the review of income and wealth

Review of Income and Wealth
Series 63, Supplement 2, December 2017
DOI: 10.1111/roiw.12327

MAINTAINING THE NATIONAL ACCOUNTS AS OFFICIAL STATISTICS

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Confidence in national accounts is undermined by expanding the conceptual framework to serve the needs of productivity analysis. Extensions of the SNA to include knowledge assets as produced output and direct volume measures of government output require an increasing number of assumptions and imputations, which threaten the status of national accounts as a reliable source of official economic statistics. Both national accounts and productivity analysis would be better served by meeting the data needs of productivity analysis through satellite systems. It is recommended that the movement towards increased recognition of capital formation of knowledge in the core system of national accounts be halted. The recording of the performance of Research and Development expenditures as capital formation and the endorsement of direct volume measures for the provision of government services introduced with the 2008 SNA should be reconsidered in the next revision of the SNA.

JEL Codes: D24, H40, O34

Keywords: national accounts, productivity, intangible assets, research and development, government output

1. INTRODUCTION

This paper considers two changes that took place with the 2008 SNA. These are the recognition of the performance of R&D as capital formation, and directly measuring government output in volume terms. These are changes to the system of national accounts that will undermine its general applicability and reduce confidence in official statistics. The paper does not intend to reopen the discussions with all the pros and cons on these issues that took place prior to the adoption of the 2008 SNA, but rather, in the spirit of the IARIW-OECD Conference on the future of the national accounts,[1] to comment on the development of the system of national accounts and the driving forces behind it. The change in limits of the production boundary and asset boundary of national accounts is seen as a key issue.

[1]This paper is based on the separate papers presented by the two authors at the IARIW-OECD Special Conference "W(h)ither the SNA?" held in Paris in April 2015, see Lynch, R. (2015) and Thage, B. (2015), available at http://iariw.org/c2015oecd.php

The next section clarifies the meaning of concepts that play a central role in the discussion of the relationship between statistics, national accounts and economic modeling. The requirements for statistics to qualify as official statistics are outlined; the purpose of the national accounts is discussed, noting that the system may be on the move from a general purpose system to a special purpose system. Further the meaning and role of imputations in relation to both the question of reliable statistics and the purpose of national accounts is discussed.

The third section deals with the ongoing trend to capitalize more expenditures in the SNA. The relationship of the needs of productivity analysis to national accounting, and the computation of total factor productivities (TFP) are discussed. The inclusion of knowledge assets as a result of capital formation leads to an increase in measures of the stock of fixed produced assets and the associated measures of capital consumption. These estimates are based on imputed transactions, and not observable exchanges in a market economy. Although it is accepted that useful national accounts require a limited number of imputations, the balance between basing estimates on ex post observations and on assumptions must be kept under surveillance if confidence in the national accounts as reliable statistics is to continue.

In the fourth section, the case for recognizing the performance of R&D as the creation of a non-produced asset as opposed to capital formation is discussed. It is in two parts. The first sets out an alternative conceptual framework to the 2008 SNA model for the treatment of intellectual property in national accounts. The alternative model reinstates the pre-1993 SNA treatment of license payments for access to intellectual property, reclassifying these service payments to property income (rent, originally labelled royalties). Under the alternative model, the measurement challenges in estimating the value of the non-produced assets remains, especially for the most common case of R&D assets created and kept within a multinational, when no equivalent market transactions can be observed. But the alternative model does not change aggregate measures of GDP and Gross Fixed Capital Formation. The second part sets out the measurement challenges and the effects on the system of national accounts.

The fifth section considers the volume measurement of growth in the provision of government services through direct measures. A parallel is drawn between the role of government and that of a home provider in a household. The analogy helps to understand why "output" of government cannot be satisfactorily identified and measured, and a costs approach to measuring real change is the only one consistent with the measurement boundary of national accounting.

Section six gives concluding remarks on the future of the SNA.

2. Three Central Concepts

2.1. *Official Statistics*

Official statistics are statistics published by government and their agencies. The statistics should comply with The Fundamental Principles of Official Statistics that were adopted by the United Nations Statistical Commission in 1994. This was followed by the European Statistics Code of Practice in 2005. The

quality criteria of statistics published by a national statistical office (NSO) are the following: independence, relevance, impartiality, sound methodology, confidentiality, international standards, transparency and dissemination. Users need to be confident that the results published are authoritative and unbiased. It is the responsibility of the NSO to avoid publishing data as official statistics when the quality criteria are not met. Compiling statistics unduly reliant on modelling techniques results in publishing unacceptable official statistics. They do not become acceptable simply through making publicly available the metadata on methods and procedures.

Both the UN and EU principles are cast in the framework of collecting, processing and disseminating statistics. There is no mention of national accounts statistics and their special place in the statistical system. In this sense the national accounts are secondary statistics, feeding on other kinds of statistics. On the other hand national accounts statistics are not exempted, and in the IMF's data quality assessment framework (DQAF) and in the IMF special and general data dissemination standards (SDDS/GDDS), national accounts are clearly expected to comply with the overarching international principles for official statistics.

Users of official statistics expect that the information can form the basis for "informed decisions". Therefore it is essential to draw a clear dividing line between data that reliably reflect social and economic realities, and model-based results. For the latter this is especially important where published figures are based on the use of economic models building on assumptions about behavior or production techniques. Economic researchers and model builders have traditionally filled data gaps for their specific needs, and created databases with data only loosely based on observable events. Producers of official statistics are not (or should not be) in the same position.

2.2. *Purpose of the SNA*

Since the discussion in the beginning of the 1950s about whether to have one general purpose system of national accounts or several systems drawn up to fit different purposes (statement of results, business cycle analysis, structural analysis and national budgeting) ended up in favor of the former, this system has been safeguarded during the various revisions of the SNA. The various boundaries of the system laid down in the beginning have survived up to the adoption of wide ranging changes in the 1993 SNA and continued with the 2008 SNA. These changes are a move towards a specialized system for the purpose of productivity analysis, which in turn leads to increasing capitalization of knowledge-based types of expenditures. The changes result in aggregates such as GDP and NDP becoming less well-defined, and the proposed methods of recognizing and measuring output of government in real terms, distorts estimates of real growth of GDP.

