Organisation for Economic Co-operation and Development

SDD/DOC(2021)2

Unclassified

English - Or. English

20 August 2021

STATISTICS AND DATA DIRECTORATE

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SDD WORKING PAPER No. 109

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JT03480137

Developing thematic satellite accounts

The example of a thematic satellite account for transport

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[1] The author would like to thank Ann Lisbet Brathaug (Statistics Norway), Herman Smith (United Nations Statistical Department), Jim Tebrake (International Monetary Fund, former Statistics Canada), Elena Rusticelli and David Turner (OECD Economics Department), and various other national accounts experts for their valuable suggestions to this paper.

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Abstract

The 2008 System of National Accounts (SNA) provides the international standards for compiling macro-economic statistics. In addition to the core set of accounts, the 2008 SNA also introduces satellite accounts, which are linked to, but distinct from, the central framework of national accounts. One type of satellite accounts involves some rearrangement of central classifications and the possible introduction of complementary elements, to give a more detailed description and monitoring of a certain theme, such as tourism, education, health, the digital economy and transport. They may involve some differences from the standards applied in the central framework, but they generally do not change the underlying concepts of the SNA in a fundamental way. The second type of satellite analysis is mainly based on concepts that are alternatives to those of the SNA. They may include a different production boundary, an enlarged concept of consumption or capital formation, an extension of the scope of assets, and so on.

There is a growing demand for satellite accounts, especially for the first type of thematic satellite accounts. This paper aims to clarify the key steps for the compilation of such thematic satellite accounts, using the example of a satellite account for transport. The main steps to arrive at an enlarged set of the traditional supply and use tables, as well as possible extensions of the institutional sector accounts, are described. It may thus support (more significant contributions to) the set-up of such satellite accounts by the people responsible for the relevant area of statistics.

Keywords: national accounts, 2008 SNA, satellite accounts, transport satellite account

JEL Classification: E01, L91

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Résumé

Le Système de Comptabilité Nationale (SCN) 2008 fournit les règles internationales pour le calcul des statistiques macroéconomiques. En plus d'un noyau central de tableaux comptables, le SCN 2008 introduit également des comptes satellites qui sont liés au cadre central des comptes nationaux, tout en lui étant distincts. Un premier type de comptes satellites implique une réorganisation des nomenclatures de base, avec une possible introduction d'éléments complémentaires pour donner une description détaillée et suivre un certain domaine, par exemple le tourisme, l'éducation, la santé, l'économie numérique ou le transport. Ces comptes satellites peuvent comporter des différences par rapport aux normes qui s'appliquent dans le cadre central mais, en général, ils ne modifient pas fondamentalement les concepts sous-jacents du SCN. Le second type de comptes satellites est fondé sur des concepts différents de ceux du SCN. Ils peuvent comporter des différences dans la frontière de production, des extensions des concepts de consommation ou de formation de capital, une extension de la définition des actifs, etc.

Il y a une demande croissante pour les comptes satellites, en particulier pour ceux du premier type. Cet article vise à une clarification des étapes essentielles pour l'établissement de ces comptes satellites thématiques, en prenant pour exemple le compte satellite du transport. Les principales étapes pour parvenir à une extension des tableaux entrées-sorties habituels, ou à une extension des comptes de secteurs institutionnels, y sont décrites. Ce document pourrait donc faciliter (grâce à des contributions plus significatives) l'établissement de tels comptes satellites par les personnes chargées des domaines statistiques correspondants.

Mots-clés : Comptes nationaux, SCN 2008, Comptes satellites, Compte satellite du transport

Classification JEL : E01, L91

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1. Introduction

1. A great strength of the System of National Accounts (SNA)[2] is that its articulation is sufficiently robust to allow for a great deal of flexibility in its implementation while remaining integrated, economically complete and internally consistent. A further and more extensive form of flexibility is that of a satellite account. As its name indicates, it is linked to, but distinct from, the central framework of national accounts. Many satellite accounts are possible but, though each is consistent with the central framework, they may not always be consistent with each other.

2. Broadly speaking, there are two types of satellite accounts. One type involves some rearrangement of central classifications and the possible introduction of complementary elements. They may involve some conceptual differences from the central system, such as an alternative treatment of ancillary activities, but they do not change the underlying concepts of the SNA in a fundamental way. The second type of satellite analysis is mainly based on concepts that are alternatives to those of the SNA. These include a different production boundary, an enlarged concept of consumption or capital formation, an extension of the scope of assets, and so on.

3. There is a growing demand for satellite accounts, in particular for the first type of satellite accounts, providing a more detailed description of a particular economic function or theme, including its interaction with and the impact on the economy at large. Examples are satellite accounts for education and training, health, tourism, transport, aviation, non-profit sector, ocean economy, culture, etc.[3] A major strength of such satellite accounts is that they are fully embedded in the traditional set of national accounts data, thus making it possible to analyse the impact of certain theme-related policies on economic growth, employment, government debt and deficit, foreign trade, etc. In addition to this value added from an analytical perspective, compiling satellite accounts can also have other advantages, such as an improvement of relevant statistics, including the national accounts estimates, by revisiting and confronting various (new) sources of information. Satellite accounting can also promote more intensive partnerships and engagements between statisticians, researchers and policy analysts, both within and beyond the traditional field of official statistics.

4. Demand for these accounts has become so popular that setting them up and maintaining them often cannot be taken up (solely) by the national accounts community, as part of the regular compilation of a continuously growing set of national accounts requirements. More cooperation between national accountants, area specialists and researchers, including a re-balancing of work, may be needed to advance the agenda more quickly.

5. This paper clarifies the key steps for the compilation of a thematic satellite account. It thus supports the set-up, and contributes to the compilation, of such satellite accounts by area specialists. They are often much better equipped than national accountants to compile satellite accounts, because of their knowledge of the area under consideration and their access to more granular data. These are needed to implement the more detailed classifications and/or to make the estimations according to alternative concepts and definitions. On the other hand, the national accountants community brings to the table the

[2] The System of National Accounts 2008 (2008 SNA) is the latest version of the international statistical standards for compiling national accounts.

[3] For an overview of existing national practices with satellite accounting, reference is made to UNECE (2019).

underlying accounting concepts and estimation methodologies within the system of national accounts.

6. The paper first discusses, in Section 2, the so-called supply and use tables, which are often, although not necessarily, the starting point for compiling satellite accounts. Section 3 subsequently addresses the link between the numbers in the supply and use tables and the ones in the underlying source statistics. All of this is done in rather generic terms. More detailed information on the framework of supply and use tables can be found in the 2008 SNA and in various accompanying manuals containing further details and elaborations (see e.g. United Nations, 2018a).

7. In Section 4, the various steps in compiling a thematic satellite account are discussed. In doing so, transport is consistently used as an example, but the same principles apply for other thematic satellite accounts as well. In Section 5, attention is paid to the possible further extension into the institutional sector accounts, which describe the incomes and expenditures, the financing and the balance sheets for economic sectors. Section 6 summarises the main conclusions and recommendations.

2. The framework of supply and use tables

8. Thematic satellite accounts typically use the framework of supply and use tables as a starting point, as illustrated below. Alternatively, a simpler methodology could be applied, by disaggregating the production and generation of income accounts. The latter accounts provide an overview, by economic activity, of output and the inputs needed to produce this output (intermediate consumption of goods and services, and the inputs of labour and capital). In this context, a thematic satellite account would try to single out and estimate output, value added, and employment generated by the economic activities relevant for the theme under consideration, thus arriving at a summary indicator of e.g. the contribution of a theme to GDP and total employment.

9. A major advantage of using the supply and use framework is that it provides a much more complete and comprehensive description of the theme at hand. While it is clear that the compilation of such satellite accounts is more demanding, using supply and use tables as a starting point adds considerably to the analytical usefulness of the exercise. More details would become available on the linkages with the rest of the economy through the use of other goods and services in the production, allowing for the estimation of the indirect impact, through input-output types of analysis, of additional output of goods and services by the activities under consideration. It would also provide information on the users or beneficiaries of the products produced. Who are, for example, the main users of domestic tourism? Are domestic households the main users? Or is domestic tourism mainly depending on foreign demand? In addition to this value added from an analytical point of view, using and applying the requirements of consistency and comprehensiveness within the supply and use framework would also contribute to the rigour of the estimation methodology. This works in two ways, in the sense that compiling satellite accounts may not only improve the exhaustiveness of the source data for a certain theme, but that it can also add to the quality of the national accounts estimates.

