IARIW Digital Session on the SNA Update and Related International Standards, Wednesday, August 26, 2020

Updating the System of National Accounts to Reflect the Role of Digitalization*

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Abstract: Digitalization is transforming production processes and products for businesses and creating new consumption options for households. As digitalization becomes more common in economic activity, the relevance of macroeconomic statistics depends on the ability to adapt the SNA and develop supplemental frameworks to meet the evolving needs of policymakers and other users. This paper summarizes work in five areas to address digitalization in the SNA under the SNA Subgroup on Digitalization. The Subgroup is being supported by the Inter-Secretariat Working Group on National Accounts (ISWGNA) of the United Nations Statistics Division. The five areas include 1) a framework for a satellite account on digital economy, 2) recording and valuation of data in national accounts, 3) treatment of "free" products, 4) cryptocurrencies, and 5)price and volume measures.

Paper Prepared for the IARIW SNA Update
August 26, 2020
Part II: Digitalization and Globalization

* This paper summarizes guidance notes in four areas of digitalization under the SNA Subgroup on Digitalization. Members of the Subgroup include Andreas Dollt (Eurostat), Kevin Fox (UNSW), Ziad Ghanem (Stats Canada), Richard Heys (ONS), Stanimira Kosekova (ECB), Nicola Massarelli (Eurostat), John Mitchell (OECD), Markie Muryawan (UNSD), Dylan Rassier (BEA), Marshall Reinsdorf (IMF), Jennifer Ribarsky (IMF), Sebastián Rébora (Central Bank of Chile), Carol Robbins (NSF), Benson Sim (UN), Sri Soelistyowati (Statistics Indonesia), Teck-Wong Soon (Statistics Department Singapore), Erich Strassner (BEA), and Jorrit Zwijnenburg (OECD). Views expressed are those of the authors and should not be attributed to any organization, including the IMF, Eurostat, OECD, BEA, or ONS.

1. Introduction

The *System of National Accounts 2008* (*SNA 2008*) is the core statistical framework that supports policymaking and other purposes. Digitalization is transforming production processes and products for businesses and creating new consumption options for households. As digitalization becomes more common in economic activity, the relevance of macroeconomic statistics depends on the ability to adapt the *SNA* and develop supplemental frameworks to meet the evolving needs of policymakers and other users.

This paper summarizes work in five areas to address digitalization in the *SNA* under the *SNA* Subgroup on Digitalization. The Subgroup is being supported by the Inter-Secretariat Working Group on National Accounts (ISWGNA) of the United Nations Statistics Division. The five areas include 1) a framework for a satellite account on digital economy, 2) recording and valuation of data in national accounts, 3) treatment of "free" products, 4) cryptocurrencies, and 5) price and volume measures. In addition to the summaries here, background documents for each area are available on the UNECE website at: http://www.unece.org/index.php?id=52561 .

2. Increasing the Visibility of Digitalization in the National Accounts through Compilation of Digital Supply-Use Tables

This section summarizes how to increase the visibility of digitalization in macro-economic statistics, in particular within national accounts, through the compilation of digital supply-use tables.

2.1. Background

Digitalization has allowed firms to radically alter production processes and their access to markets using digital tools. Despite digitalization being overtly present in our professional and personal lives, it is not nearly as identifiable in the various indicators currently used to measure the economy. This absence of specific information on such a key development in the economy continues to create confusion about what is (and is not) being included and who is (or is not) benefiting from these changes.

The guidance note on digital SUTs (OECD 2020, available on the UNECE website provided above) sets out a framework for the production of digital supply-use tables (digital SUTs), which define a range of products and actors at the core of digitalization in the economy. In doing so, the framework can produce statistics on digital activity that can assist the development of appropriate policy as well as facilitate international comparisons between countries. Additionally, it provides insight in how specific elements of the digital economy are accounted for—elements that have traditionally been considered missing or underrepresented within the national account aggregates.

Any discussion on measurement of the digital economy needs to include references to how the digital economy might be defined, and while the guidance note on digital SUTs does this, it does not itself propose any one definition of the digital economy or advocate a single indicator to represent digitalization's impact on the economy. This is deliberate and reflects the fact that the

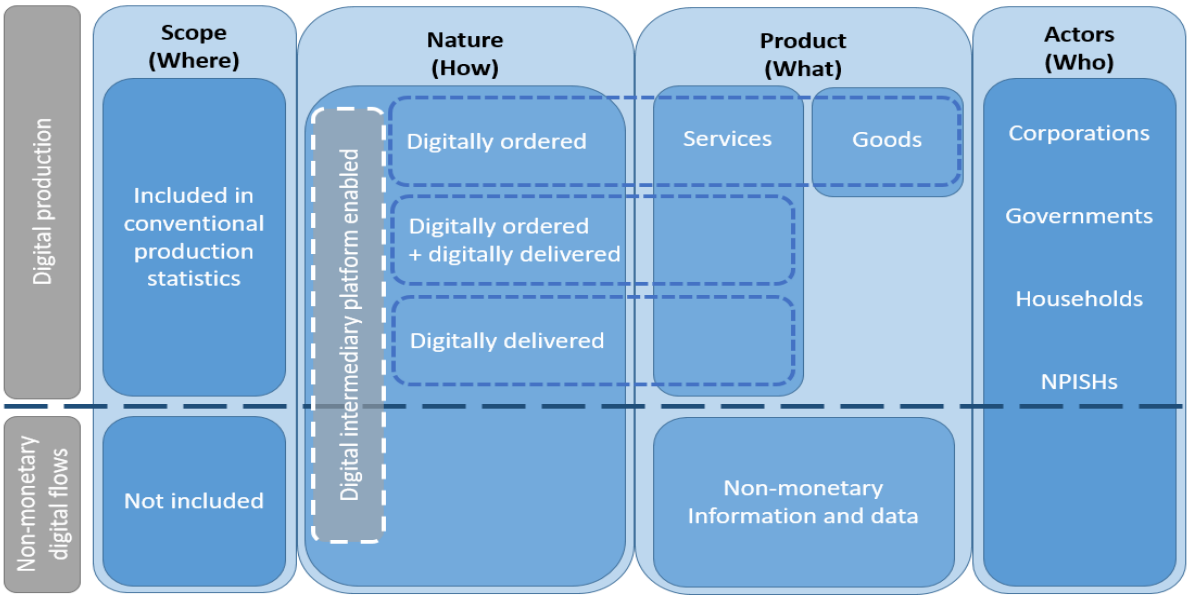
framework is designed to meet a multitude of needs and demands, which cannot be met by any single measure.

The options outlined and considered in the guidance note involve how best to define and identify the necessary transactions and actors involved in the digital economy, while still aligning with the *SNA*. The advantages and disadvantages of these various options are discussed in the note, as well as the proposed option of the digital SUTs, which allow for a variety of perspectives on the digital economy to be measured and disseminated. By advocating for many different approaches to the measurement of digitalization, the digital SUTs can address the policy questions created from the various definitions put forward by users of economic statistics, all while being consistent with the established statistical standards of the *SNA*.