The 2008 SNA itself is remarkably silent on the purpose. Three general *objectives* on which everybody can agree, are mentioned: monitoring the economy, macroeconomic analysis, and international comparisons, though for the last one, surprisingly it is stated that: "*The SNA has not been created for this purpose*" (SNA, 2008 1.35). However, in connection with the production boundary relative

to household production the following statement is made: (SNA, 2008 1.42) "The SNA is designed to meet a wide range of analytical and policy needs. A balance has to be struck between the desire for the accounts to be as comprehensive as possible and the need to prevent flows used for the analysis of market behavior and disequilibria from being swamped by nonmonetary values. . . . The services are excluded because the decision to consume them within the household is made even before the service is provided."

This precludes the possibility that national accounts should be extended to include all types of specialized data that users may demand, or be conceptually adjusted to particular economic schools of thought. Thus (SNA, 2008 1.30) states that ". . . the SNA is sufficiently flexible to accommodate the requirements of different economic theories or models, provided only that they accept the basic concepts of production, consumption, income, etc. on which the SNA is based."

These statements clearly indicate that the ideal for the SNA is still the single general purpose system, not to be "swamped" by special purpose concepts and data demands. But specialist users such as productivity analysts have been successful in gaining the modification of important parts of the system to meet their needs, thereby weakening the general purpose characteristics. Further recognition of knowledge capitalization, will continue this process.

It is, however, remarkable, that whereas the 2008 SNA nowhere uses the term "multi-purpose system", the multi-purpose nature of the SNA was made clear in the 1993 SNA (1.82), where it is stated that: "SNA is intended for purposes of economic analysis, decision-taking and policy-making. It is a multi-purpose system designed to meet the requirements of different kinds of users: governments, businesses, research institutes, universities, the press and the general public. No single user, or group of users, can take priority over all others. The use of one or two aggregates to gauge changes in welfare may be one of the more important uses of the System, but it is only one use. The System is primarily intended to provide data at different levels of aggregation to meet the needs of analysts and policy makers interested in the behavior of the economy and the factors responsible for major market disequilibria, such as inflation and unemployment. The System is inevitably a compromise intended to yield the maximum benefits to different kinds of users and may not therefore be optimal for any one purpose taken in isolation."

2.3. *Imputations*

It is well-known that it is impossible to compile national accounts at current and constant prices without having to adjust, redefine and supplement existing source statistics. However, these processes are in general based on the same kind of statistical procedures that are used when processing and "grossing up" basic statistics to whole population levels. In fact the term "editing and imputation" is widely used to allow for missing, invalid or incomplete responses in statistical surveys. In some cases this pre-treatment of source data for the national accounts may be far-reaching, to generate national accounts covering all within the production boundary for GDP, but such procedures are still informed by statistical

considerations. The procedures applied may affect the reliability of results, but they are in general not "imputations" in the national accounts meaning of this term.

The 2008 SNA (3.75) includes the following explanations of the term imputation:

"Non-monetary transactions are transactions that are not initially stated in units of currency. The entries in the SNA therefore represent values that are indirectly measured or otherwise estimated. In some cases, the transaction may be an actual one and a value has to be estimated to record it in the accounts. Barter is an obvious example. In other cases, the entire transaction must be constructed and then a value estimated for it. Consumption of fixed capital is an example. (In the past, the estimation of a value has sometimes been called imputation, but it is preferable to reserve that term for the kind of situation that involves not only estimating a value but also constructing a transaction.)"

This statement is consistent with the definition of imputation used in previous SNAs, but is contradicted by 2008 SNA (9.48):

"In the interests of brevity, a transaction for which a value has to be imputed may be described as an "imputed expenditure" and this terminology is used below. Strictly speaking, however, the imputation refers to the value of goods or services involved and not to the expenditure itself. In other words it is the valuation that is imputed, not the fact that the transaction takes place. It is therefore preferable to refer to measuring the flows indirectly rather than by imputation."

This uncertainty about the definition of imputation has contributed to the extension of the production boundary. By characterizing the behavior of the government as a set of transactions meeting the wants of society—exchanges between two parties with a market equivalent—it seems possible to therefore estimate values for these transactions, as many other estimates are made in the national accounts. But if an imputation is taken to refer only to invented transactions or exchanges, where no real exchange takes place, then it becomes apparent that recognition of government "output" through imputation of transactions is effectively extending the boundary of production.

The extent of imputations as defined above has previously been quite limited (the consumption of fixed capital and owner-occupied dwelling services are the two main exceptions). The introduction of own-account output of knowledge based capital and the interpretation of sum of costs as a produced output of government: both significantly increase the imputed content of real measures of GDP growth.

Those in favor of increased use of imputed figures in the national accounts often refer to the already included imputations, such as for owner-occupied dwellings and output of banks and insurance companies, arguing that as there are already important imputations in the existing accounts there is no reason to oppose even more. However, the present treatment of owner-occupied dwellings has a long history in national accounts. The value of the imputed rental that owner-occupiers pay to themselves can be estimated with reasonable confidence through current market transactions in similar dwellings. The reliability of the value estimates are supported by its use in income tax systems of countries across

the world. Concerning the imputations made for the output of banks and insurance companies this is a "regrettable necessity" that has caused debate amongst national accountants since the very beginning. Changes have been introduced with each successive version of the SNA without the resolution of basic measurement issues. These are not examples to be followed by new imputations that can hardly be described as "regrettable necessities".

Much of the recent extension of the national accounts boundaries are based on an optimistic view about what can be measured, if not today then tomorrow. This view is taken even where the very existence of the phenomenon to be measured is doubtful or ambiguous. In the meantime internationally agreed or recommended assumptions that replace the missing statistical observations may be mistaken for a solution to conceptual uncertainties and practical measurement problems.

3. National Accounts and Productivity Analysis

The comprehensive revisions of national accounts released by most countries since 2012 reflect the adjustments due to the introduction of the new international standards—2008 SNA and ESA 2010. The most significant changes are the recognition of the performance of R&D as capital formation, and for some countries the use of direct output measures for the volume of individual government non-market services. These two major changes were adopted to make the SNA better suited for productivity analysis. This includes analyzing the effect on productivity of the increasing expenditures on intellectual property, and resolving the old "weakness" that the system did not allow productivity measurement for government production of non-market services, as the volume of output was determined by the volume of the inputs.