10. A major impediment to using the supply and use framework as a starting point for compiling satellite accounts is that this framework is often perceived as esoteric and difficult to understand, probably because of some of the more detailed intricacies that are being applied to deal with certain phenomena. Another reason may be the sheer magnitude of the tables. In some countries the supply and use tables are as large as 250 columns, representing the various industries according to the International Standard Industrial

Classification (ISIC), and up to 2 000 rows, representing the products according to Central Product Classification (CPC), and this does not even take into account the different layers of valuation, first and foremost the distinction between current prices and constant prices (i.e. adjusted for price changes).[4] The main principles of supply and use tables however are quite simple and straightforward. The framework is an example of elegance for the description of the domestic production process and the transactions in goods and services, including imports from, and exports to, the rest of the world. These main principles are described below. For more details, reference is made to chapter 14 of the 2008 SNA.

11. The main underlying idea of supply and use tables is its description, for each product, of total supply and total use. This supply and use per product are represented in the rows of the supply table and use table, respectively.

Total supply of a product *i* equals domestic production, usually referred to as *output*, by economic activity, plus imports:

$$\text{(1) Total supply}_i = \sum_{j=1}^{n} O_{i,j} + M_i$$

in which: $O_{i,j}$: Output of product *i* produced by domestic economic activity *j*

M_i: Imports of product *i*

12. On the other hand, total use consists of the goods and services that are being used up in the production of other goods and services, referred to as *intermediate consumption*, by domestic economic activity; domestic final use, consisting of final consumption by households (and non-profit institutions serving households (NPISHs)), final consumption by government, and investments or *gross capital formation* (including changes in inventories); and exports. The following formula presents the total use for product *i*:

$$\text{(2) Total use}_i = \sum_{j=1}^{n} IC_{i,j} + C_i + I_i + X_i$$

in which: $IC_{i,j}$: Intermediate Consumption of product *i*, used in production by domestic economic activity *j*

C_i: Final consumption of product *i*

I_i: Investments (including changes in inventories) of product *i*

X_i: Exports of product *i*

[4] In this note, reference is only made to the supply and use tables in current prices. However, to deepen the analysis, it may be useful to also compile the tables of the satellite account in prices of the previous year, in order to be able to distinguish between volume and price changes over time. However, supply and use tables in prices of the previous year are less widely available.

13. Aggregating the above equations for all products (m), and combining the two equations representing the identity of total supply being equal to total use by definition, leads to what can be considered as the most famous macro-economic equation, as follows:

(3) Total supply = Total use

(4) $\sum_{i=1}^{m} \sum_{j=1}^{n} O_{i,j} + \sum_{i=1}^{m} M_i = \sum_{i=1}^{m} \sum_{j=1}^{n} IC_{i,j} + \sum_{i=1}^{m} C_i + \sum_{i=1}^{m} I_i + \sum_{i=1}^{m} X_i$

(5) $\sum_{i=1}^{m} \sum_{j=1}^{n} O_{i,j} - \sum_{i=1}^{m} \sum_{j=1}^{n} IC_{i,j} = \sum_{i=1}^{m} C_i + \sum_{i=1}^{m} I_i + \sum_{i=1}^{m} X_y - \sum_{i=1}^{m} M_i$

(6) Output – Intermediate consumption = GDP = C + I + X – M

14. Taking a step back, consider a concrete example of a two-product economy: apples and apple-cider. In the example, it is assumed that 50 units of apples are produced domestically and 20 units are imported. Of this total of 70 units, 40 are directly consumed by households, while 30 are processed by local manufacturers to produce cider. The producer of cider sells his product for the value of 80, of which 60 is consumed by households, and 20 is exported. The simplified supply and use table would then look as presented in Table 1.

15. To complete the use table in this example, as presented at the bottom of Table 1, the columns of the domestic activities are supplemented with total output (equal to the total output in the supply table) of each domestic economic activity. The difference between output and intermediate consumption equals value added, whereas the sum of all value added equals Gross Domestic Product (GDP). In addition, this value added can be disaggregated, for each activity, into its main components: compensation of employees, other taxes less subsidies on production, and (gross) operating surplus/mixed income; see also paragraphs 31 – 34 below.

16. Although the example in Table 1 is simplified to a considerable extent, it does however provide the basic principles of a supply and use table. Some further complexities, in relation to the recording of trade and transport margins and the recording of taxes less subsidies on products, are explained in Annex A of this paper. They are highly relevant for a transport satellite account and other accounts dealing with supply and use of goods, less so for satellite accounts whose main focus is on services, such as education and health.

Table 1. A simplified example of supply and use tables

Supply Table

		Output by domestic industry			Imports	Total supply
		Agriculture	Manufacturing	Total		
Supply by product	Apples	50		50	20	70
	Apple-cider		80	80		80
	Total output/imports	50	80	130	20	150

Use Table

		Intermediate consumption by domestic industry			Final expenditures			Total use
		Agriculture	Manufacturing	Total	Final consumption	Investments	Exports	
Use by product	Apples		30	30	40			70
	Apple-cider			0	60		20	80
	Total intermediate consumption/final uses	0	30	30	100	0	20	150

Use table (including output and value added by economic activity)

		Intermediate consumption by domestic industry			Final expenditures			Total use
		Agriculture	Manufacturing	Total	Final consumption	Investments	Exports	
Use by product	Apples		30	30	40			70
	Apple-cider			0	60		20	80
	Total intermediate consumption/final uses	0	30	30	100	0	20	150
Value added (gross)		50	50	100				
Output		50	80	130				

3. The link between source statistics and supply and use tables

17. The compilation of thematic satellite accounts often requires a further breakdown or different groupings (reclassification) of activities, products, etc., as included in the supply and use tables. These details can only be derived from the relevant source statistics, or other additional sources of information. To appropriately estimate the further breakdowns, or reclassifications, in the supply and use tables, it is important to know how the numbers from the source statistics relate to the numbers in the supply and use tables. For more details on this link, especially when it comes to the quantification of the various differences, it might be necessary to liaise with the relevant specialists in the national accounts division. Here, a more general overview is provided of the usual adjustments made for national accounts purposes:

- *Definitional adjustments*: National accounts are compiled according to the concepts and definitions of the (2008) SNA and, for European countries, the European System of Accounts (ESA). The latter standard is almost fully consistent with the 2008 SNA. The definitional adjustments to source data can relate to a variety of

cases. An example is the treatment of expenditures on intellectual property products (R&D, software, databases, artistic originals, etc.), which are treated in the national accounts as investments, while in business accounting these expenditures may be recorded as current costs. Other examples relate to the definition of compensation of employees, where national accounts include certain employers' social contributions, tips, and the provision of in-kind compensation (e.g. allowances for transport to and from work, and the provision of meals). The inclusion of production of goods for own final use, such as the case for self-subsistence farming, is another example. Also the time of recording transactions in national accounts may differ from the one used in source statistics. An example of the latter concerns the recording of output (and intermediate consumption) at the time the product has been produced (used in the production process), instead of recording it at the time of sale (purchase).

- *Adjustments for exhaustiveness*: National accounts aim to arrive at a full coverage of economic activities, thus including informal, hidden and illegal activities. Adjustments may be made explicitly, especially in cases where data on both supply and use are lacking, or implicitly, by adjusting supply to use or vice versa, depending on what type of information is available. An example of the latter is the estimation of total construction of dwellings based on the number of new dwellings realised in a year, and adjusting the relevant output of construction activities to this total. Examples of the former relate to illegal activities (e.g. the production and consumption of drugs) and paid household activities such as taking care of children or house cleaning.

- *Adjustments for time consistency*: The primary goal of national accounts is to arrive at results which are consistent over time. If, for example, improvements are made to source statistics, the improvements in the level estimates usually will not be taken on board in the system of national accounts, until a new benchmark revision is being introduced. This avoids breaks in the series due to changes in sources and/or methods. The benchmark revisions, which involve a complete overhaul of the level estimates based on new and improved source data, new and revised methodologies and/or the introduction of new international standards, usually take place once every five to ten years. After the benchmark revision, the national accounts data for past years are revised to bring them in line with the latest benchmark level estimates. These time series compilations may go back as far as 70-80 years, but usually they concern a time period of say 20-30 years. These recalculations will also result in an additional layer of differences with the underlying source statistics.