2.2. The Proposed Digital Supply-Use Tables

The proposed digital SUTs break down the supply and use of products based on the nature of the transaction (see figure 1), separating production that is either digitally ordered, digital delivered, or both. This delineation based on the nature of the transaction allows the tables to show how digitalization has affected the provision of traditional products as well as digital products.

Figure 1: Conceptual framework for measurement of digital economy



Source: OECD, adapted from OECD-WTO-IMF (2019).

The proposed tables delineate specific "digital industries" where firms are allocated based on how they are leveraging the digitalization occurring, thereby allowing for estimates of value added by each "digital industry" to be generated. Additionally, on a product side, the tables aggregate ICT goods and digital services, as well as separately identifying some products integral to the digital economy. Importantly, this product view allows for a simplistic but easily interpretable indicator of the level of digitalization affecting production across both digital and conventional industries.

Use of this framework in national accounts also ensures consistency between attempts to measure domestic production affected by digitalization and the approach to measuring digital trade, where digital trade transactions are defined as those that are digitally ordered and/or digitally delivered.

The digital SUTs framework accommodates the inclusion of estimates related to the provision of "free" digital services and the use of data. Countries are encouraged to complete these additional lines in the digital SUTs in order to form the basis of a digital economy satellite account (DESA). Specific guidance on the appropriate conceptual treatment and practical measurement of "free" digital services and the value of data is provided in *SNA* guidance notes on these topics. Further development of any proposed DESA may involve the inclusion of employment data within the delineated "digital industries". Such a step would appear logical from a viewpoint of producing productivity statistics, while the level of employment within this step of the value chain would be much sought after from a policy perspective.

To allow these additional classifications to be represented, the conventional supply-use tables have been modified.[1] The modifications include:

- Five additional rows under each product (and aggregates of products), representing the nature of the transaction.
- Two additional columns in the supply table delineating the nature of the delivery of the service as either digitally delivered or not-digitally delivered.
- Seven additional industry columns, representing the new "digital" industries.
- Four additional rows, representing digital product categories that fall within the *SNA* production boundary.
- Three additional rows, representing data and digital services currently outside the *SNA* production boundary.

2.3. Practical Implementation

The OECD's Informal Advisory Group on measuring GDP in a Digitalized Economy, as well as the Working Party on National Accounts, have discussed and supported the conceptual basis of the digital SUTs; however, work on the practical implementation of the tables is still in its infancy. The area of concern for most countries is a lack of available data sources to assist in delineating the nature of the transaction between producer and consumer. Additionally, there is also a lack of resources available to assist in identifying firms that meet the digital industry definitions outlined in the framework and moving their outputs from the conventional ISIC based categories to the new "digital industries".

An additional concern expressed by countries regarding the practical implementation of the digital SUTs involves the overall size of the tables. Due to the ambitious nature of fully populating the digital SUTs and the various levels of data sources and resources available, some high priority indicators were selected. These indicators include the following:

1. Output, Gross Value Added (GVA) and its components, of digital industries;

[1] A version of the modified template is available here.

2. Intermediate consumption of Digital Intermediary Services (DIS), Cloud Computing services (CCS) and total ICT goods and digital services; and
3. Expenditures split by nature of the transaction.

The framework, including the high priority indicators and indeed the digital SUTs template that supports it, are designed, in part, to act as road maps that help to motivate the development of new data sources, where these are needed. This would encourage countries when developing new outputs related to the digital economy, including the data sources that underpin them, to do so with a clear output in mind, one that would be consistent internationally. There is an expectation that in the initial compilation of the digital SUTs, the outputs would be considered experimental in nature.

2.4. Changes to the *SNA*

The digital SUTs were deliberately designed to be as consistent as possible with the existing *SNA*; due to this, it is unlikely that any existing guidelines or language within the *SNA* would need to be altered. Instead, the classifications and definitions used in this framework are more likely to influence changes in the respective statistical classifications that sit alongside the *SNA*. An example is the inclusion of digital intermediary services and cloud computing services in the next revision of the product (CPC 2.1 or CPA) or industry (ISIC) classification.

If desired, the *SNA* could be altered to provide clarity regarding the treatment of digital intermediary services either as a separate product or as a trade margin (requiring a change to the current definition to incorporate the reselling of a service). Clarity is likely required in response to other digital platforms (as outlined in the other digitalization guidance notes). Furthermore, additional language that explains the concepts of the digital SUTs could be added to the *SNA* in either chapter 14 (*The supply and use table, and goods and services account*) or perhaps more appropriately within chapter 29 (*Satellite accounts and other extensions*).

A final but important consideration in regards to the current *SNA* is that while the exact definition and therefore the size of the digital economy is debated, the output and value added generated by the transactions identified in the digital SUTs (within the current *SNA* production boundary) are already included within the current SUTs. Due to this, while explicitly identifying these might result in additional balancing between products and industries in the conventional SUTs, this work would have no impact on the overall aggregate level or growth rate of GDP.

3. Recording and Valuation of Data in National Accounts

From a macroeconomic measurement perspective, there are two developments from digitalization that require careful consideration for future valuation and treatment in statistical frameworks: 1) data as an asset and 2) “free” products. The value of data and, in certain contexts, “free” products may be outside the current scope of the *SNA 2008* boundaries. Several questions have been debated:

- How should they be defined and classified for statistical purposes?
- How should they be valued?

- How should their flows (and stocks) be recorded in a national accounting framework?
- Should they be included in the core accounts or satellite accounts?
- How can we track their cross-border flows?
- Who is the economic owner of data and "free" assets?

The ISWGNA Subgroup on Digitalization is trying to answer these questions and make recommendations that allow an accurate measurement of GDP and productivity and a correct allocation of production and expenditure across institutional sectors. This section presents the views and the proposals of the Subgroup on the recording and valuation of data in national accounts so far. Since its setup in 2019, the Subgroup has reviewed the existing literature and has identified and analyzed possible options to tackle the issues at stake, considering both conceptual soundness and practical aspects. This has allowed the Subgroup to identify possible solutions for several issues.

The Subgroup is addressing in parallel issues related to "free" products, considering the strong links between data and these topics. "Free" products will be the subject of a separate note. At present, work is more advanced on "data" than on the other two topics.

The Subgroup shares the opinion that "data" is produced and should be included as such in the "core" part of the *SNA*. The subgroup has not yet formed an agreed view on the treatment of "free" products, in particular to what extent "free" products should affect the core accounts and/or if they should be addressed in detail in satellite accounts.