The role of knowledge in the economy is important in relation to both of the major changes to the SNA discussed in this paper. Knowledge as a driver of economic progress has not previously been represented in the national accounts. It has been outside the measurement boundary in the same way as the equally elusive concepts of sustainability and welfare. The role of knowledge in the accounts may suffer from basic conceptual and philosophical deficiencies, as discussed in Sakuma (2013) where it is pointed out that fundamental boundary problems related to the very core of the national accounting system remain unsettled, and inconsistencies between the definition of the production boundary in the 2008 SNA and the definition and treatment of "intellectual property products" leads to conflicting criteria as to what is produced and non-produced. Sakuma suggests that the 2008 SNA implies that creations of the mind such as intellectual property are non-produced and that the role of knowledge and culture is better treated as part of the environment in which economic activity takes place, rather than the result of economic activity.

3.1. *Growth accounting and Total Factor Productivity (TFP)*

The connection between national accounts and productivity analysis has traditionally been limited to calculating labor productivities as volume of gross

output or Gross Value Added (GVA) per unit of labor employed. Statistically, the task to compile employment data consistent with the activity classification in the national accounts is a demanding one, and such data are still missing for many countries. It should be noted that employment data, ideally also subdivided by skill and gender and by employees and self-employed, already make up a satellite system to the national accounts and in statistically advanced countries this takes the form of a comprehensive labor accounting system. As elaborated below, there are good reasons for treating capital in the same way.

With the increased interest in understanding the driving forces behind changes in labor productivity, growth accounting and the calculation of TFP has developed as a specialized field of research linked to national accounts concepts. Basically the idea is to enable a price-volume split of the part of GVA that accrues to capital. Combined with a similar price-volume split for labor, the total volume measure of labor and capital inputs can be compared to the volume of GVA (GDP). The difference in growth rates between the volume of inputs and the volume of output is the TFP, which is a residual measure. In addition to the choice of model, it reflects the combined effects of technical change, economies of scale, efficiency change, variations in capacity utilization, measurement errors, and missing categories of assets.

National accounts do not give a breakdown into volume and price of capital services used in production, nor on the income earned by the various types of capital, and so the measure of TFP is based on a good deal of imputed data. The applied economic theory includes assumptions about perfect competition, profit maximizing behavior, production functions with constant returns to scale and remuneration according to marginal productivity, so that the income distribution in the economy reflects relative efficiencies. The imputed price of the capital service (the user costs) may take several forms, including either an exogenous or an endogenous return to capital[2], and including or excluding holding gain on the particular type of capital. Tax-related issues and imputed return to monetary deposits may also be incorporated. Further ex ante and ex post distinctions are made. In addition it is necessary to impute labor income to self-employed persons to break the gross mixed income down into labor and capital income. The extent of the necessary imputations and estimates to enable such measures to be presented in the accounting system would reduce the reliability of the resulting measures. The 2008 SNA presents the data needs of these models as a natural

[2]The difficulties facing statistical offices when using data constructed by means of economic models are outlined. In growth accounting the choice of an exogenous or an endogenous rate of return in the user costs formula will both signal troubles. If an agency picks the rate of return exogenously that is appropriate for calculating the 'real' cost of capital, it is directly involved in estimating the 'monopolistic' surplus. The latter is not a product that can be regarded as having the quality required for the purpose at hand" If on the other hand an endogenous rate of return is used exhausting gross operating surplus this problem is avoided, but then it is assumed that the set of assets involved in the calculation "is complete in the sense that all assets are observed by the statistician who compiles the national accounts. It will hardly ever be possible to be truly exhaustive in the set of underlying assets". Further there will be systematic differences between the exogenous and endogenous rates of return for particular industries, which "complicates life for the statistician who needs to communicate on these differences which is not always straightforward" In addition to the statement that the quality of data cannot support the results if users should take them seriously, this clearly show that growth accounting (and therefore computing TFP) is outside the sphere of official statistics.

extension of the statistical system of national accounts. A separate chapter on Capital Services is included, though this is not part of the adopted SNA standard set of accounts.

Researchers and analysts in academia, international organizations and government offices carry out modeling exercises to investigate economic behavior and provide the basis for informed policy decisions in business and government. The recognition of the performance of R&D as capital formation in the 2008 SNA, and pursuit of the inclusion of more aspects of the knowledge economy has been a consequence. The proposal to present estimates of capital services in the core national accounts requires data reflecting imputations of transactions through several rounds (output of R&D, the capital stock, consumption of fixed capital, the user costs, and the imputed labor income of self-employed). There is ample evidence that it is possible to carry out productivity analysis without extending capitalization in the national accounts (OECD project on KBC, 2013a), (OECD, 2015a) and (Corrado, 2009).

On the data side the TFP exercises would be well served if expenditures that are candidates for capitalization were identified as separate expenditures categories according to the Classification of the Outlays of Producers According to Purpose (COPP). This approach requires that output for own use of these items be separately identified and not treated as ancillary activity. For R&D expenditures this treatment was already recommended in the 1993 SNA (5.12 and 6.164), but on the whole not implemented. In environmental accounting this approach has worked well, identifying environmentally interesting types of expenditures. This approach will not change any important variables of the system, but simply make further specifications available.

3.2. *Capital stock and consumption of fixed capital*

National accounts have traditionally included the concept of consumption of fixed capital (CFC), the item linking gross and net concepts. But CFC as defined in the national accounts is not the depreciation found in financial statements of enterprises, and government accounts often do not record any depreciation at all. This lack of source data means that compiling national accounts estimates of CFC has caused considerable problems over time. In practice these estimates are most often based on assumptions, using the Perpetual Inventory Method (PIM) where the capital stock and consumption of capital are derived in a single process. The special status of CFC is acknowledged in the SNA, so that it is possible to compile the whole set of accounts all the way down to net lending/borrowing without the estimate of CFC affecting the main balancing items. The fact that CFC is a non-observable transaction[3] makes it different from other NA estimates. This is the reason why Gross Domestic Product (GDP) and not Net Domestic Product (NDP) is mostly chosen for economic policy purposes, and is the household word for the general public as the measure of economic growth.

[3]In SNA terms CFC is a non-monetary transaction, but quite different from other non-monetary transactions such as barter, where the transactions clearly exist and can be separately physically identified, whereas that is not the case for the wear and tear, normal rate of obsolescence and accidental damage for a fixed asset.

