect data on contract production services from large plants most likely to be involved in the export and import of commercial services. 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 the same enterprises' exports and imports of goods identified in merchandise trade that meet the definition of goods sent abroad for processing.

3. Sampling

77. The 1993 SNA exposes the data collection process to a sampling problem when it treats contractor-type producers and the traditional producers which make up the majority of units in an industry as homogeneous. Some countries seek complete coverage of MNEs and other entities accounting for a large proportion of the industry's turnover, and sample other smaller establishments, grossing up the sample results for non-sampled units. Units in the same industry or sampling stratum will have the same probability of being selected for the sample. 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 the contractor-type producers 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 variability into time series of basic industry statistics even when a simple random sampling procedure is used.

78. Finally, contractor-type producers will have fewer chances of being selected in the sample if sampling is based on turnover instead of value added. This is important in relation to the issue underlying table 5.5 since,

without information about the mix of producers, it will be difficult for IO compilers to assess the accuracy of the production accounts.

4. Intra-annual surveys

79. Several countries collect intra-year data on turnover and inventories in order to monitor production in the manufacturing sector. To the extent that sending goods abroad for processing is important, surveys which do not distinguish between shipments and processing fees will be misleading. Finally, since the price of goods processed and the "price" of processing services will probably differ, price deflators for processing need to be developed.

5. Annual surveys

80. Given the probable difficulty of obtaining satisfactory trade data from the more frequent surveys, annual industry surveys can be used as a second and complementary source to obtain estimates of exports and imports of goods for processing. For a principal unit, new questions in production surveys should cover the value of goods of own manufacture that are sent abroad or outsourced domestically for processing, the post-processing value when the goods are returned, and the fees paid to foreign and domestic contractors that, adjusted for timing and transaction costs, make up the difference between the two values. The two gross values, summed across all industries, could be compared with the tagged data obtained from customs sources to enhance data quality and consistency of a given class of goods.

81. Data on costs of processing services when goods are processed abroad and revenues earned by domestic contractors from foreign clients are two important elements required in order to implement the 2008 SNA. In general, in current surveys, from the response of processors, it is not possible to determine if the principal being served is an affiliate or not, located abroad or domestically, and whether the goods are returned to the principal or shipped to a third party or country. Moreover, it is often not possible to separate costs related to goods for processing from other outsourcing costs. Current surveys must be expanded in order to better measure the goods for processing phenomenon. In the case where the principal is a resident firm, information about the value of the goods returned from processing would be valuable, since it could be compared with customs data, assuming the value of the processed goods can be identified in merchandise trade statistics. This would greatly facilitate the compilation of statistics according to the 1993 SNA that many analysts such as IO modellers focusing on physical movements of goods would like to obtain.

82. Similarly, information is often available regarding the gross income of processing units from contracting fees, often referred to as revenues from "custom work". Such income will include processing for domestic and foreign principals, and income from processing that meets the definition of goods for processing as well as from other activities. More specific wording and a separate question in these surveys are needed in order to isolate income from processing goods for foreign principals and so allow comparison with the net values of trade obtained from international trade statistics.

83. Various attempts have been made to collect information about amounts paid to and received from sending or receiving goods for processing. Results indicate that the flows concerning processing abroad are very difficult to observe. The fact that goods often return in a different time period, the difficulty for MNEs to distinguish between domestic processing and processing abroad, and valuation problems due to discrepancies caused by import tariffs and duties and transportation costs, all present a challenge for quantifying the phenomenon of goods sent abroad for processing.

6. Prices

84. Industry statistics are prepared in real as well as in nominal terms. Price indices are normally available for products, but much less information is available about prices related to assembling them.

85. With the implementation of the 2008 SNA and the concept of goods for processing, there is a need to develop price indices for both the production and intermediate consumption of contractor-type producers. The price of the final product and the "price" of the processing service are unlikely to move in line.

Box 5.1. Implications for environmental accounting

The implications of the 2008 SNA regarding merchanting, production abroad and goods sent abroad for processing are not confined to the national accounts. The question arises in addition of how physical flows underlying these transactions should be recorded in the System of Environmental and Economic Accounting (SEEA). The purpose of environmental accounting is to describe how economies interact with the environment as well as with other economies. The SEEA and many of its accounts attempt to describe the physical requirements of the economy. The new 2008 SNA recommendations will mean that some of the key physical flows will no longer be recorded in the national accounts, because there is no accompanying change of ownership.

The London Group on Environmental Accounting has decided to record transactions according to the economic, and physical flows according to the physical, reality (option 2A in the paper of van Rossum and others, 2010)). This means that transactions are recorded as recommended in the 2008 SNA and physical flows are recorded corresponding to the physical reality, which is that goods for processing cross borders whereas goods subject to merchanting do not, with a consequent (and regrettable) loss of consistency between the 2008 SNA and the SEEA. Users of the data should be aware of some consequences for hybrid indicators and IO analysis. The lack of consistent national accounts and physical data means that great care should be taken when deriving hybrid indicators or performing IO analysis.

Interpretation of production-based hybrid indicators (like energy and material productivity) needs to be made carefully, as was the case with the 1993 SNA which, for trade between non-affiliated resident enterprises, did not impute a change in ownership for goods sent for processing. The 2008 SNA brings the transactions between non-resident enterprises into line with those between resident enterprises, which will change current statistics and affect the interpretation of hybrid indicators. For this reason a change in a hybrid indicator needs to be interpreted very carefully, since it may reflect an improvement or worsening in environmental efficiency or merely a change in the legal arrangement between principal and contractor. To avoid these issues, it is recommended to use hybrid indicators based on value added.

The 2008 SNA treatment also has potential implications for environmental IO analysis. Depending on whether the enterprises involved in processing produce goods on their own account or not, implementing the new 2008 SNA concepts may make industries appear more or less homogeneous.

V. Concluding remarks

86. Globalization brings a need to portray production activities in a different way, with more focus on how globalized production is organized rather than on the technology of production. Information on international trade needs to be better related to information on business practices.

87. A better understanding of goods sent 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 the economy. In many ways, the 2008 SNA will be simpler to apply than the 1993 SNA since it will no longer be necessary to impute values in various parts of the IO framework. The recording of goods for processing was discussed extensively during the updates of the 1993 SNA and BPM5, and agreement was reached to cease imputing a value for such transactions. Implementation of this aspect of the 2008 SNA could be difficult due to data gaps. But so it is also when applying the 1993 SNA - imputing for goods for processing requires adjusting annual surveys on production to customs data, while not imputing requires removing goods for processing from customs data to align them with annual surveys on production. Consequently, national statistical institutes will probably need to continue to gather a significant amount of information on goods for processing. Above all, there is a need to ensure they are removed from customs data designed to meet administrative needs.

88. It is recognized that implementing the 2008 SNA will change the structural relationships shown in the IO framework based on the 1993 SNA. The conclusion suggested by this analysis is that both the "imputation" and the "no imputation" treatments should be maintained to ensure that SU tables continue to be useful.

Compiling and presenting the data on both bases and informing data users should preserve the advantages of both treatments. The fact that statistics on goods for processing are necessary to implement both the 1993 and 2008 SNA concepts makes this approach very attractive.

89. The SU framework is the only statistical framework that explicitly shows what goods and services enter into the production of other goods and services. How this relationship or "production technology" is represented is critically important to the questions that SU tables can answer. It will be necessary to explore further 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 IO tables.

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