- *Balancing adjustments*: After the previous adjustments have been made to the source statistics, the adjusted and completed data are entered into the supply and use framework (or the system of institutional sector accounts; see Section 5). As can be expected, total supply and total demand for each product (or transaction) will not match initially. The matching of the initial estimates, to arrive at a consistent set of data, is referred to as the balancing process. As a consequence of this balancing, dependent on the magnitude of the initial imbalances, significant adjustments may be made to the source statistics. These balancing decisions are often based on explicit but sometimes rather implicit assessments of the quality of the underlying source statistics, or they rely on quite typical and well-founded reasons for underreporting such as the underreporting of consumption of cigarettes and alcohol in consumer surveys, or – in the case of institutional sector accounts – the underreporting of receipts of property income (i.e. interest, dividends, etc.).

18. For the compilation of national accounts, a variety of data sources is used. A noticeable development in the past decades is the growing use of administrative data sources, either or not in combination with the more traditional survey data. The former data sources may be less well aligned to the definitions of transactions and positions applied in the System of National Accounts, but they typically have the advantage of granularity and, in a number of cases, exhaustiveness. Most administrative data sources are derived from entities in the public sector. Detailed data on VAT and taxes on income and wealth, registrations of employment and compensation of employees, data on social security, credit registers, and supervisory data on financial corporations are only a few examples. These public databases are more and more supplemented by datasets from private parties, such as payments data from credit card companies, profit and loss accounts and balance sheets derived from annual reporting by corporations, and scanner data on prices in supermarkets. In addition to these, generally well structured, datasets, more and more unstructured big data are being used to add to the information base. Because of their granularity, all these data sources allow for very detailed breakdowns, once the link with the national accounts estimates has been established. As such, they can be extremely helpful in compiling satellite accounts, which often require additional details to describe a certain phenomenon.

19. However, it should also be acknowledged that the compilation of satellite accounts may have to rely on data sources, which are not used in compiling macro-economic statistics. In Section 4, several examples are mentioned, ranging from time use surveys to compile estimates of unpaid household activities, to indicators on the performance of the outcomes related to a certain phenomenon. Data on environmental externalities could also be mentioned here. Moreover, the data sources used in the compilation of national accounts may lack the necessary granularity to allow for further breakdowns, and other data sources may have to be brought to the table. In all these cases, it is necessary to establish an appropriate link between the alternative data sources and the already existing sources and methodologies for compiling national accounts estimates.

20. Furthermore, alternative estimation techniques may need to be explored. An example, also mentioned in the following section, is the valuation of transport services produced on own account, and the valuation of unpaid transport services produced by households, based on person-kilometres and/or ton-kilometres. Moreover, the alternative data sources may not be available for all years under consideration. They may also lack timeliness. Here, it will be necessary to develop and apply interpolation and extrapolation techniques to fill the gaps. More generally, it may be considered to relax some of the quality criteria of official statistics, especially in the field of reliability, and go for more experimental estimates, which can be improved later on, after having gained more practical experience. Obviously, appropriate communication about the quality of the estimates and provision of adequate metadata are paramount. It is important to realise that perfect can be the enemy of the good, especially in the early stages of compiling satellite accounts.

4. Ten steps towards a thematic supply and use table

21. After the short exposé on the main principles of the supply and use tables and the reasons for differences between source statistics and national accounts estimates in the previous sections, we now turn to the various steps that need to be undertaken to arrive at a full-fledged thematic satellite account. As noted before, the main starting point for developing satellite accounts is the supply and use framework, in particular the use table in current prices.[5] [6] The transport satellite account is used as an example, but the same guiding principles apply to other thematic accounts as well.

22. However, before applying these more technical steps, a critical discussion needs to take place, in consultation with the main users, about the definition of the theme, by setting a boundary around what would be included and what is not included. This is often one of the most contentious issues when working with users because their inclination is to include as much as possible, as they are often interested in ensuring whatever they measure concerns a significant part of GDP. This initial discussion also helps in determining if the delineation of the theme is going to stay within the conceptual boundaries of the SNA, or that it will go beyond these boundaries.

23. With respect to transport, for example, it is necessary to consider which types of transport are to be included in the theme. Further consideration also needs to be given to whether or not (services derived from) underlying transport infrastructure, employment market related indicators, etc. are to be included. Another important aspect concerns the inclusion or exclusion of own account transportation services, by enterprises and/or households, thus going beyond the traditional production boundary of paid transport services.

24. The various compilation steps below have been listed from a technical or compilation perspective. But it is clear from the above that it is more an iterative process, in which one may need to return to the initial discussion on the delineation of the theme under consideration. This also concerns the often quite delicate balancing between user demands and practical feasibility. When it comes to the latter feasibility, the quality criteria may be somewhat more relaxed for satellite accounts, when compared to the standard programme of official statistics, because of their experimental nature, certainly in the initial stages of compilation.

25. More generally, when setting up satellite accounts, it is important to note that it is often not necessary to start from scratch. For quite a number of satellite accounts, international guidance as well as practical experience at the country level is available; see e.g. the annex of UNECE (2019), which contains a quite exhaustive inventory of available international guidance, handbooks and manuals. Aligning the accounts to this guidance and national experience would add the potential of international comparison to the analysis of a certain theme, which is often a quite important dimension in evaluating the performance of a country.

[5] See footnote 3.

[6] In this Section, reference is often made to the internationally agreed supply and use tables. The relevant tables, collected by the OECD, can be found in the statistical database of the OECD (OECD.Stat). See the following link: http://dotstat.oecd.org/?lang=en, under National Accounts, Annual National Accounts, Supply and Use Tables.

Step 1: Defining and compiling data for the desired breakdown of economic activities

26. The first step is to define the preferable additional breakdowns of economic activities, i.e. the columns of the supply and use table. The internationally agreed supply and use tables delivered to international organisations (predominantly Eurostat and the OECD) have a breakdown of 64 activities with the following distinction for transport-related activities:

- Land transport and transport via pipelines
- Water transport
- Air transport
- Warehousing and support activities for transportation
- Postal and courier services

27. Further breakdowns, for example on passenger transport versus freight transport, may be desirable. For land transport, having, for example, a breakdown of railway transport and/or public transport, may also be considered relevant. More detailed information will need to be derived from the relevant source statistics. Apart from linking these source statistics to the numbers in the supply and use framework, full details may not be available on the various goods and services used for intermediate consumption, as a consequence of which some further assumptions need to be applied to arrive at the targeted breakdown of the columns in the use table.

28. Another relevant category to distinguish separately relates to some of the enablers of transport that are most of the time included in the category *Public administration and defence; compulsory social security*. These enablers concern, for example, government entities producing *infrastructure services*. In the absence of market prices to value the production of these services, the output is measured as the sum of costs expended by government on public infrastructure: consumption of fixed capital (depreciation) of infrastructure, compensation of employees for civil servants involved in maintenance of infrastructure, and out-of-pocket expenditures on the maintenance of infrastructure (not included in investments).

29. When it comes to government services, which are considered relevant for a description of the transport function, further costs made by government may be relevant, such as costs related to policing, registration of vehicles, and general administration and policy development of transport. A possible source of information could be the tables in which government expenditures are broken down into functional categories (Classification of the Functions of the Government, COFOG). In these tables, transport features at the second digit level. For European countries, data at second digit level are usually available, but for other countries, the situation is often less favourable.

Step 2: Defining and compiling data for the desired breakdown of products

30. Similar to including more detailed breakdowns of economic activities, further breakdowns of the goods and services, presented in the rows of the supply and use table, may be considered relevant. In the internationally agreed supply and use table, quite similar to the above activities, the following transport related services are distinguished:

- Land transport services and transport services via pipelines
- Water transport services

- Air transport services
- Warehousing and support services for transportation
- Postal and courier services

Furthermore, the following products may be relevant as well:

- Motor vehicles, trailers and semi-trailers
- Other transport equipment

31. In this breakdown of goods and services, adding more detailed numbers on the various transport modes or transport vehicles may be desirable. Take for example the first category, for which it may be relevant to distinguish between land transport and transport via pipelines, and to have a further breakdown of land transport, e.g. freight transport versus passenger transport, with the latter further broken down by busses, metro, trains, and taxis. The relevant information may often be derived from the relevant company records, but if it concerns, for example, a public transport company that provides multiple types of land transport services, it may be necessary to rely on e.g. number of passengers and average ticket prices to arrive at estimates.