TABLE 1
THE CHS CLASSIFICATION OF KNOWLEDGE BASED CAPITAL (KBC)

Asset type	Capitalized in National Accounts?
Computerized information	
1. Software	1993 SNA
2. Databases	1993 SNA/2008 SNA
Innovative property	
3. Mineral exploration	1993 SNA
4. R&D	2008 SNA
5. Entertainment and artistic originals	1993/2008 SNA
6. New product/systems in financial services	No
7. Design and other new product/systems	No
Economic competencies	
8. Brand equity	
a. Advertising	No
b. Market research	No
9. Firm-specific resources	
a. Employer-provided training	No
b. Organizational structure	No

Updated version of The CHS classification of Knowledge Based Capital (KBC) according to Corrado, C., J. Haskel, C. Jona-Lasinio, and M. Iommi, "Intangible Capital and Growth in Advanced Economies: Measurement Methods and Comparative Results," INTAN-Invest Mimeo, 2012

In recent years many countries have developed capital stock estimates, primarily based on the PIM method. The data requirements are considerable. Time series of gross fixed capital formation, broken down by investment goods and industries are needed. The time series, and the related prices index series, must exist as far back in time as the longest lasting capital good. For each product/industry combination service life and efficiency decline over time must be decided. These model-based estimates are quite different from the observable estimates filling the accounts of the central NA system. In Blades (2015), a short-cut model used in many developing countries for estimating CFC, requires only input of GFCF for a single year, its growth rate and the depreciation rate. This underlines the speculative nature of these estimates in the accounts.

3.3. *The performance of R&D as capital formation—measurement issues*

The increasing interest in growth accounting and productivity measurement has been a key driver of the extension of the asset boundary in the national accounts. With the performance of R&D recognized as capital formation in the 2008 SNA and proposals for capitalizing more Knowledge Based Capital (KBC) in the future (see Table 1), the reliability of core national accounts may be significantly decreased.

It is a characteristic not only of the intellectual property resulting from the performance of R&D, but also of the additional candidates for capitalizing in future versions of the SNA, that they mainly represent own-account output not separately identified in the system, and for which no market price exist. There is a very limited amount of R&D services traded in the economy—most R&D is performed within large multinational companies for their own use. These activities within multinationals are typically ancillary for which no separate data on output

values exist. They therefore need first to be identified and then an estimate made of the value of the transaction imputed. Both these steps are based on assumptions, as now evidenced for R&D and demonstrated in the projects so far implemented with a further extended asset boundary.

In recent years several projects have tackled measuring intangible assets beyond the SNA boundary. These intangibles include employee skills, organizational know-how, databases, design, brands and various forms of intellectual property, and have been classified more formally under three broad categories, i.e. computerized information, innovative property and economic competencies in the widely accepted and applied CHS classification (Corrado *et al*., 2005) (see Table 1). With the 2008 SNA all the assets types in the table down to entertainment and artistic originals are already capitalized. The OECD project on Knowledge Based Capital (KBC) (OECD, 2013b), demonstrates that total expenditures on KBC as defined in the project now exceed the conventional physical fixed capital formation in many countries, and the estimates of these expenditures have been increasing much faster than GDP over recent decades. It is also found that KBC expenditures other than R&D have caused this accelerated growth.

In the foreword of the Handbook on Deriving Capital Measures of Intellectual Property Products (OECD, 2010a) it is argued that capitalization of R&D is a natural extension to the 1993 SNA, which already prescribes recording acquisitions of software and databases, mineral exploration, and entertainment, artistic and literary originals as capital formation. The inclusion of a chapter on capital services in the 2008 SNA foresees further adjustments of the national accounts to meet the needs of productivity analysis[4]. The research agenda in the 2008 SNA includes broadening the fixed asset boundary to include other intangible assets such as practically all those covered by the CHS classification. The SNA research agenda includes requests to address the issue of human capital within the framework of the SNA.

Intellectual property is increasingly recognized as a key driver in economic growth. It follows that compilers of economic statistics must explore and attempt to measure the values and effects. The key issue is whether these measures should be accepted in the core national accounts or pursued in satellite accounts.

It is remarkable to read that such changes are justified through the inclusion of statements in the 2008 SNA as: "R&D should be recognized as part of capital formation. In order to achieve this, several issues have to be addressed. These include deriving measures of research and development, price indices and service lives. Specific guidelines, together with handbooks on methodology and practice, will provide a useful way of working towards solutions that give an appropriate level of confidence in the resulting measures."

[4]"By recognizing capital services as an integral element, the 2008 SNA has cleared the way for the incorporation of productivity measures into systems of national accounts. This resolves long-standing controversies and has led to a very significant convergence of views" (Jorgenson and Schreyer, 2013). In 2008 SNA paragraph 20.5 it says "It has long been commonplace to recognize that operating surplus is the return to capital used in production but an articulation of how this surplus is generated and how it relates to the value of an asset and the way in which this value changes during a period has not previously been included in the SNA."

To the critical mind, this paragraph (SNA, 2008 10.104) says R&D is not yet measurable, and hopes that future work will provide solutions that are not yet available. The handbooks on implementation (OECD, 2010b) and (Eurostat, 2014) do not offer convincing solutions of the conceptual or practical problems.

The OECD KBC project recognizes the challenges: "Achieving consistent and high-quality estimates of investment for the many assets that compose KBC will require sustained effort over many years. Monitoring and coordinating the efforts of research groups and national statistical offices worldwide, in particular by facilitating knowledge sharing, enabling peer review and avoiding duplication, will accelerate this process. There are several key challenges, opportunities and areas of progress" (New Sources of Growth: Knowledge-Based Capital Key Analyses and Policy Conclusions, OECD, 2013a.)

But how will the capitalizing of intangibles affect the reliability of the key measures of the system of national accounts? The 2008 SNA accepts that excluded services provided within households qualify as production and contribute to economic welfare, but adds in paragraph (6.29):

"However, national accounts serve a variety of analytical and policy purposes and is not compiled simply, or even primarily, to produce indicators of welfare. The reasons for not imputing values for unpaid domestic or personal services produced and consumed within households may be summarized as follows:

a. The own-account production of services within households is a self-contained activity with limited repercussions on the rest of the economy. The decision to produce a household service entails a simultaneous decision to consume that service… [following text on goods not relevant].
b. As the vast majority of household services are not produced for the market, there are typically no suitable market prices that can be used to value such services. It is therefore extremely difficult to estimate values not only for the outputs of the services but also for the associated incomes and expenditures that can be meaningfully added to the values of the monetary transactions on which most of the entries in the accounts are based.
c. With the exception of the imputed rent of owner-occupied dwellings, the decision to produce services for own consumption is not influenced by and does not influence economic policy because the imputed values are not equivalent to monetary flows. Changes in the levels of household services produced do not affect the tax yield of the economy or the level of the exchange rate, to give two examples."