3.1. Definition of Data

The Subgroup recommends updating *SNA 2008* to include *data* as the concept is defined below in the production and asset boundaries. The Subgroup also considers that the underlying *observable phenomena* (which lead to data) are non-produced and do not have the characteristics of an asset. As such, they are considered neither produced nor non-produced assets and should not be recorded at all in the *SNA*.

An approach to valuation is needed for data assets produced on own account (as data that are purchased in market transactions can be valued by their price). Data are to be seen in strict relation to databases, which are already covered in *SNA 2008*. The recording of data as an asset together with databases may be more feasible in practice than trying to separately identify data and databases.

SNA 2008 paragraph 10.112 provides a definition of databases that refers to data, without however specifying what data is: ***Databases*** *consist of files of* ***data*** *organized in such a way as to permit resource-effective access and use of the data. Databases may be developed exclusively for own use or for sale as an entity or for sale by means of a license to access the information contained.*

SNA 2008 paragraph 10.113 specifies: *The cost of preparing data in the appropriate format is included in the cost of the database but not the cost of acquiring or producing the data.* It is therefore the cost of acquiring and producing the data that the next *SNA* update should cover, to

complement that of preparing the data in the appropriate format. The Subgroup proposes the following statistical definition for data:

> **Data** is information content that is produced by collecting, recording, organizing, and storing *observable phenomena* in a digital format, which can be accessed electronically for reference or processing. Data from which its owner(s) derive economic benefits by using it in production for at least one year is an asset.

Based on this definition, *data* is included in the *SNA* production boundary. When it produces an economic benefit to its owner(s) by use in production for at least one year (*SNA 2008* paragraph 10.33), termed "long-lived data" in this paper, then data is also to be included in the *SNA* asset boundary. Short-lived data (i.e., useful for less than one year) is instead to be considered as intermediate consumption when it is purchased from third parties, or as the product of an ancillary activity, i.e., an integral part of the primary activity, when the production is taking place within the same unit. In this latter case, while it should not be separately recorded as output or intermediate consumption, it should be reflected in the value of output to which it contributes.

Data can be stored in a digital or a non-digital format. However, the Subgroup recommends the exclusion of non-digitalized data from the *SNA* production and asset boundaries for practical reasons. It only makes up a small amount of the data within the economy and its monetary value to production is considerably lower than digitalized data. The Subgroup thus recommends focusing on digital data only, which has the potential to greatly influence the efficiency and scale of production due to its ability to be easily processed and to be sold/leased/purchased.[2]

Another crucial distinction is between produced *data* and the underlying non-produced observable phenomena.[3] *An **observable phenomenon** is the occurrence of a singular event or piece of information*.[4] Observable phenomena simply exist, independently of if they are observed, recorded, and used for economic purposes. They are non-produced. They do not meet the characteristics of an asset and should not be included in the *SNA* asset boundary.

The above definition identifies "data" as the result of a production process. It also implies that data can be subject to economic ownership and have the characteristics of an asset, including being subject to depreciation.

[2] A general definition of data, including digital and non-digital data, is: "Data is information content, which results from collecting, recording, organizing, and storing observable phenomena that can be accessed for reference or processing and from which economic benefits are derived by their owner(s) by holding or using it".

[3] The term "observations" has also been considered by the Subgroup. It should be noted however, that this term is already loosely used in the *SNA*, although not defined. For example, in paragraph 18.39: "*Simply benchmarking four quarterly observations to the eventual annual figure, though, may give unexpected and implausible changes from the last revised quarter to the next quarter (a 'step') unless techniques are used that address this problem*". To avoid confusion and make clear that these are states of nature or events and not a produced output, the Subgroup recommends the use of the term "observable phenomena".

[4] Adapted from OECD (2020), "Measuring data products".

3.2. Economic Ownership

Based on the definition above, the economic owner of data is the holder of the intellectual property rights over the data. This is (at least initially) the entity that produces the data and not the person or entity to which the underlying observable phenomena refer. For example, when someone searches on his/her computer, the search engine records all those 'clicks' and digitizes those observable phenomena into data, producing them and thus becoming their owner.

In general, the *SNA* definition of economic ownership applies.[5] In case of own account production, the economic owner is the producer of the data and not necessarily the owner of the place where the data is stored (e.g., if the server that hosts the data belongs to a different unit). In general, a license to use data is not considered a change in economic ownership. However, when a copy of data is acquired under a license to be used in production for more than one year, the licensee assumes all the risks and rewards of ownership (*SNA 2008* paragraph 10.100). Multiple copies of data can be licensed to several licensees at the same time, which opens the possibility of multiple owners of the same data. A second case where the producer ceases to be the owner is when an outright sale of data (i.e., an explicit transaction) occurs.

Determining the economic owner in the case of a multinational enterprise group (MNE) may not be straightforward, e.g., when a digital platform is headquartered in one country, records its IPP in another country, stores data in the cloud and/or operates data centers around the world. A joint ISWGNA-BOPCOM Task Force on IPPs is addressing these issues. Their guidance will apply also to data owned by MNEs.

3.3. Data as an Asset

The Subgroup agrees that long-lived data should be included in the **fixed asset category**, be this own-produced or purchased. The inclusion of data as a produced asset has the effect of increasing output, value-added, and GDP. For market producers, this stems from the fact that the new data assets will be the result of productive activities. For non-market producers, this increase derives from the additional consumption of fixed capital of the data assets.

The usefulness of data in production differs widely, with some data being useful for a long period and others becoming soon obsolete. Of course, only data with a long-lasting (i.e., one year or more) use in production qualifies as an asset, whereas short-lived data does not.

Data cannot be classified as inventories, because it cannot exit the capital stock like other inventories, nor as valuables, as it is not acquired with the main intention to store value over time. Several options have been considered on how to record long-lived data within fixed assets. From a conceptual point of view, the Subgroup's favored option is to create a new specific category of fixed assets for data, under "Computer software, *data* and databases (AN1173)". This option,

[5] The *SNA* definition of economic ownership in paragraph 10.5 states "…the economic owner of entities such as goods and services, natural resources, financial assets and liabilities is the institutional unit entitled to claim the benefits associated with the use of the entity in question in the course of an economic activity by virtue of accepting the associated risks."

which keeps data separate from databases, would give more relevance to data as a separate fixed asset, thus highlighting its importance in today's economy. Measuring it separately from databases may however be challenging in practice.

An alternative option to expand the scope of databases in capital formation, to include the costs to produce or acquire data, may be considered. The rationale for this option is mainly practical: national accountants may not always be able to separate the costs of database structure from that of the database content (i.e., data). As long as own-account estimates will be based on occupational data, it may be hard to make a clear distinction between these categories. In practice, the publication of more detailed breakdowns might be restricted to growth rates, if estimating actual nominal values is not feasible. This approach is in line with the current *SNA 2008* approach for software and databases, which would ideally be separately estimated but in practice are often combined. This approach would just require an extension of the paragraphs on software and databases to also cover data.