Step 3: Further breaking out taxes less subsidies on products

32. Taxes less subsidies on products can be defined as taxes or subsidies that are directly related to the quantity or the value of the goods and services produced or imported. In the use table, they are included in the purchasers' price of the product. As a consequence, they are an indistinguishable part of the value of the purchases recorded in the use table. In the supply table, output is initially valued at basic prices, i.e. excluding taxes less subsidies on products. Subsequently, a valuation layer is included in the form of (an) extra column(s); see Table A.3 in Annex A.

33. Some of the taxes and subsidies on products are highly relevant for the monitoring and analysis of transport. On the output side, the most obvious example concerns subsidies on public transport. On the use side, in the case of transport, taxes on petroleum products could be separately distinguished. To better account for e.g. the potential impact of changes in these taxes and subsides, the rows of the relevant products in the use table could be broken down, valued at purchasers' price, into the relevant taxes and subsidies and the value excluding these taxes and subsidies.

Step 4: Defining and compiling data for the desired breakdown of value added components

34. Value added is the income generated through the production of goods of services. For each economic activity, it can be calculated as total output minus total intermediate consumption. The following components of value added (gross) are distinguished in the internationally agreed use table:

- Compensation of employees
  - Of which: Wages and salaries
- Other taxes less subsidies on production
- Consumption of fixed capital (depreciation)
- Operating surplus and mixed income, net

- Operating surplus and mixed income, gross
    - Of which: Mixed income (gross)

35. For corporations the resulting income from the production of goods and services, after deduction of paid compensation of employees and other taxes (minus subsidies) on production, is called *operating surplus*. In the case of self-employed persons and owners of unincorporated enterprises, the relevant concept is referred to as *mixed income*, as in these cases it usually also includes a compensation for the labour of the self-employed, the owner and his/her family members. The difference between gross and net concerns consumption of fixed capital, or – as it is more commonly referred to – depreciation.

36. As said before, it is important to be aware of the fact that output and value added by economic activity are valued at basic prices. As such, they do not include taxes (less subsidies) on products. These taxes (less subsidies) are also excluded from the above item *other taxes (minus subsidies) on production*. The latter item only concerns taxes (less subsidies) on production which are not directly related to the quantity or the value of the produced goods and services. They also do not include taxes on income or wealth. Examples of other taxes (less subsidies) on production are taxes (or subsidies) on the payroll or the workforce, taxes on land or buildings, payments for business and professional licenses (e.g. taxi licenses), recurrent taxes on land and buildings, taxes on the use of fixed assets or other activities (e.g. taxes levied periodically on the use of vehicles, ships, aircraft, and other equipment used by enterprises in their production process, stamp taxes, and taxes on pollution (or subsidies on the reduction of pollution)).

37. Generally, the above distinction is considered sufficient, although a further breakdown of compensation of employees into various categories of employment may be desirable; see also step 7. Furthermore, in the case of transport, one could consider a further breakdown of other taxes (less subsidies) on production, to separately account for taxi licenses, taxes on the use of transport equipment, etc. In this respect, it is important to be aware of the fact that the latter taxes paid by households in their role as consumers are treated as taxes on income and wealth. This point will be further addressed under step 6.

Step 5: Extending the production boundary with services produced within the enterprise

38. Services not purchased from another enterprise but produced within an enterprise for own intermediate consumption are generally not included in the production boundary of the 2008 SNA.[7] Often these services concern *ancillary activities: essentially, they are the basic services that every enterprise needs to have in order to operate effectively. The sorts of services referred to include keeping records, files or accounts in written form or on computers; providing electronic and traditional written communication facilities; purchasing materials and equipment; hiring, training, managing and paying employees; storing materials or equipment: warehousing; transporting goods or persons inside or outside the producer unit; promoting sales; cleaning and maintenance of buildings and other structures; repairing and servicing machinery and equipment; and providing security and surveillance* (§5.35 of the 2008 SNA).

[7] In some cases, a separate unit (establishment) that produces such services could be defined. In doing so, these services are then recorded as output of the separated unit, the intermediate consumption of which is recorded by the using establishments within the same enterprise. For reasons of simplicity, these complications are ignored in this paper.

39. In order to arrive at a more comprehensive recording of certain activities in the context of a thematic account, it is necessary to account for such services produced in-house, which are not charged explicitly to the users of these services, be it internal users, i.e. within the enterprise, or external users. The need for such imputations obviously become more relevant, if the theme under consideration includes services which are frequently produced within an enterprise.

40. To account for these services produced on own account, the production boundary has to be extended consistently with the SNA. Typical examples in the compilation of thematic satellite accounts are the recording of in-house training in the case of a satellite account for education and training (or human capital more generally), environmental protection expenditures in the case of the System of Environmental-Economic Accounting (SEEA), or advertising and marketing in the case of a satellite account for a fuller recording of intangible assets (to account for e.g. the building up of a brand name). But transport is perhaps the most obvious example of all.

41. When making the above adjustment for internally produced services, the value of the ancillary services is added to both output and intermediate consumption of the relevant enterprise/activity, on the row of the relevant service. As both output and intermediate consumption are adjusted for the same amount, these adjustments will not affect value added and Gross Domestic Product (GDP). The valuation of the additional services is typically based on a cost approach, i.e. the sum of the expenditures spent within the enterprise to produce the relevant services: compensation of employees, intermediate consumption, other taxes (less subsidies) on production, and consumption of fixed capital. For transport services, information is thus needed on the salaries of the truck/car drivers employed within the enterprise, the expenditures on the maintenance of transport equipment, petrol, etc., the taxes on production related to the use of transport equipment, and the depreciation costs of the transport equipment. In some cases, an average mark-up for profits is added. The whole idea is to arrive at a market-equivalent price, which is assumed to be at least equal to the sum of costs. An alternative approach in the case of transport services is to value the output on the basis of ton-kilometres or person-kilometres times the average prices of these services on the market. But applying this methodology would only be possible, if such physical data on the internal production of transport services is available.

42. In Tables A.2 and A.3, as presented in Annex A, it was assumed that the internally produced transport services have a value of two units in the case of apples and also two in the case of apple-cider. To include these internally produced transport services in order to arrive at a fuller recording of, in this case, transport services, Table A.4 in the annex shows the changes that need to be made to the supply and use tables (highlighted in red). By doing so, one arrives at a more complete recording of transport services. It would also lead to a better monitoring of, for example, the effects of transportation on the environment, and shifts between for hire trucking to in-house trucking.

Step 6: Extending the production boundary with services produced by households for own private use

43. One of the most disputed issues in the system of national accounts concerns the exclusion of unpaid household activities from the production boundary. Without going into details of the reasoning for their exclusion,[8] the 2008 SNA generally excludes the (unpaid) production of services by households for own final consumption. Only the production of

[8] For further information, see e.g. Van de Ven and Zwijnenburg (2016).

goods for own final use, and also two notable exceptions for services (housing services from owner-occupied dwellings, and production of domestic and personal services by employing paid domestic staff) are included with the production boundary.

44. As a consequence of the above, the following examples of unpaid services for own final use are excluded from the measurement of output and GDP: the cleaning and decoration of the dwelling occupied by the household; the cleaning, servicing and repair of household durables or other goods (including vehicles used for household purposes); the preparation and serving of meals; the care, training and instruction of children; the care of sick, infirm or old people; and the transportation of members of the household or their goods. It is clear, however, that some of these services can be quite important to fully capture the production of certain services in a thematic account, such as satellite accounts for education and training, health, and, last but certainly not least, transport.

45. In a thematic satellite account on transport, it may thus be considered relevant to extend the production boundary for the unpaid transport services produced by households for their own final consumption. The principles for recording these unpaid household services are quite similar to the treatment of ancillary services within enterprises, discussed under step 5, but there is one important difference. In the case of these unpaid household services, value added and GDP will be affected as well, because – as was the case for ancillary services – the use of the extra output does not end up in intermediate consumption, thus cancelling out the increase of output; instead it ends up in final consumption expenditure of households.