And in (SNA, 2008 6.30): "Thus, the reluctance of national accountants to impute values for the outputs, incomes and expenditures associated with the production and consumption of services within households is explained by a combination of factors, namely the relative isolation and independence of these activities from markets, the extreme difficulty of making economically meaningful estimates of their values, and the adverse effects it would have on the usefulness of the accounts for policy purposes and the analysis of markets and market disequilibria."

The judgment is that although production of services within households occurs, it is not recognized within the national accounts production boundary because the estimates are not sufficiently reliable, and production, income generation and use are a single self-contained process.

Identical judgments can be made regarding the capitalization of activities that were previously, as ancillary activities, outside the economic measurement boundary of the accounts. The above SNA text "to produce indicators of welfare" could be supplemented with "or productivity measures." With increased capitalization, the additional output, income creation and use of income will happen simultaneously and reflect one single decision. This income never becomes "disposable." Already with the capitalization of R&D and own-account production of software and databases this "non-disposable" income makes up around 5 percent of total GDP in many countries. A further capitalization of the CHS will increase this share to more than 10 percent of GDP. This imputed and "non-disposable" increase will inflate central national accounts concepts in the accounting system all the way down to the capital account. The level of GDP may increase by around 10 percent, but the percentage increase in saving and GFCF will be much larger, and for some industries and the non-financial corporation sectors these imputed amounts will play a major role.

It would be difficult to attach economic interpretation to these inflated flows, given such a high share of imputed income. Already with the capitalization of R&D the gross operating surplus in pharmaceutical and electronic industries has increased very significantly, but the companies' financial statements do not show any significant intellectual property value in the balance sheet. The exception is when the IP is registered in low tax countries as part of tax-minimizing behavior.

As the vast majority of KBC services are produced for own use, there are typically no suitable market prices available to value them, no identifiable units of output, and no way to measure the services produced. It is therefore recommended by the 2008 SNA to estimate values for the outputs of these services as the sum of costs. In a situation where own-account output of KBC products could be as much as 10 percent of GDP, the over-all usefulness and reliability of the accounts will be significantly reduced.

Using the sum of cost convention also for the volume estimates, as recommended in the 2008 SNA, implies zero increase in productivity when producing R&D services, unless an assumption about increasing productivity is explicitly introduced. So far there seems to be different practices across countries. The U.S. estimates includes productivity adjustments based on non-farm business multifactor productivity estimates (BEA, 2013), whereas Eurostat advised that EU member states should not make such adjustment as this would reduce the comparability of statistics across EU member states (ONS, 2014). Such differences in methodology across countries will lead to corresponding differences in real GPD growth, the real stocks of R&D capital and related productivity measures.

According to Corrado *et al*. (2012), alternative approaches to using the sum of costs convention have also been attempted in research projects. A calculation of a price deflator for R&D implemented in terms of estimating its contribution to productivity applied to the UK gave a price deflator for R&D that fell at an average rate of 7–1/2 percent per year from 1995 to 2005—and thus implied that

real R&D rose 12 percent annually over the same period. This is in contrast to the practice of using the GDP deflator (which rose 3–4 percent per year in the comparable period) to calculate real R&D. In Fixler (2009) volume estimates for R&D output based on quantity indicators such as employment of research staff and change in number of successful patents are examined and give widely different results. These examples illustrate that the R&D output at both current and constant prices, and thus R&D capital, depend as much on the assumptions made and the methods chosen, as on available data. They also illustrate that results based on the SNA recommended method of estimating volume from the cost side may be of limited interest for analysts.

4. The Creation of Intellectual Property

4.1. *Conceptual issues*

In this section the conceptual foundation for treating the performance of R&D activities as gross fixed capital formation in the 2008 SNA is discussed. The main proposition is that Intellectual Property (IP) is a creation of the mind and the result of general knowledge-seeking and creative behavior in business, government and households, and not the result of a production process. Two approaches are followed: The first is strictly theoretical, outlining the consequences for the entries in the system and the valuation, and the second a practical version where the valuation problem is handled in a pragmatic way.

An alternative treatment to the 2008 SNA is described for the performance of R&D services resulting in "Intellectual Property Products". The creation of Intellectual Property in general is reclassified from fixed capital formation to "other changes in volume" (following the principles behind "patented entities" in the 1993 SNA) and payments for access to IP reclassified from services to property income (following the principles in the pre-1993 SNA). Contrary to the solution chosen in the 2008 SNA, the inconsistency between classifications of assets and payments for their use in the 1993 SNA is eliminated by reclassifying the payments for access to the IP, from purchases of services to property income (rent), and retain the IP as a non-produced asset.

The 2008 SNA definition of production is:

"Economic production may be defined as an activity carried out under the control and responsibility of an institutional unit that uses inputs of labour, capital and goods and services to produce outputs of goods and services."

However, Intellectual Property (an idea) is discovered, invented or "thought up" by a person with no economic inputs of the kind described in the definition of production. Ideas are not produced in that sense, but "discovered." As no production of the idea is involved, then no economic good can be said to be produced and so no corresponding fixed asset can be recognized as the counterpart to production. However, the labelling of the resulting ideas as Intellectual Property Products in the 2008 SNA consolidates the premise that economic production has taken place.

The treatment of Research and Development, and the production of originals and copies, is set out in 2008 SNA Chapter 6, sections 9 and 10 as two separate categories, but in Chapter 10 they are treated under the same heading as intellectual

property products, and subject to the same valuation principles. But there is an apparent contradiction in the SNA treatment of the results of R&D vis a vis other Intellectual Property Products. This is due to the lack of distinction between the process—the performing of R&D activities, and the result—the creation of IP.

In chapter 6, R&D is described as creative work that should be valued on the basis of estimated basic "prices paid as if the R&D was sub-contracted commercially." It is also described in chapter 10 as the value of "expenditures" on creative work. However, both of these methods of valuation are at odds with chapter 10 of the SNA, which says that the "value of R&D should be determined in terms of the future economic benefits." These statements confuse the performance of R&D, whether in-house or sub-contracted, with the intellectual property created. Further, none of these valuation principles are possible when the assets are not separately identifiable, and SNA ends up (SNA, 2008 10.103) suggesting that valuation "by convention" be made from the cost side.