Practical tests of the two options will be crucial to make a final recommendation. Whatever the chosen option, the conceptual distinction between data and databases is useful to bring clarity and should be included in the next version of the *SNA*.

3.4. Valuation and Depreciation of Data

Data assets can be produced on own-account or purchased. This distinction is relevant for the *valuation* of data, which should use the sum of costs approach for own-produced data and market prices for purchased data.

The cost of producing own-account data should include the costs of collecting or acquiring data. This includes surveying, locating and capturing the underlying observable phenomena, including through providing "free" services or discounts. The preparation of the database structure, the cost of preparing data in appropriate format and storage costs (including cloud storage) are already included in the value of own-produced databases in *SNA 2008*. However, it is possible to conceive of storage, processing and distribution costs specific to data production, which should be included in the value of own-account data. Disentangling the part of costs specific to data from that related to databases is an issue that requires practical considerations, not addressed in this paper.

Purchased data are part of pre-existing datasets and are bought and sold in the commercial market as part of a database. *Depreciation* of data as a fixed asset should be estimated through the PIM approach, using appropriate service lives and depreciation patterns. If data assets are valued and recorded separately from databases, services lives could be estimated empirically where feasible. If instead data assets are combined with databases and software, then the same service lives could be assumed for data.

Finally, the value of some data may increase over time. In general, the increase would be treated as a revaluation. However, if the source of the change is a discovery of a new use for the data, then this should be recorded as an 'other change in volume'.

4. "Free" Products

Several options have been proposed for the treatment of "free" products in a national accounting framework. The *SNA* Subgroup on Digitalization has not agreed on a way forward for "free" products and will thus engage in further consultation. In this paper, we summarize two perspectives that seem to be establishing direction of the current discourse: 1) bartering personal observations and 2) measuring "free" digital platforms. In any case, the Subgroup generally tends to support a treatment for "free" products in a satellite account rather than the core *SNA* framework.

4.1. Bartering Personal Observations

The *SNA* does not currently provide explicit recommendations for unpriced products. The scope of transactions included in the *SNA* does include barter transactions, and some authors have argued that "free" products should be treated as one side of a barter transaction (e.g., Heys 2020, Soloveichik 2020, OECD 2020). The *SNA* paragraph 9.49 defines a barter transaction as a transaction "*…where one basket of goods and services is exchanged for another basket of different goods and services without any accompanying monetary payment…Values have to be estimated indirectly for goods and services exchanged in barter transactions equal to their market values.*" Thus, under some conditions "free" products could be one side of a barter transaction.

One recent paper proposes treating "free" digital services and long-lived personal *data* as two sides of a barter transaction (Heys 2020). This is distinct from other proposals for a barter treatment (e.g., Soloveichik 2020) in arguing that the scope of "free" services is limited to digital content provided without charge to households (rather than including a variety of digital and non-digital goods and services to any user sector as suggested in Soloveichik (2020)). In exchange, households provide a license to access and use personal *observations*. In addition, households in Heys (2020) are engaged in production of own-account services using the "free" digital services as intermediate consumption. In contrast to "free" content in Soloveichik (2020), which includes digital and non-digital content, "free" digital services in Heys (2020) are equated with capital services provided by software that has been developed and is already captured in the *SNA* production boundary. Thus, labor plays no role. The key question is whether the provision of personal *observations* should be considered an *SNA* transaction if the household is unaware of submitting personal *observations*, even for satellite account purposes.[6] There may be numerous cases in the production boundary where consumers may be said to not completely understand the transaction (e.g., insurance, FISIM, complex financial transactions, etc.).

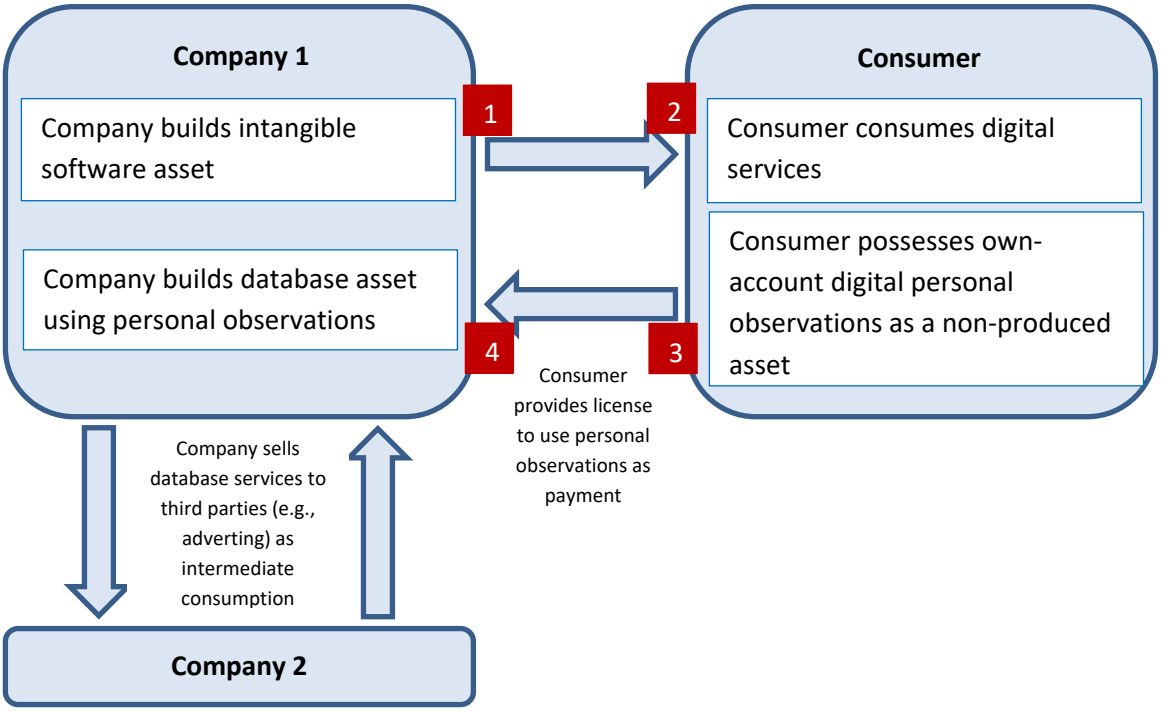
Figure 2 illustrates four ways to estimate the value of the barter between "free" digital services and household observations. Value 1 is the company's cost of producing the capital services from the software asset. Value 2 is the value the consumer places on the capital services received. Value 3 is the consumer's "willingness to accept" price for making personal observations available to others. Value 4 is the value the company places on the observations as intermediate consumption

[6] Transactions are defined in *SNA* paragraph 3.7 as "…an economic flow that is an interaction between institutional units by mutual agreement…" Economic flows are defined in *SNA* paragraph 3.6 as reflecting "…the creation, transformation, exchange, transfer, or extinction of economic value; they involve changes in the volume, composition, or value of an institutional unit's assets and liabilities."

for production of the database used to enhance advertising, marketing, and sales messages. Assuming rational firms, values 1 and 4 will be equal because company 1 delivers capital services from the software asset that reflect the value of the capital services from data received by company 1. Two new flows need to be created: one for "free" digital service output (value 2) and one for personal observations as intermediate inputs (value 3), which will always be of equal and opposite nominal value. The barter treatment increases measured value-added for company 1 only as a result of the new data asset. In addition, the barter treatment reflects households producing own-account services using capital services as intermediate consumption and, thus, results in an increase in value-added in a household account covering production beyond the boundary of GDP.