46. When it comes to the measurement of output, the principles of trying to arrive at a market-equivalent price are also quite similar to the measurement of ancillary activities. Most frequently, the sum of costs method is applied. However, as compared to the ancillary transport services, there are a couple of additional complications for each of the cost elements constituting the market-equivalent price of the relevant services:

- *Compensation for labour input*: Unlike the case of ancillary services, there are no actual data on the payments for labour used in producing the services. The method usually applied is to multiply the number of hours spent on the production of, in this case, unpaid household transport services, to be derived from time use surveys, with an average salary per hour. For the latter, there are two basic methodologies that can be applied: i) the replacement cost method, i.e. the average hourly wage that one would need to pay for someone in the market to provide the relevant service; and ii) the opportunity cost method, i.e. the average hourly wage on the market of the person actually producing the unpaid services. Usually, the second approach will result in a higher estimate than the first approach. If the person/household has a choice between providing the services him/herself, or to purchase them on the market, the replacement cost method would be the preferred way to value this element of the production costs. If there is no choice, the opportunity cost method may also be considered appropriate.[9] In respect of the estimated amount of compensation for the labour input, it should be noted that this item will end up in the (net) value added of the unpaid household activities, more specifically under *mixed income*.
- *Intermediate consumption*: Here, it concerns the use of goods and services that are immediately used up in the production of the unpaid household services. In the case of transport services, one can think of petrol, maintenance costs, etc. In addition to

[9] For more details on the criteria for the choice between valuation methods, reference is made to Schreyer and Diewert (2014).

estimating these intermediate expenses, they also require a change of recording, from final consumption to intermediate consumption.

- *Other taxes (less subsidies) on production*: As in the case of ancillary services, taxes paid for the use of transport equipment should also be taken into account. In the case of households, these taxes are recorded as taxes in income and wealth, so they also require a change in the recording of these expenditures.
- *Costs related to the use of capital goods*: For the production of unpaid household activities, durable goods may be used. In the case of transport, this first and foremost concerns cars. The capital services provided by these capital goods consist of two elements: consumption of fixed capital (or depreciation); and the direct or opportunity costs for the financing. In practice, the latter element is sometimes not included, for reasons of simplicity. Estimates for the depreciation costs related to these investments could be derived by using the Perpetual Inventory Method (PIM).[10] As in the case of intermediate goods and services, a change in recording needs to be applied here as well. The relevant durable goods are to be relocated from final consumption to gross fixed capital formation (investments).

47. One problem in deriving (timely) estimates in applying the sum of costs method is the timeliness and the quality of data from time use surveys. Typically, samples are relatively small, data are not available on an annual basis, and they may only be available with a delay of several years. In the case of transport, total output could also be estimated by multiplying the number of person-kilometres with a relevant market price. Or information on the developments in the number and prices of person-kilometres could be used to extrapolate less timely level estimates from the sum of costs method. Anyhow, also when using this method for valuing output, estimates of intermediate consumption, taxes (less subsidies) on production and consumption of fixed capital would still be needed to arrive at the appropriate measure for value added (net) and mixed income. Moreover, the above changes in recording of the relevant final consumption expenditures and taxes should be included.

48. In Table A.5 of Annex A, the changes in recording within the supply and use framework are shown in blue. In this example, it is assumed that the output of unpaid household transport services equals 30 units, while intermediate consumption is set equal to 5 units, other taxes (less subsides) are assumed to be equal to 4, and the investments in and the depreciation costs of cars are set equal to 10 and 8 units, respectively. New lines for petrol and maintenance, cars, and consumption of fixed capital have been included to clarify the example. Note that the output and production costs are included in the column for transport activities. In the thematic satellite account for transport, The introduction of a separate column for these unpaid household activities may be preferable.

Step 7: Defining and compiling data for more detailed data on employment

49. An important issue to consider in compiling thematic satellite accounts, but also in relation to the compilation of supply and use tables more generally, concerns the inclusion of more variables related to the labour market. In the internationally agreed set of national accounts tables, data are available for employment by economic activity at a level of detail which goes slightly beyond the level of the standard supply and use framework, but they do not contain any more details for transport-related activities (see step 1). Employment data on the number of jobs, the number of persons employed and the number of hours

[10] For more details on the estimation methodology of capital stocks and depreciation, reference is made to OECD (2009).

worked are requested, broken down by employees and self-employed, but in quite a number of countries some of these measures may be missing (with priority given to hours worked).

50. It may also be desirable to include more labour market related variables for the economic activities, which are relevant for the theme under consideration. Here, data by level of education, by gender, and/or by type of jobs may be considered relevant. In the case of data by type of jobs, data on the supply of labour could be introduced as well. Obviously, decisions on the inclusion of more detailed employment data depend greatly on the labour market issues that are considered important for policy and research. However, including such data may not be that straightforward, certainly if a system of labour accounts, in which labour market statistics are linked to the system of national account, is not compiled at the national level. Whatever the case, the employment data can be simply added as rows at the bottom of the use table.

Step 8: Defining and compiling data for more detailed data on investments and capital stocks

51. In addition to having data on the intermediate inputs, the value added components (step 4), and more details on labour input (step 7), it may be considered useful to have more details on the investments, the capital stocks, and the capital services for various types of non-financial assets. The totals for these transactions/positions are available in the internationally agreed set of supply and use tables, as additional rows at the bottom of the use table, or in the case of depreciation, as part of the breakdown of value added. However, in the case of transport, having, for example, more details on different types of transport infrastructure (roads, railway tracks, etc.) and different types of transport equipment (aeroplanes, trains, ships, trucks, cars, etc.) may be desirable.

52. In respect of these more detailed breakdowns, it should be noted that the internationally agreed tables for the collection of data by international organisations does not contain that much detail on investments and capital stocks by economic activity. Further breakdowns for the cross-classification of economic activities and types of assets are available for 20-40 economic activities, of which the whole group of *transportation and storage* is treated as one group. The same holds for *public administration and defence, compulsory social security*. Looking at the type of assets, data are often available for the total of *transport equipment*, while transport infrastructure is grouped under *other buildings and structures*. However, at the national level, more details may be available. As can be derived from a survey that was conducted in 2014,[11] some countries, such as the United States, can actually provide quite a few additional details. Data for consumption of fixed capital (depreciation) are available at a level of detail which goes slightly beyond the standard breakdown of supply and use tables, although – as is the case for employment data – not containing more details for the transport-related activities (see step 1).

Step 9: Complementing the supply and use tables with physical performance and/or outcome indicators relevant for the satellite account under consideration

53. One may want to complement the socio-economic data on the production process (including labour input, investments and capital stocks) and the related transactions in goods and services with data which provide additional information on the performance or the outcomes of the theme under consideration. Including such data would make it possible

[11] In 2021, this survey has been conducted again. However, at the time of drafting this paper, the results of this latest inventory have not yet been published.

to link the production of relevant goods and services, which often is the starting point for (government) policies, with the actual outcomes, and thus analyse the effectiveness of such policies.

54. In the case of transport, it may be considered relevant to include physical data on transport infrastructure, such as data on the actual use and capacity of the infrastructure, condition and quality of the infrastructure, etc. Also data on freight- and person-kilometres, the number of the various types of transport infrastructure, etc. could be envisaged. Or (data on the impact of) traffic jams. When it comes to recording this additional information, one would need to assess which socio-economic information provides the best link with these physical indicators. Additional data on infrastructure and transport equipment most probably could, for example, be linked to the data on capital stocks, as additional rows at the bottom of the use table. Physical data on the production and use of transport services could be linked to the relevant rows in the supply and use table.

Step 10: Complementing the supply and use table with other physical indicators relevant for the satellite account under consideration

55. In addition to the physical data on the performance or outcomes directly related to the theme under consideration, other policy relevant information could be added as well. As an example in the case of transport, it may be desirable to provide further information on e.g. environmental externalities, such as linking data on air emissions to the use of energy products for, in this case, producing the transport services.