Following this convention, the asset created through the performance of R&D is not recognized separately from the performance costs. It is assumed that the sum of costs *is* the value of the asset. Specific units of the R&D asset are not separable or identifiable, and the SNA gives no indications of the kind of observable units that might be behind this concept (contrary to what was done for patented entities in the 1993 SNA). Therefore it is also impossible to identify the time when a unit comes into existence, disappears, is traded or revalued. Other IP assets included in the 2008 SNA (mineral exploration, computer software and databases, and entertainment literary and artistic originals) consist of identifiable units on which statistics could in principle be developed or already exist. This special position of the R&D asset reduces it to a kind of bookkeeping exercise where certain expenditures, rather than being deducted in the current period, are spread over a number of future periods. The "asset" is thus made up of the right to make future deductions in taxable income, but it may have no counterpart in IP assets as a factor of production. We are in a book-keeping world of costs recovery.

In the subsequent analysis, the 2008 SNA model is taken to be as follows:

a) The performance of R&D is gross fixed capital formation of intellectual property products (IPPs), and the value of these products is ideally the net present value of future economic benefits.
b) Where the products are not sold on the market, and no similar products are marketed, then the costs of performing the R&D can, by convention, be used as an estimate of output value
c) The result of the R&D is an original asset—the IPP, and copies of this original can be made. The sale or use of copies generates receipts, which are payments for services, covering the capital services provided by the IPP and the costs of producing the copies themselves.

It is the contention of this paper that this model leads to inconsistencies in the national accounts treatment of Intellectual Property.

An alternative model is as follows.

a) The performance of Research can result in Intellectual Property which is not "produced" in the SNA sense of the word, but rather a creation of the mind, and so invented or discovered.

b) The original IP can be elaborated and refined through the production of a succession of prototype access devices which allow the idea to be accessed, tested and improved.
c) As the Intellectual Property in this model is non-produced (in the SNA sense), it first appears in the "Other changes in volume of assets account" rather than as an output in the production account, As the IP is non-produced, it cannot be valued as costs of production.
d) Payments for access to IP are property income (rent).
e) The benefits available from the intellectual property are obtained through access devices. Hill (2014) suggests the term host instead of access device.
f) Access devices are produced goods and/or services and can be produced by copying a master access device. Payments for acquisition of an access device will cover the cost of producing the access device and a property income payment covering the benefits available through sharing in the IP.

An issue that highlights the difference between the models is how the widely accepted phenomenon that IP does not suffer wear and tear is treated. The absence of wear and tear means that there is no physical change (no real change) in Intellectual Property over time.

This is recognized in the alternative model through value in IP being lost only through a decrease in the price of access. The subsequent loss in value of the IP is recorded in the revaluation account.

The 2008 SNA treatment assumes that there is a measurable capital service provided, including consumption of fixed capital. But this poses the question: If there is no wear and tear, how can there be a reduction in the quantity measure of the IPP, and how can there be a corresponding measure of real capital consumption?

At the very least, this issue deserves discussion and guidance by the international standard setters for national accounts, not least because of the significant effect on the handling of the role of IP in productivity analysis. Under the alternative model, the effect of IP on production is not an increased flow of capital services, but a technical change enabling upward shifts in the production frontier.

4.2. *Measurement issues*

Valuation of Intellectual Property where it is not made available on the market through licensing or outright sale is extremely difficult. Even where the performance of R&D services is sub-contracted in the market, the contract cost does not reflect the value of the resulting IP—it is the services that are being bought, not the IP. In this connection an obvious question is why statistical offices, as compilers of national accounts, do not carry out surveys on IP assets in the economy, thus leaving the valuation to the owners of the assets. But an over-riding barrier is that enterprises do not keep records of such values, and the IP value may be reflected only in the market values of companies mixed indistinguishably with other factors influencing the expected future profitability. What comes closest to a specific valuation is where a company either acquires another enterprise

with a promising product in the pipeline or purchases outright a specific patent. In none of these cases will the historic R&D costs provide a satisfactory basis for the value of the IP.

After the idea behind an IP has first been conceived, there is usually a period of complex interaction between refining the idea and development of an effective access device. The fact that significant production may take place during this period gives rise to a misconception that it is the IP that is being produced during the development phase. But the production is of an early access device to the IP, and testing this device will generate a refined version of the original idea, before both idea and access device reach a stage where the commercial benefits can be realized.

An example of such an interaction is the performance of research and development for a new medicine. Clinical trials take a long time and the development period can spread over many years, with continual refinement of the recipe for the new drug. The productive activity during R&D is not the direct generation of IP, it is the creation of access devices and testing them to enable refinement of the IP to take place.

At this stage a first estimate of the value of the IP may be made as the sum of costs for all the research and development, clinical trials, marketing, etc. undertaken to bring the new drug to the market, and including the costs of unsuccessful R&D in a project with the same general objective. This initial estimate can be revised as market performance and the observed monetary returns become available, giving a firmer basis for estimating asset value as the sum of future discounted economic benefits.

But these valuation methods presume that specific research projects can be distinguished, where the costs and profitability of each one will eventually be known. Probably the closest to statistical observations would be variations in the market value of the medical firm caused by expectations on the performance of the new medicine, but again the market value will be influenced by other factors making allocation of the values to a specific medicine extremely difficult.

It follows that there are no easy ways to obtain a reliable market valuation of IP. The value of the IP is the net present value, determined by expected future receipts for access to the IP. In theory this value would be reflected in the market price for a similar asset (SNA, 2008 6.251). But the unique nature of IP (if it is not unique, then it must be a copy of existing IP and so of no extra value) means that unlike produced tangible capital assets, there can be no similar assets with comparable basic prices.

According to 2008 SNA 10.99 "the knowledge remains an asset as long as its use can create some form of monopoly profit for its owner. When it is no longer protected or becomes outdated by later developments, it ceases to be an asset." As IP assets have no material existence there is no wear and tear, and no accidental damage, and therefore their service life is wholly determined by their becoming obsolescent—i.e. when the price for access to the IP becomes zero. IP can increase in value over certain periods of their life time, as the idea "catches on," rather than just showing a continuous decline. But as noted above, the lack of identifiable units and specific prices reduces these valuation principles to an academic exercise.