Heys (2020) distinguishes as two separate assets the 1) software developed to provide "free" digital services from the 2) personal observations collected using capital services. The value of the database that holds the observations reflects the value of the labor input to create the database but not the value of the resulting data. One option is to treat the observations as intermediate consumption in the production of the database, which is the treatment reflected in figure 2. However, Heys (2020) also argues that observations should not be treated as intermediate consumption because they are not used up in production, and that they rather qualify as a standalone asset (presumably non-produced).

Figure 2: Barter of Personal Observations for "Free" Services



Source: Adapted from Heys (2020).

4.2. Measuring "Free" Digital Platforms

The most recent entry to weigh in on "free" products recognizes a bundling of products by free digital platforms in which the provision of lower-priced products (and "free" products) are subsidized by higher-priced products (Reinsdorf 2020). Taken as a whole, the bundle generates revenue that is commensurate with the amount of production taking place in the economy, and it would be a mistake to "correct" the prices that have been subsidized, possibly all the way down to zero, without simultaneously correcting the marked up prices that make the subsidy possible.

Platforms are service providers that facilitate interactions between two or more parties (OECD 2019). "Free" platforms funded by advertising and collection of user data have become an important part of the digital economy, leading to a concern that the "free" services that they supply to households may be missing from GDP.

Nevertheless, outputs that are free, or at least priced below the cost of production, are common throughout the market economy. To ensure a consistent treatment of free and subsidized outputs of market producers, free digital platforms must be approached in the context of a more general conceptual framework.

Measuring the output of ordinary producers serving one-sided markets when some of their outputs are free or subsidized involves the same principles as the more complex problem of measuring platforms offering free and subsidized services. This section therefore develops a measurement framework for free and subsidized outputs of ordinary market producers, then builds on that framework to develop a framework for measuring the output of platforms offering free and subsidized services.

An understanding of the distinction between measuring the level of GDP at current prices and measuring GDP volume growth is another part of the background needed to develop a measurement framework for free digital platforms. The key issue for measurement of GDP level is ensuring that domestic producers' output is all counted exactly once. In contrast, for GDP volume growth, the deflators are key, and the consumer surplus generated by the appearance of free services or by other price developments could be captured in a consumption deflator. Measurement of price and volume growth will be discussed after measurement of output levels.

4.2.1. "Free" and Subsidized Output of Ordinary Market Producers in Measuring the Level of GDP

Subsidizing certain prices, often down to zero, is a common technique for increasing sales of complementary items at marked-up prices. For example, a telecom carrier may offer subsidized smartphones, or a manufacturer of ink cartridges and printers may subsidize the printers. Another example is free software that entices users to purchase support services and related software products. Reducing transactions costs can also be a motive for providing "free" products as part of a bundle of items that are usually consumed together.

Subsidized items and the marked-up items that they help sell can be treated as an implicit bundle. Supplying the cross-subsidized items is profitable because they generate revenue indirectly through increased sales of the marked-up items. They do not cause any of the producer's output to be missed by as long as the revenue from the entire bundle is taken into account. If output really were missed, the producer's net operating surplus would likely be negative (meaning that too little output has been produced to cover the costs of production). Reassuringly, suppliers of subsidized and free outputs usually have a positive aggregate net operating surplus.

Subsidized outputs of ordinary (non-platform) businesses are used by the same group of consumers—though not necessarily the same individuals—who purchase the marked-up output. Consumers themselves therefore fund the subsidies that they receive, and their expenditure on the bundle of outputs includes the full value of the cross-subsidized components of the bundle.

Even though the standard procedures for measuring output capture the full value of the "free" and subsidized items supplied by market producers, two kinds of measurement problem can arise under some circumstances. First, the timing of the recording of the output may be lagged. Certainly, for an individual consumer, the consumption of the "free" or subsidized output often comes first, and the wait until the purchase of the marked-up item may be significant. However, for consumers in the aggregate, a balanced mix of the supplier's cross-subsidized and marked-up products will be consumed in the steady state. Only during periods of rapid growth will the supplier's output be understated. But during periods of falling demand, the supplier's output will be overstated, and for a broad aggregate such as GDP, the net effect of such timing problems should be negligible.

The second measurement problem has the potential to cause GDP to be underestimated by enough to be a concern. Prices of investment goods such as software or equipment may often be cross-subsidized by marked-up supplies and services that the investment good helps sell. This would cause the fixed capital formation and the value added of the user of the bundle of outputs to be understated, and intermediate consumption of supplies and services to be overstated. The feasibility of correcting for this problem by reallocating the subsidies to the price of the investment good may depend on the circumstances.

4.2.2. "Free" and Subsidized Services of Platforms

For platforms, "free" and subsidized outputs are not merely common—they are the rule. Two-sided platforms typically have a subsidized side, which is often free, and a funder side. The different types of platform users usually differ in their willingness-to-pay for opportunities to connect with those on the other side and in the willingness-to-pay of those on the other side to connect with them. The platform responds by subsidizing the users whose presence on the platform will raise the value of the platform to those with a high willingness-to-pay, then capitalizing on their presence by marking up the price of the services needed to reach them.

For example, many manufacturers of consumer products have a high willingness-to-pay to inform potential customers about their products as a way of increasing sales. Platforms such as television broadcasters assemble the necessary audience by supplying free content, and then recover the cost of supplying the free content as part of the price of airtime paid by advertisers. The manufacturers, in turn, recover the cost of the platform's services through mark-ups on the advertised products.

Platforms normally obtain enough revenue from their funder side to cover the cost of the subsidies to the other side, leaving them with a positive net operating surplus. Thus, the "free" and subsidized services do not cause GDP as measured by the production approach to be understated. However, the users of "free" platform services pay for those services through a chain of transactions. This makes the analysis of the measurement of GDP with expenditure approach more complicated for platforms than for ordinary producers that bundle "free" and marked-up outputs.

In the case of platforms, the direct funders of the "free" services are not the consumers of those services, but rather those who want to interact with them. The platform's funders recover this expense later as part of the transactions with those on the other side facilitated by the platform. As was the case for ordinary producers, the consumers of the "free" platform services ultimately fund those services. Even if the set of individuals who pay the mark-ups and the set of individuals who consume the "free" services overlap only partially, households are collectively the funders of the "free" platform services used by households.