56. When linking emissions to the production of transport services, it is important to realise that the output and value added, as recorded in the system of national accounts, relates to the income generated by resident corporations and households. It may thus also concern international transport outside the domestic territory of the country under consideration, while on the other hand part of the transport services on the domestic territory may relate to production by non-residents. In the tables according to the System of Environmental-Economic Accounting (SEEA) 2012 Central Framework, the emissions are recorded according to this residency principle, as a consequence of which one arrives at a direct link between the production process and the emissions to air. This differs from the inventories compiled under the auspices of United Nations Framework Convention on Climate Change (UNFCCC), in which air emissions are recorded in line with the territory principle, i.e. the place where the emissions take place.

57. It goes without saying that the impact of economic activities on the environment is only one of many policy issues that may need to be addressed in a thematic satellite account, but it goes slightly beyond the scope of this paper to provide more examples.

5. Introducing income and finance: Institutional sector accounts

58. In addition to having a more detailed description of the relevant production processes and related transactions in goods and services, including a variety of supplementary information, a more granular description of the profitability and the financing may also be relevant for the theme under consideration. Here, right from the start, it should be acknowledged that linking the production process to income and finance is not that straightforward. In this section, first some of the main issues are discussed, after which some ideas on complementing the information, as included in the detailed supply and use tables, are put forward.

59. In the system of national accounts, income and finance are described in the *institutional sector accounts*. The following main sectors are distinguished: non-financial corporations, financial corporations, general government, households, and non-profit institutions serving households (NPISHs). For each of the institutional sectors, these sector accounts provide a detailed description of all current incomes and expenditures, the resulting saving, investments in non-financial assets and financial assets, the incurrence of debt, holding gains and losses, and the resulting stocks of assets and liabilities. In this sense, it is quite similar to the profit and loss account and the balance sheet of a corporation. To arrive at such statements for the theme under consideration, which are consistent with national accounts, it´s important to be aware of some complexities.

60. First of all, in the supply and use tables, the statistical unit for the measurement is the *establishment*. An establishment is an enterprise, or a part of an enterprise, that predominantly produces a certain type of good or service, and for which data on the production process (output, intermediate consumption, compensation of employees, consumption of fixed capital and operating surplus) are available. The statistical unit for the institutional sector accounts is the *institutional unit*. This unit can be characterised as *… an economic entity that is capable, in its own right, of owning assets, incurring liabilities and engaging in economic activities and in transactions with other entities* (§4.2 of the 2008 SNA). Typically, for such units having autonomy of decision, full profit and loss accounts and balance sheets are available, or it is feasible to compile them. An institutional unit consists of one or more establishments. Due to this unit issue, it may thus be possible that an enterprise involved in the economic activities under consideration is also engaged in, and combined with, other economic activities. An example in the transport sector may be airports which also exploit catering and shopping services (or the renting out of space for these services).

61. Another issue is related to the fact that not all establishments recorded in the economic activities under consideration end up in the same institutional sector. In addition to unincorporated enterprises being recorded as part of the population of the households' sector, corporations may be recorded either as part of (non-)financial corporations, or as part of general government (or non-profit institutions serving households), depending on whether they produce market goods and services or non-market services. The distinction between market and non-market is based on whether or not the products are sold at *economically significant prices*, i.e. *… prices that have a significant effect on the amounts that producers are willing to supply and on the amounts purchasers wish to buy* (§6.95 of the 2008 SNA). In practice, this distinction is often based on the so-called 50%-criterion, i.e. whether the sales are more/less than 50% of the production costs.

62. Another issue, of special interest for describing transport-related activities, is the actual recording of public-private partnerships (PPPs), for example in the construction and exploitation of transport infrastructure. In some countries, such partnerships have become very popular, partly due to the increased attention for, and monitoring of, government deficit and debt in European countries, under the Excessive Debt Procedure (EDP), and the concomitant wish to keep investments in public infrastructure out of the books of government. Extensive jurisprudence has been developed on whether these PPPs should be recorded as part of government or as part of non-financial corporations. Much more information can be found in e.g. the Guide to the Statistical Treatment of PPPs (Eurostat et al., 2016).

63. A more general point relates to the fungible character of income and especially finance. It may not be possible to make a direct relationship between income and financing on the one hand, and the production activities on the other hand. It may show not to be possible, for example, to fully disentangle an unincorporated enterprise (establishment)

from the household owning this enterprise, and thus arrive at a clear separation of transactions and positions related to the enterprise and those related to other household activities. How to allocate, for example, the mortgage debt and the saving deposits that are used to purchase a combined dwelling/office space and/or to purchase consumer durables? The same problems may arise when dealing with multi-establishment enterprises. This is one of the reasons for distinguishing institutional units, and not directly linking income and finance to establishments.

64. Finally, at the national level, one may indeed have data which link output, intermediate consumption and, most importantly, (components of) value added by economic activity, as recorded in the supply and use framework, with the transactions and positions recorded in the institutional sector accounts. But institutional sector accounts are typically only compiled at the most aggregate level of main sectors (see above), with a slightly more detailed breakdown of financial corporations (into different types of financial institutions) and general government (into different layers of government).

65. Given the above, it is usually not that easy, or even possible, at least from a conceptual point of view, to compile full income and expenditure statements and balance sheets for a certain economic function or theme, which is also fully consistent with the system of national accounts. That is not to say that nothing can be done here. Below some suggestions are provided for the example of transport.

Step 11: Linking output and value added with income and finance

66. In trying to arrive at a full accounting of income and finance, it is probably best to start with the allocation of the (components of) value added generated by the economic activities under consideration to the various institutional sectors.[12] For some themes, this can be simple and straightforward, as almost all activities are performed within the non-financial corporations' sector. Linking this information to income and finance then mainly becomes a matter of using available information from annual reports and related statistics, and trying to make them as consistent as possible with the populations and definitions from national accounts. A potential problem concerns the presence of multi-establishment corporations. Here, it could be feasible to disentangle the transactions and positions for the various establishments.

67. Unfortunately, however, for some other themes, like transport, establishing a clear and unambiguous link with income and finance is less straightforward. Transport related goods and services are produced by corporations, unincorporated enterprises, and government units alike. For unincorporated enterprises, it may be possible to rely on micro information from tax authorities, which may actually contain separate information on income and finance related to the productive activities. If not, having full information on the income and finance of households which run an unincorporated enterprise providing transport services may entail highly relevant information for research and policy as well.

68. When it comes to government units, it is not always clear whether or not the relevant establishments are recorded as part of government. For example, a public transport company may be subsidised to such an extent that it is being considered as a producer of non-market services, and therefore part of government. Organisational distinctions may also exist between, for example, the provision of the railway infrastructure versus the

[12] Here, it is important to be aware of possible imputations of additional value added for unpaid household activities. These activities could either be allocated to the household sector, or to a separate (sub)sector. In the remainder of this section, this issue will be ignored for reasons of simplification.

running of transport services; and also financing structures being established in the form of PPPs; etc. One advantage of all these units is that they are often run as separate agencies, or (quasi-)corporations, as a consequence of which a direct link between production, income and finance can be generated, if the relevant source data are available. It becomes trickier in the case the relevant units are an intrinsic, non-separable parts of broader government institutions, say the provision of public infrastructure being part of the Ministry of Transport. In those cases, some information on income and expenditure may be derived from detailed government ledgers or from data broken down by government function (Classification of Functions of Government, COFOG), but delineating balance sheets will be practically impossible, simply because it is an indistinguishable of the part of the larger government unit, or in the case of public debt the government at large.

69. A simplified example of such tables on income and finance is provided in Annex B. It is a simplified example, as the transactions and positions have been limited to the main categories relevant for business accounting. Furthermore, no accounts have been included for holding gains and losses, which may add to the value of the stocks of assets and liabilities, in addition to the net purchases of assets and the incurrence of liabilities. In the case of including unpaid household services, which are added to the production boundary (see step 6 in Section 4), additional lines for e.g. the consumption of such services may be desirable.

Step 12: Separately distinguishing certain transactions

70. From a government policy perspective, it may be of quite some interest to separately distinguish certain transactions. In the above, taxes and subsidies on products have already been alluded to; see Section 4, step 3. But it may be of quite some interest to show the involvement of government in transport more generally. This could be done by adding sub-categories to the relevant transactions, if not already included as part of the units distinguished under step 11. An important data source for this type of information would again be the table with functional breakdowns of government expenditures (COFOG). For European countries, these tables are typically available at the 2-digit level, which means that data on the functions of transport and street lighting are available. Unfortunately, as noted before, the situation is less favourable for other countries, with the exception of Israel and Japan.