TABLE 2

The Different Effects of the SNA 2008 Model and the Alternative Model for the Performance of R&D Creating Intellectual Property

Characteristic	2008 SNA treatment of IP	Alternative
Intellectual Property	Produced	Non-produced
Performance of R&D	Capital formation	Intermediate consumption
Appearance in accounts	Production account Capital account	Other changes in volume account
Payments for access	Services	Property Income
Change over time	Consumption of fixed capital	Revaluation
Role in productivity analysis	Provision of additional capital services	Technical change

It should be noted that when "knowledge" as an asset ceases to exist because it can no longer create monopoly profits for its owner (SNA, 2008 10.99), this does not mean that the knowledge it represents disappears. The utility flowing from the invention/discovery/creation will still benefit society, and now perhaps even to a greater extent, as it can be more widely used. This is the case in the production of pharmaceuticals, where drugs protected by patents may sell for extremely high prices, but when the patent expires, they are replaced by generic versions, access to which through injections or pills is sold at a fraction of the previous price.

Table 2 sets out the different characteristics of the two models, and the implications for the national accounts and productivity analysis.

The table shows 2008 SNA recognizing the production and use of the intellectual property products as capital formation of new assets which add to SNA 1993 measures of GFCF, GDP and the level of assets held in the economy. The reclassification of IP from non-produced to produced assets affects GDP directly. It is noted that payments for access to some IP was already treated as payments for services in the 1993 SNA.

The alternative model also shows an increase in the level of assets (but in this case as non-produced assets), assuming that estimated IP will exceed the more restricted value of "patented entities" in the 1993 SNA. Further there will be a change to GDP with the net external payments for access to IP assets now treated as rent, whereas GNI will not be affected. As sale of some IP assets were already in the 1993 treated as a sale of non-produced assets, with current transactions appearing only on the NA capital account/BOP accumulation account, there will be no change over 1993 SNA with the alternative model for these assets.

It should be noted that with the changes introduced by the alternative model, the reclassification of payment for access to IP from a payment for a service to property income (rent) is of major practical importance. The increasing tendency of multinational enterprises to register their IP as the property of a unit in one country when they are used in production in another, has led to a significant increase in international transactions related to access to the IP. As the intangible characteristic of IP enables companies to easily register their IP as owned by a unit in a low-tax jurisdiction, the tax-minimizing behavior of multinationals, often involving very large and artificial transfer payments, directly affects GDP,

usually by a significant percentage in the case of low tax jurisdictions and in relatively small economies.

4.3. *Pragmatic approach to measurement under the alternative model for IP*

Despite the valuation problems outlined above, users wishing the accounts to reflect the full set of Intellectual Property assets, can define and value these assets from the cost side as is now suggested in the 2008 SNA, but retain them as non-produced assets, so that changes will appear as "other changes in volume" and not as fixed capital formation. There will be no associated consumption of fixed capital, but only write-down of value, reflected in the Revaluation account.

The advantage of this approach is that the creation and subsequent revaluation of the Intellectual Property is kept separate from the production system, and can be valued in alternative ways without affecting the core system. This creates more flexibility for users. Further the treatment of payments for access as rent safeguards GDP against being arbitrarily affected by tax minimizing behavior of multinational enterprises.

5. Direct Measures of Government Services

Since the beginning of national accounting there have been discussions on how to deal with government non-market activities, as the system was based on the observation and classification of market activities[5]. The choice has been between considering the government as a producer or a consumer. The classic early discussion found in Ohlsson (1953) and Yu (2004) gives a good overview. For government as a producer, the emphasis is on the resemblance to private producers, identifying and measuring output independently, making possible analysis of productivity. For government as consumer, the emphasis is on government acting as a collective agent for public consumption.

In successive versions of the SNA the treatment of government has differed between showing only government compensation of employees (and CFC) in the production part of the system, (corresponding to the treatment of households as employers of domestic personnel), and showing all government current account purchases of goods and services as intermediate consumption. In the 1993 and 2008 SNA those government purchases that are provided directly to households without any further processing constitute final consumption expenditures by government and the rest intermediate consumption (SNA, 2008 6.234), thus displaying government as a producer, but still measuring "output" as the sum of costs.

In spite of the different bookkeeping treatments of government in the SNA over time; the substance has been the same, namely that all the current expenditures (except for any sales revenue) have ended up in government consumption

[5]There are linguistic traps in some of the present terminology that may prompt unwarranted conclusions about the character of the data and the need for changes to the system. It is remarkable that major features of the economy are mis-named. A prime example is the labeling of the imputed transactions of government providing a health service to households as "actual" consumption. This gives the opposite impression of the situation in real life, where there is no actual consumption through economic transactions. A linguistic trap also occurs when "output" is used for the "sum of costs" with regard to government non-market activity

expenditures with varying parts taking the round-about way as intermediate consumption. Thus the government GVA and consumption expenditures at current prices have been unaffected by these changes, and this is also true for the volume estimates as long as they are made from the cost side. This implies that both at current and constant prices there is no independent "output," and the term output is used for government as short-hand for "sum of costs". There is no "imputed" output for the government non-market activity, as all the transactions related to government activities in the national accounts are actual market transactions (except the imputed CFC), namely purchases of goods and services and compensation of employees.

As long as the de facto treatment of government as a collective agent for public consumption is maintained, the constant price estimate from the cost side is the only correct one (in fact, there is no other side), in analogy to the treatment of private households. It may help to recall why the SNA does not include households' own-account production of services, as the same reasons apply for not recognizing government output. The collective agent approach for government implies that final consumption (government, household, NPISH) is always valued at costs in the system, and that the volume estimates are derived by price deflation of these costs, reflecting a measurement boundary excluding welfare measurements. If the quality of labor input changes, this will be part of the volume change when applying the input method, as it is the sum of worked hours and their quality change that makes up the total change in the volume of labor costs. The change in the over-all labor quality can come about either as a result of changing composition of the work force, and by applying an exogenous rate of increase. Both effects are well-known from the conventional costs-based volume estimates, but as there exists no independent volume estimate for output, the change in "labor productivity" that can be calculated is conceptually quite different from productivity estimates for private business or when using the output method for government.