The finding that "free" platform services funded by advertising are already correctly measured by the procedures of the *SNA* is reassuring, but digital platforms have an additional source of revenue from their interactions with the users of their "free" services. They collect the users' data.

The value of data that the platform uses as an input for targeted advertising is embedded in its advertising revenue. In effect, in this case data merely enables a new technology for producing an improved version of an existing service, ad delivery. However, the platform may also sell users' data, or use the data as an input for creating long-lived information assets. The revenue from selling users' data should be automatically measured as part of the platform's output, but new procedures may be needed to capture the own-account investment in information assets. In particular, the cost of collecting the users' data could be included in a measure of investment in information assets.

Users' data has also been discussed as part of a barter transaction in which the users exchange a license to access to their data for the ostensibly "free" services of the digital platform (Heys 2020). Recording such barter transactions in the national accounts would entail an imputation of income flows from the platform to its users and an equal imputation of purchases of the platform's services. The imputed income from the license would be classified as a rent, and not a rental, because users' data is a non-produced asset. The imputed sales of services would expand the measure of the platform's output and add to GDP.

There are two points of controversy with the barter proposal. First, the skeptics argue that the platform's "free" services have already been paid for indirectly, leaving no room for them to be purchased again. However, the proposal's proponents reply that the platform produces unrelated services to more than one customer (e.g., search services in exchange for personal data and enhanced advertising services in exchange for cash), and that one service should not necessarily be combined with the other. Second, the skeptics argue that platform's users and the platform do not mutually agree that the users are to supply their data as an inducement for the platform to supply services, so the conditions for a transaction to exist as the term is defined in the *SNA* are not fulfilled. In effect, the "free" services are a lure to attract users to the platform so that their

data can be collected, not part of an agreement to exchange value for value. The proponents reply that mutual agreement is implied by the household's mere use of a platform (whether or not the household knowingly agrees to submit personal data), so the *SNA* conditions for a transaction have indeed been satisfied.

Finally, the user base may itself be an economic asset for the platform. Growth in platform users is often a strategic objective of platforms because network effects are key to their fortunes. Each additional platform user raises the value of the platform to the other platform users, potentially attracting still more users. Such positive reinforcement of network effects can even lead to winner-takes-all dynamics in which the fastest-growing platform eventually captures all or most of the market. Yet even though network growth is often an objective, or at least a benefit, of offering "free" services, network externalities cannot qualify as an asset in the framework of the *SNA*. Moreover, a broad aggregate such as GDP will contain platforms at different stages in their life cycle. The above-average profits that are pay-off for achieving a dominant network will offset the below-average profits of younger platforms that are offering "free" services in order to grow.

4.2.3. "Free" Platforms and Measurement of Price and Volume Growth

The key step in estimating volume growth of aggregates such as household final consumption expenditures is the construction of the deflator. In practice, the output growth of a platform funded by advertising would be measured by deflating its ad revenue. However, a full picture of the growth of household final consumption must consider changes in the availability of "free" platform services consumed by households. As the techniques for estimating the consumer surplus from the appearance of "free" platform services involve uncertain assumptions that are unsuitable for official measures of GDP growth, the adjustments for this sort of consumer surplus would have to be incorporated in supplemental indicators identified as experimental alternative measures of household consumption prices and volumes.

The theoretical framework for adjusting a consumption price index for new and disappearing goods also applies to goods that are free. In this framework, the appearance of a new good is handled by assuming that the good's price in the period before it appeared equaled the reservation price—the price just high enough to drive demand to zero (Brynjolfsson et al. 2020). However, estimating the reservation price by fitting a demand curve is impossible in the case of a new good that is free. Discrete choice experiments on amounts that users of "free" digital platforms would have to be paid to give them up have therefore been used to estimate the consumer surplus (Brynjolfsson et al. 2019).

A more tractable problem is changes in the price of an existing good either down to zero or up from zero. These price changes should be included in the price index covering the bundle or basket that contains the item in question. Most of the time, they can be handled by tracking the change in the cost of bundle that contains the newly free, or previously free, product. Furthermore, under most circumstances, cross-subsidized prices in general can be handled by tracking the cost of the bundle.

Twitter is an example of a "free" digital platform that could cease to be free, as the design of the platform is not well-suited for advertising. If Twitter begins to charge subscription fees, its

services that are consumed by households should be added to the household consumption basket beginning before the fee appeared. The new expense will then have an upward effect on the deflator for household final consumption that reflects the decline in consumer welfare. Of course, some Twitter users may prefer to give up access to the platform. If so, a Paasche price index (based on amounts paid by those who remain) would rise less than a Laspeyres index (based on amounts that would have been paid if everyone stayed on platform). The Paasche index may be more practical to compile.

5. Cryptocurrencies

The last few years have seen a significant proliferation in the number and types of crypto assets. As guidance on how to record crypto assets in macroeconomic statistics is largely absent, the IMF and the OECD started to explore guidance for their recording. This has led to interim guidance (see International Monetary Fund (2019) and Zwijnenburg, De Queljoe, and Ynesta (2020)).

Whereas for most types of crypto assets there is broad consensus on their recording, there is still quite some discussion regarding one specific subcategory, i.e., cryptocurrencies without a corresponding liability that do not yet act as a general medium of exchange. Work is still ongoing to address the pending questions regarding their treatment. This will be discussed at the meeting of the Advisory Expert Group on National Accounts in October 2020, after which the paper with recommendations on the recording of crypto assets in the national accounts will be updated accordingly.

5.1. Interim Guidance

The IMF and the OECD started to explore the statistical measurement of crypto assets in 2018. Discussions took place at meetings of the IMF Committee on Balance of Payments Statistics (BOPCOM), the OECD Working Party on Financial Statistics (WPFS), and the Advisory Expert Group (AEG) on National Accounts in 2018 and 2019, feeding into interim guidance on the recording of crypto assets in macroeconomic statistics. All of this has been reflected in an IMF paper that was published in 2019 and in an updated OECD paper in 2020. The latter paper also contains updated guidance on the recording of crypto assets that emerged over the last year. In addition, it addresses feedback received from the 2019 AEG meeting regarding the need for more specific definitions and classification of crypto assets.

The interim guidance breaks down crypto assets into four main categories: 1) crypto assets acting as a general means of payment, 2) payment tokens, 3) security crypto assets, and 4) crypto assets acting as a store of value.

5.1.1. Crypto Assets Acting as a General Means of Payment

This includes cryptocurrencies that are regarded as a well-accepted means of payment. At the moment, this is not the case for most of them, but this might change over time. When they are not acting as a well-accepted means of payment, most of them mainly act as stores of value and should be categorized accordingly (see below). For their recording in the *SNA*, it is important to further

distinguish between those with a corresponding liability and those without a corresponding liability.