6. Main conclusions and recommendations

71. The objective of this paper is to describe the development and subsequent compilation of thematic satellite accounts in relatively easy terms. Obviously, there is much more to say about this topic, especially when it comes to the practical implementation. The paper uses transport satellite accounts as an example. The same principles apply to most other thematic satellite accounts as well, although it goes without saying that the delineation issues may clearly differ from one another. Furthermore, the availability of data sources and the compilation methodologies will differ as well. More documentation can be found in a variety of manuals and guidance notes that have been drafted in the (recent) past, such as the ones on satellite accounts for tourism, the non-profit sector, health, education and training (including human capital) and unpaid household activities, to mention a few. In the list of references, links to a number of these manuals have been included.[13]

[13] For a more detailed list, reference is made to UNECE (2019).

72. Usually, the starting point for the compilation of thematic satellite accounts is the supply and use framework of the national accounts. In the case of going beyond the description of the production process and the transactions in goods and services, and also wanting to include the monitoring of income and finance, it becomes necessary to look at possibilities to have more breakdowns of transactions and positions which are recorded in the institutional sector accounts.[14] This may also require further considerations about the links between income and finance versus production, given the fungible character of finance in particular.

73. Although from a conceptual point of view it may seem rather straightforward to compile a thematic satellite account, in practice one will be confronted with various problems in the availability of data, and the need to apply sometimes rather strong assumptions. It is therefore of the utmost importance, when defining and setting up the framework of the accounts under consideration, to strike a good balance between user demands and practical possibilities. On the other hand, it is also good to show some ambition in setting up thematic satellite accounts, as compiling them will make the data gaps much clearer and more explicit, and may thus help to further enhance the data content by arriving at a much more focused approach, when it comes, for example, to further developing statistics in the area of concern. One can also argue that the results cannot drift that far from the truth, as most data are directly linked to the published national accounts.

74. A nice overview of the state of affairs regarding the compilation of satellite accounts is provided in a paper prepared for the Conference of European Statisticians, with the title *In-depth Review of Satellite Accounting*; see UNECE (2019). This paper contains the results of a worldwide survey, with responses from more than 80 countries. The survey did not only ask for the actual compilation of satellite accounts. It also included questions on the financing, the organisation, the frequency and timeliness, data gaps, data sources and methods, etc.

[14] In some cases, such as satellite accounts on pensions or shadow banking, the satellite account may actually be limited to, or first and foremost targeted at, (parts of) the framework of institutional sector accounts.

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Annex A. Further details on the recording of trade and transport margins and taxes less subsidies on products with the supply and use framework

Introduction

Section 2 of this paper presented a simplified example of supply and use tables. In this annex, two further complexities in the recording of transactions in the supply and use framework are explained by using relatively simple examples. In doing so, Table 1 in the main text is used as a starting point. The first complexity that is discussed in this annex concerns the recording of trade and transport margins. This is done in two steps, to begin with a simplified recording, followed by a more realistic example which allows for different modalities of providing transport. The second complexity relates to the recording of taxes less subsidies on products. As noted in the main text of this paper, these issues may be less relevant in the case of satellite accounts which mainly deal with the production and transactions in services, such as education and health.

Table A.1: Introducing trade and transport margins

A rather specific treatment, which directly concerns the recording of transport services, is related to the treatment of trade and transport services. The products as included in Table 1 are usually not directly sold by the producers of the relevant products, but they are typically intermediated by wholesale and retail traders. Here, it is assumed that the trade margins are equal to 25 units. In addition, transport costs need to be made, also assumed to be equal to 25 units. Table A.1 below presents the addition of the trade and transport margins. In the example, it is assumed that the trade and transport margins on apples are 20 units and those on apple-cider are 30 units, and that these were initially included in the output of the relevant producers. Furthermore, it is assumed that the trade and transport margins only relate to final consumption (40) and exports (10). For reasons of keeping the example concise, no margins have been allocated to imports and intermediate consumption.

Table A.2: Making the treatment of trade and transport margins more realistic

In Table A.1, it is assumed that the final user (here, final consumption or exports) explicitly pays for the trade and transport services. This is usually not the case. The trade margins are simply added to the price that a final user has to pay to the trader, while the major part of the transport services is implicitly included in the price. In relation to these transport services, four basic scenarios can be distinguished: i) the transport services are taken care of, and implicitly charged, by the producer/trader; ii) the transport services are outsourced, and charged, either implicitly or explicitly, by the producer/trader; iii) the transport services are taken care of by the user; and iv) the transport services are outsourced, and explicitly paid for, by the user. Table 1 in the main text in fact represents the first alternative, while Table A.1 in this annex represents the fourth alternative. In practice, there will be a mixture of all four scenarios.

The exact recording of (trade and) transport margins is closely related to the valuation of the transactions in goods and services in the supply and use tables. In the supply table, the domestic production of goods and services is valued at *basic prices*, i.e. the amount receivable by the producer, excluding any taxes (less subsidies) on products. The basic price of the goods produced also excludes the transport margins invoiced separately by the producer, the latter being considered as another product delivered by the producer.

In the use table, the purchases of consumers, intermediate as well as final consumers, are valued at *purchasers' prices*, i.e. the amount payable by the purchaser including any (trade and) transport margins, not only the margins implicitly included in the price charged by the producer, but also the ones paid separately by the purchaser to the producer/trader. Here, it is assumed that the change in ownership, and the related purchasers' price, is at the time the product is delivered to the user. If the user takes care of the transport services, then it is assumed that the change in ownership takes place when the product leaves the producer/trader, and the transport margins are not recorded as part of the purchasers' price, but instead recorded separately as a purchase of transport services. It should be noted here that the purchasers' price also includes taxes (less subsidies) on products excluding deductible VAT, but this will be dealt with later, in Table A.3.

In Table A.2 below, it is assumed that part of the transport services is being outsourced (and paid) by the producers (of apples 3, and those of cider also 3) and implicitly charged to the purchaser, as part of the basic price. Another part is assumed to be produced internally by the producers (of apples 2, and those of cider also 2) and again implicitly charged to the purchaser, as part of the basic price. The rest (15 units) is outsourced and paid for by the traders, and subsequently implicitly charged to the final user, as part of their margins.

The treatment of trade and transport margins in Table A.2, in which the above assumptions have been applied, requires some further explanation, as follows:

- The output at basic prices of the apple producers increases, as compared to Table A.1, with 5 units, from 30 to 35, to reflect the transport services outsourced and internally produced, and subsequently implicitly charged by the producer. The use of outsourced transport services (3) is reflected as intermediate consumption, in the column of the apple producers in the use table. The value of the internally produced transport services (2) is reflected as additional value added of the producers, at the detriment of output and value added generated by the transport industry. The same treatment needs to be applied to the apple-cider producers, with output at basic prices going up from 50 to 55.
- The output of the trade industry goes up from 25 to 40, to reflect the additional transport services of 15 units outsourced and included in the trade margins. These purchases of transport services are reflected in the intermediate consumption of the trade industry, similar to the above treatment of outsourced transport services.
- As can be derived from the use table in Table A.2, the above changes do not impact on the value added by industry, with the exception of the internally generated transport services, which increase the value added of the apple producers and the apple-cider producers, and lower the value added of the transport industry.
- Finally, to arrive at an alignment of the row totals in the supply table and those in the use table, a column is added to the supply table that reflects the move from basic prices to purchasers' prices. It adds the trade and transport margins of the trade industry to the basic prices charged by the producers of apples and apple-cider. This is then counterbalanced by an equivalent negative entry in the row of the trade and transport services, to avoid double counting.

Table A.3: Adding taxes (less subsidies) on products

One other complexity in the valuation of goods and services, which was already shortly referred to, concerns the recording of taxes (less subsidies) on products. For transport services, this may be a very important item (e.g. taxes on petrol), but for most other

products it is quite relevant too, if one thinks of non-deductible VAT. These taxes (less subsidies) are excluded from the basic price, but they are recorded as part of the purchasers' price. As for trade and transport margins, this valuation difference is reflected in an extra column in the supply table. If we assume that taxes on products are equal to 8 units for apples (20% VAT on final consumption), and 25 for apple-cider (20% VAT, or 12 units, on final consumption, and the rest consisting of taxes on alcohol (9 on final consumption and 3 on exports)), the supply and use table would look as presented in Table A.3 below. In this example, it is assumed that the taxes (less subsidies) were not yet included in the valuation of the products in Table A.2. They have therefore been added to the initial value of the supply and use of goods and services.

Table A.4: Accounting for transport services produced on own account

Table A.4 below presents an example for the inclusion of transport services produced by enterprises on own account, to provide transport internally and externally, the latter first and foremost referring to transport services which have not been charged explicitly to the purchasers of the enterprise's primary products. The imputations, as explained under step 5 in Section 4, are highlighted in red.

Table A.5: Accounting for unpaid transport services produced by households

Finally, Table A.5 includes an example, in which the accounting for unpaid transport services produced by households has been added. The extra imputations, as explained under step 6 in Section 4, are highlighted in blue.

Table A.1. Introducing trade and transport margins

Supply Table

		Output by domestic industry					Imports	Total supply
		Agriculture	Manufacturing	Trade	Transport	Total		
Supply by product	Apples	30				30	20	50
	Apple-cider		50			50		50
	Trade and transport margins			25	25	50		50
	Total output/imports	30	50	25	25	130	20	150

Use Table

		Intermediate consumption by domestic industry					Final expenditures			Total use
		Agriculture	Manufacturing	Trade	Transport	Total	Final consumption	Investments	Exports	
Use by product	Apples		30			30	20			50
	Apple-cider					0	40		10	50
	Trade and transport margins						40		10	50
	Total intermediate consumption/final uses	0	30			30	100	0	20	150
Value added (gross)		30	20	25	25	100				
Output		30	50	25	25	130				

Table A.2. Making the treatment of trade and transport margins more realistic

Supply Table

		Output by domestic industry					Imports	Trade and transport margins	Total supply
		Agriculture	Manufacturing	Trade	Transport	Total			
Supply by product	Apples	35				35	20	15	70
	Apple-cider		55			55		25	80
	Trade and transport margins			40	21	61		-40	21
	Total output/imports	35	55	40	21	151	20	0	171

Use Table

		Intermediate consumption by domestic industry					Final expenditures			Total use
		Agriculture	Manufacturing	Trade	Transport	Total	Final consumption	Investments	Exports	
Use by product	Apples		30			30	40			70
	Apple-cider					0	60		20	80
	Trade and transport margins	3	3	15		21				21
	Total intermediate consumption/final uses	3	33	15		51	100	0	20	171
Value added (gross)		32	22	25	21	100				
Output		35	55	40	21	151				

Table A.3. Adding taxes (less subsidies) on products

Supply Table

		Output by domestic industry					Imports	Trade and transport margins	Taxes less subsidies on products	Total supply
		Agriculture	Manufacturing	Trade	Transport	Total				
Supply by product	Apples	35				35	20	15	8	78
	Apple-cider		55			55		25	24	104
	Trade and transport margins			40	21	61		-40		21
	Total output/imports	35	55	40	21	151	20	0	32	203

Use Table

		Intermediate consumption by domestic industry					Final expenditures			Total use
		Agriculture	Manufacturing	Trade	Transport	Total	Final consumption	Investments	Exports	
Use by product	Apples		30			30	48			78
	Apple-cider					0	81		23	104
	Trade and transport margins	3	3	15		21				21
	Total intermediate consumption/final uses	3	33	15		51	129	0	23	203
Value added (gross)		32	22	25	21	100				
Output		35	55	40	21	151				

Table A.4. Accounting for transport services produced on own account

Supply Table

		Output by domestic industry					Imports	Trade and transport margins	Taxes less subsidies on products	Total supply
		Agriculture	Manufacturing	Trade	Transport	Total				
Supply by product	Apples	35				35	20	15	8	78
	Apple-cider		55			55		25	24	104
	Trade and transport margins	+2	+2	40	21	61+4		-40		21+4
	Total output/imports	35+2	55+2	40	21	151+4	20	0	32	203+4

Use Table

		Intermediate consumption by domestic industry					Final expenditures			Total use
		Agriculture	Manufacturing	Trade	Transport	Total	Final consumption	Investments	Exports	
Use by product	Apples		30			30	48			78
	Apple-cider					0	81		23	104
	Trade and transport margins	3+2	3+2	15		21+4				21+4
	Total intermediate consumption/final uses	3+2	33+2	15		51+4	129	0	23	203+4
Value added (gross)		32	22	25	21	100				
Output		35+2	55+2	40	21	151+4				

Table A.5. Accounting for unpaid transport services produced by households

Supply Table

		Output by domestic industry					Imports	Trade and transport margins	Taxes less subsidies on products	Total supply
		Agriculture	Manufacturing	Trade	Transport	Total				
Supply by product	Apples	35				35	20	15	8	78
	Apple-cider		55			55		25	24	104
	Trade and transport margins	+2	+2	40	21+30	61+4+30		-40		21+4+30
	Total output/imports	35+2	55+2	40	21+30	151+4+30	20	0	32	203+4+30

Use Table

		Intermediate consumption by domestic industry					Final expenditures			Total use
		Agriculture	Manufacturing	Trade	Transport	Total	Final consumption	Investments	Exports	
Use by product	Apples		30			30	48			78
	Apple-cider					0	81		23	104
	Petrol and maintenance				+5	+5	-5			0
	Cars						-10	+10		0
	Trade and transport margins	3+2	3+2	15		21+4	+30			21+4+30
	Total intermediate consumption/final uses	3+2	33+2	15	+5	51+4+5	129+15	0+10	23	203+4+30
Value added (gross)		32	22	25	21+25	100+25				
Other taxes (less subsidies) on production					+4	+4				
Consumption of fixed capital					+8	+8				
Mixed income (net)					+13	+13				
Output		35+2	55+2	40	21+30	151+4+30				

Annex B. A simplified set of institutional sector accounts

	Non-financial corporations		General government		Households		Total	
	Resources	Uses	Resources	Uses	Resources	Uses	Resources	Uses
Production account								
Output (basic prices)	X		X		X		Σ	Σ
Intermediate consumption		X		X		X	Σ	Σ
Value added (gross) (basic prices)		X		X		X	Σ	Σ
Total	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ
Generation of income account								
Value added (gross) (basic prices)	X		X		X		Σ	Σ
Compensation of employees		X		X		X	Σ	Σ
Other taxes (less subsidies) on production		X		X		X	Σ	Σ
Operating surplus (gross)		X		X		X	Σ	Σ
Total	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ
Allocation of primary income account								
Operating surplus (gross)	X		X		X		Σ	Σ
Interest	X	X	X	X	X	X	Σ	Σ
Distributed income of corporations (dividends)	X	X	X	X	X		Σ	Σ
Other property income	X	X	X	X	X	X	Σ	Σ
Primary income		X		X		X	Σ	Σ
Total	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ

	Non-financial corporations		General government		Households		Total	
	Resources/liabilities	Uses/assets	Resources/liabilities	Uses/assets	Resources/liabilities	Uses/assets	Resources/liabilities	Uses/assets
Secondary distribution of income account								
Primary income	X		X		X		Σ	Σ
Current taxes on income and wealth		X		X		X	Σ	Σ
Other current transfers	X	X	X	X	X	X	Σ	Σ
Disposable income (gross) = Saving (gross)		X		X		X	Σ	Σ
Total	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ
Capital and financial account								
Disposable income (gross) = Saving (gross)	X		X		X		Σ	Σ
Capital transfers (net received)	X		X		X		Σ	Σ
Investments in non-financial assets		X		X		X	Σ	Σ
Investments in financial assets		X		X		X	Σ	Σ
Incurrence of liabilities (including issuance of equity)	X		X		X		Σ	Σ
Total	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ
Balance sheet								
Non-financial assets		X		X		X	Σ	Σ
Financial assets		X		X		X	Σ	Σ
Debt liabilities	X		X		X		Σ	Σ
Equity liabilities	X		X		X		Σ	Σ
Net worth	X		X		X		Σ	Σ
Total	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