With a corresponding liability: This covers any cryptocurrency issued by a monetary authority, as well as backed stablecoins, if they imply a claim on the issuer (or any third party). In that case, they meet the criteria to be recorded as a financial instrument. The specific classification will then depend on the issuer. Those issued by a monetary authority (although this is not common practice yet) should be recorded similar to traditional fiat currency, in the category "currency" (AF.21). Those not issued by a monetary authority (e.g., backed stablecoins) should also be classified in "currency and deposits" (AF.2) but in a separate subcategory to distinguish them from fiat currency (included in AF.21) and (transferable or other) deposits (AF.22 and AF.29, respectively).

Without a corresponding liability: This includes most of the well-known (traditional) cryptocurrencies. If they start acting as general means of payment (which is currently not the case for most of them), they become quite similar to fiat currencies. In this regard, it has to be borne in mind that the liability that is recorded for fiat currency is in most cases just an accounting convention, as for most currencies it will not be possible to obtain any underlying value by redeeming the currency. It makes sense to also apply this convention to cryptocurrencies without a corresponding liability when they start acting as a general means of payment. They should be recorded in "currency and deposits" (AF.2), in a separate subcategory to distinguish them from fiat currency (included in AF.21) and (transferable or other) deposits (AF.22 and AF.29), as well as from other crypto assets under this category as described above. These cryptocurrencies will only appear on the asset side of the balance sheet, without a corresponding liability, similar to monetary gold.

5.1.2. Payment Tokens

This category includes all crypto assets that only act as a medium of exchange within a platform or network. For their recording in the *SNA*, it is important to further distinguish between those with a corresponding liability and those without a corresponding liability.

With a corresponding liability: If there is a corresponding liability, this will imply that the tokens are redeemable with the issuer. This would imply that these types of crypto assets are negotiable instruments serving as an evidence of debt, which qualifies them as "debt securities" (AF.3). However, because they are quite different from traditional debt securities, it would be best to include them in a separate subcategory.
Without a corresponding liability: These may for example be bought or obtained as a reward within the platform, acting as a means of payment within the platform, but not convertible into a legal currency or another financial asset. They may carry forward some value between accounting periods within the platform, but as they are not convertible and are usually not regarded as a form of investment, they do not qualify as assets according to the *SNA*.

5.1.3. Security Crypto Assets

This includes all crypto assets that provide a financial claim on the issuer. Dependent on the type of claim, they can be further broken down into debt security crypto assets, equity crypto assets, or derivative crypto assets.

Debt security crypto assets: These include crypto assets that serve as evidence of debt. This would also include utility tokens that provide the holders future access to goods and services. Debt security tokens always imply a financial claim on the issuer (or another third party), and as they are crypto assets are always negotiable. For that reason, they qualify as financial instrument and should be recorded under "debt securities" (AF.3), possibly recording utility tokens in a separate subcategory.

Equity crypto asset: These include crypto assets that provide the holder with a residual claim on the assets of the institutional unit that issued the instrument. They should be classified under "equity and investment fund shares and units" (AF.5).

Derivative crypto asset: These include crypto assets that provide the holder with the right to buy (or sell) a particular financial instrument (traditional or crypto) or commodity at a predetermined price within a given time span or at a given date, or to settle a specific transaction at a specified date. They should be classified under "financial derivatives and employee stock options" (AF.7).

5.1.4. Crypto Assets Acting as a Store of Value

This includes all crypto assets whose main role is to act as a store of value, possibly anticipating a future role as a general medium of exchange or another role that was initially intended by the issuer. For their recording in the *SNA*, it is important to further distinguish between those with a corresponding liability and those without a corresponding liability.

With a corresponding liability: This may include a lot of stablecoins that are not yet regarded as well-accepted means of payment. As they resemble negotiable instruments serving as evidence of debt, looking a lot like asset-backed securities, it makes most sense to classify them as debt securities (AF.3).

Without a corresponding liability: This would include a lot of cryptocurrencies that are not yet regarded as well-accepted means of payment. It could be argued that they should not be recorded as financial asset as there is no corresponding liability and as they do not (yet) resemble fiat currency. Treating them as a non-financial asset leaves the question whether they should be regarded as produced or non-produced non-financial assets. According to the interim guidance, they should be recorded as produced non-financial asset under a new subcategory of "valuables" (AN.13), but there is still an ongoing discussion whether this would indeed be the best solution (see below).

The interim guidance also discusses in more detail how to account for the creation of crypto assets that do not have a corresponding liability. It is currently proposed to record their creation as output of "crypto asset services" as a specific subcategory within information technology (IT) design and

development services (CP8314). The "miners" should be classified in computer programming activities (division 62) in ISIC Section J (information and communication), as a separate subcategory "crypto asset miners". The output should be valued as the sum of transaction fees and the value of newly mined crypto assets. However, as for the recording of cryptocurrencies without a corresponding liability that are not (yet) regarded as general means of payment, the recording of the creation of certain types of crypto assets is still part of an ongoing discussion.

5.2. Pending Questions

Whereas there is broad consensus on the recording of most types of crypto assets, discussion still remains regarding one specific subcategory, i.e., the classification of cryptocurrencies without a corresponding liability that do not yet act as a general medium of exchange. Furthermore, there is still discussion on how to account for the creation of certain types of crypto assets. The main interrelated issues concern the following:

- How to account for the creation of crypto assets without a corresponding liability? Are they the result of mining activities, i.e., do miners produce/create them, or do they "appear" in the same way that fiat currency "appears" with miners then finding them?
- Does it make sense to record some crypto assets as non-financial instruments even though they are intended to serve as medium of exchange? One could possibly consider the collective network accepting these stores of value as the counterparty for these decentralised issued currencies, similar to assuming government/central bank as the counterparty of fiat money (as is currently the case in the *SNA*).
- What is the output of miners? Are miners indeed producing cryptocurrencies or are they producing some kind of validation services?
- How should the output of miners be valued? Taking the view that they provide validation services, it follows that their output should be valued on the basis of the remuneration, i.e., including the value of the cryptocurrencies they receive, which adds to GDP. However, if they are treated as producing cryptocurrencies, the question arises whether it wouldn't be better to value their output via the sum of costs (in line with the recording of the creation of fiat money).
- Who is consuming the relevant output? In the case of recording cryptocurrencies as production of valuables, the miners would be consuming this part of their output, and the part of their validation services that is not covered by explicit fees would then be provided for free. In the case that their output is regarded as the production of validation services, it would follow that for the part not covered by explicit fees, they are being paid by the network of the relevant cryptocurrency owners collectively. This then raises the question what imputations may be needed to account for the relevant flows?

Further discussions on these pending issues will take place at the meeting of the Advisory Expert Group on National Accounts in October 2020, after which the recording guidance will be updated accordingly.

6. Price and Volume Measurement of Goods and Services Affected by Digitalization

Digitalization, the process of goods and services being delivered in new and innovative ways utilizing digital technology, is having a wide-reaching and deep impact on many parts of the productive economy and how we measure it.

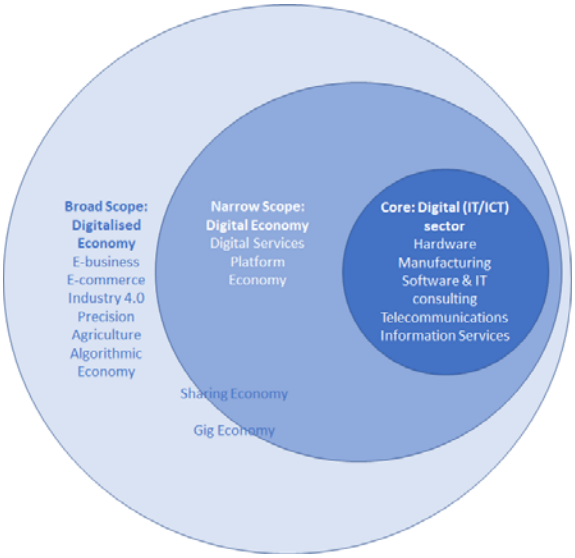
Digitalization is the representation of information in bits. This technology has reduced the cost of storage, computation, and transmission of data (Goldfarb and Tucker 2017). However, this is not the end of digital's impact. As Schreyer (2019) states, the provider of a digital service such as Facebook or Google or the consumer herself combines capital or intermediate inputs from digital services with household time to produce own-account entertainment or communication services. This similarly applies to businesses.

Thus, digital goods and services are key to our understanding of how modern economies work, and therefore we need to consider how best to capture their effect in national accounts. While the other guidance notes in this series address particular instances of the impact of the digital economy and how we measure activity in current price terms, this paper casts a wider net over how we derive prices, deflators and ultimately volume measures both for these products in the core and narrow scope, as illustrated below, but also in the broad scope those who are affected by digitalization.

This guidance note looks to answer three particular questions in relation to the specific instance where digitalization is having a material impact on measurement of deflators and volumes, and where additional guidance may be beneficial:

- What does "best practice" look like in the context of products that have seen a strong digital influence?
- For countries that cannot either afford the "best practice", or do not have access to the necessary data what does "acceptable practice" look like, and
- Given the particular nature of these products, are there current, well-recognized practices that are not valid/optimal in this context and that should be avoided, even if they are entirely suitable in relation to other products?

Figure 3: The 'digital' economy using a tiered approach



Source: The Digital Economy Report, 2019, UNCTAD, adapted from Bukht and Heeks (2017).

The paper is structured to cover the following areas:

- Sourcing current price output data on new digital products
- Price deflation and volume estimation of existing assets and products, including whether the digitally enabled services are the same or different products compared to their traditional competitors, particularly:
    - Telecommunications
    - ICT hardware
    - ICT software
    - Intangible Assets
    - Other goods and services of a non-digital nature (e.g. taxi or accommodation services)
- Price deflation and volume estimation of new digital goods, services, and assets[7], including:
    - Digital intermediaries
    - Cloud computing services
- The challenges presented in rapidly changing price data particularly in non-survey data

The paper excludes from its scope the following:

- New digital products with a zero cash price at the point of delivery, as a parallel paper is tackling these.
- The finance sector: While this is a sector that is heavily digitalised and has a multitude of issues relating to measuring prices and volume (FISIM, etc.), there is a parallel paper

[7] Where these have a non-zero and positive price

looking at crypto-assets / fintech and other financial matters that is better placed to consider these issues.

This paper presents a draft guidance note on price and volume measurement of goods and services affected by digitalization. Chapter 1 introduces the challenges for the national accountants, based on concrete examples; chapter 2 describes how to source current price output data; chapter 3 describes possible options for price deflation of existing assets and products and for the measurement of digital intermediaries (platforms); chapter 4 proposes preliminary recommendations on conceptual aspects regarding the treatment of digital platforms, and chapter 5 reviews methods to address fast-paced price change for e-commerce products.

In preparing this report the authors have worked to consolidate the existing research and capture existing and developing consensus. There remains a number of areas where the authors would be keen to collect additional information or viewpoints to inform a final draft. These are:

1. Can any country provide further insights on how they assemble current price data on nominal output of digital products that overcome the challenges of rapid product development, and potentially rapid shifts in price and weight in the basket, to feed into Chapter 2?
2. In Section 2.2 we identify three approaches to measure current price data for digital products given many platforms and providers of new digital products such as digital intermediaries tend to be located in specific territories:
    a. An international organization or national statistical agency in the territory collect the relevant data from them and disseminate via data sharing arrangements to other international/supranational organizations or national statistical agencies.
    b. Collaborating with specialized third-party market research firms to collect the input data and then make the necessary adjustments before using these data for compiling national accounts.
    c. Countries could look to domestic estimates with substitute mirror trade data for particular categories produced by the host NSO in that territory

    Can anyone provide evidence of the successful application of any of these approaches?
3. Chapter 3 reviews existing best practice guidance on how to deflate existing well-defined goods and services in the national accounts. Any additional sources that could augment this chapter would be appreciated.
4. Section 3.2.7. considers the deflation of databases dependent on the treatment of data. Opinions relating to this question, or examples from NSOs would be appreciated to provide alternatives for the guidance to consider.
5. Section 3.3.4 provides options and analysis of options for telecommunications services, which propose bringing the treatment of this service in line with electricity. Opinions on this treatment are requested.
6. Section 3.5.1 is dependent on decisions reached elsewhere in the digitalization task-team on the treatment of data in the national accounts. Views on this issue should be directed accordingly.
7. In section 4.1.2, we discuss how to treat the instance where one room in a home is rented out through Airbnb. Should this room be excluded in the calculation of the imputed rental

price, or should an adjustment be applied, and does this affect the weight of owner-occupied housing in the CPI?

8. In section 4.1.3, we discuss cloud computing and recommend using quality adjusted price indexes to deflate values developed using hedonic models that capture the variety of attributes. We would appreciate any information from NSOs that have attempted such an approach, or any alternatives.

7. Conclusion and next steps

While the digital transformation has disrupted traditional business models and changed consumer behavior, it has also challenged our existing economic measurement frameworks and their usefulness to policymakers and the public. This paper summarizes the five areas of primary research aimed to better reflect the role of digitalization in the *SNA*. Some areas of focus include making digitalization more visible within the national accounts while also addressing best practices in the economic measurement of prices and volumes in the digital age. Other areas focus on the emergence of new digital technologies like cryptocurrencies as well as the expanded role of digital platforms, data, and "free" products. Over the next several months, the Subgroup of the ISWGNA focused on the digitalization research agenda looks forward to broader consultation on emerging guidance, especially on the recording of data and "free" products, where the work in particular remains subject to debate and refinement.

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