If the household analogy is disregarded and the government considered a producer similar to market producers, the question of how to estimate output at current prices must be addressed. Here the 2008 SNA maintains the calculation of output as sum of costs, and thus preserves the basic characteristic of government as a consumer, but on the other hand states (SNA, 2008 15.116):

> "The fact that such output is valued on the basis of the value of inputs needed to produce them does not mean that it cannot be distinguished from the inputs used to produce it. In particular, the change in the volume of output can be different from the change in the volume of inputs. Changes in productivity may occur in all fields of production, including the production of non-market services."

As by definition no prices exist for government output the volume estimates can only be obtained by identifying the quantities produced and any quality change. It is a fundamental change for national accounts to move into this area which has previously been outside the measurement boundary of the accounts in the same way as household production of personal services. Of course the idea to

assess efficiency and productivity in the activities carried out by government agencies as an inclusive part of the budgeting process is not new, but should not be mixed up with NA concepts. Numerous research projects as well as the mandatory use of the output method in EU countries since 2006 have demonstrated the difficulties in identifying output indicators that lead to credible and non-volatile results.

To assist productivity analysis, there has been a strong impetus for a shift to the output method, and the Eurostat Handbook on price and volume measures in national accounts (2001) laid the ground for the mandatory use of direct output measures by the EU countries from 2006. With the Atkinson Review: Measurement of Government Output and Productivity for the National Accounts (Atkinson, 2005) and the OECD Handbook: Towards Measuring the Volume Output of Education and Health Services (OECD, 2010a), the adoption of direct output measures was advocated. It was underlined that this data intensive approach requires significant resources both in the agencies delivering the data, and in the NSOs. It should be noted that the output method has so far not been found reliable enough to be implemented in the national accounts of the United States and Canada, even though these countries have carried out extensive experiments with this type of measurement. (Statistics Canada, 2014) and (Bureau of Economic Analysis, 2011).

The Atkinson Review (Atkinson, 2005) is the most comprehensive and influential work on this subject. He underlines that the introduction of the output method requires significant investment in resources, both in the statistical offices and in the government departments where administrative data systems may need to be extended and adjusted and that direct measures of output need to be continuously monitored to ensure that they are capturing changes in quality. He also underlines that even when based on source data of very good quality, the results should not be used directly for productivity estimates, but independent corroborative evidence should be sought on government productivity, as part of a process of "triangulation", recognizing the limitations in reducing productivity to a single number. He also notes that in view of the high profile of these statistics in the political debate a careful course must be steered to guarantee the independence of this approach.

A major problem is to define output concepts for government that take into account all the utility flowing from the government function. Usually a distinction is made between inputs, activities, output and outcome; where activities represent the work processes carried out, output consists of products exchanged to meet the wants of consumers, and outcome is the effect on the consumers of consuming the products. As government agencies do not sell their services, their data recording relates mainly to activities that are often used as proxies for output.

Outcome and quality of government services is at the center of the political debate, and the question of what represents quality in government services is rooted in political dividing lines in the population. It is not realistic to expect that a statistical office can be the final judge on these matters. As noted in Yu (2004), there will be conflicting interests in the results of applying the direct output measures by the government agencies involved. No branch of government would like to see their productivity decline. It will send a negative signal and even interfere

with the bonuses of the management. They will favor "output indicators" that will imply increase in productivity. On the other hand if such increase is taken at face value by the ministry of finance, and if productivity improves over time, they may see their budgets being cut. This also illustrates that whereas productivity measurement for private business may be seen as an academic exercise, this is not the case for government, where it can have direct political and budgetary consequences for an agency. And the quality assurances needed for publishing such data for government cannot be provided by statistical offices.

Although these measurement problems are significant, a more fundamental question is the relationship of the provision of public services to the purpose and function of government. To consider the interaction between a government agency and an individual citizen as a series of imputed transactions, is a misrepresentation of the utility flowing from for example a general health service supplied free to society. Utility is also flowing to all those citizens that are not personally using the health system, through their knowledge that they can be treated freely as required. Thus the health system also has the character of an insurance service of a kind that could not be purchased from an insurance company (no health conditions, no limit on claims). Other spill-over effects such as a reduced loss of working days though illness is also beneficial to society at large. This raises questions about the distinction made in the SNA between collective and individual government services, as all services that government supplies are essentially collective in nature—the very reason for government involvement. As it is generally accepted that direct output measures do not make sense for collective services, this also by analogy applies for the so-called "individual" services.

Both the 2008 SNA and the ESA 2010 recommend using the "output method" for calculating the volume of individual government non-market services, in particular health and education. But the discussion above regarding replacing the input method with the output method suggests that this is not just another improvement in methodology, although it is presented as such. This change represents a completely new approach, through imputed transactions extending the production boundary of the SNA.

2008 SNA shows no doubt about the appropriate measures of volume output for government. Paragraph 15.116 (quoted above) reveals how the needs of productivity analysis have affected the national accounts system. The next three paragraphs in 2008 SNA describe three different approaches to measuring volume of output, which will enable real output to be compared with real inputs and so generate productivity measures of government activity. They illustrate the problems of measurement.

Paragraph 15.117 "The first [approach] is to derive a pseudo output price index such that when it is compared to the aggregate input price index the difference reflects the productivity growth thought to be occurring in the production process. Pseudo output price indices can be derived in various ways, such as by adjusting the input price index according to the observed productivity growth of a related production process or by basing the growth of the pseudo output price index on the observed output price indices of similar products. However such data are rarely available for goods and services produced by government and NPISHs."

This paragraph proposes a self-defining method of obtaining a productivity measure equivalent to that observed in the production of "similar products." The conclusion is that such data is rarely available, so the approach is effectively discarded (15.117). The reason is that despite appearances, the two kinds of activity are so fundamentally different (market v non-market) in economic terms that any assumption of productivity measures from the private sector would be wrong.

Paragraph 15.118 says "The second approach, the 'output volume method' is recommended for individual services, in particular, health and education. It is based on the calculation of a volume indicator of output using adequately weighted measures of output of the various categories of non-market goods and services produced. These measures of output should fully reflect changes in both quantity and quality."

But there is no description in the following paragraphs of how the outputs should be chosen in practice. Market sales bring with them their own self-selection according to the values of sales for each product sold. But non-market output has no such consumer choice of product measure, unless it is accepted that input costs reflect government choices.

Paragraph 15.120 attempts to define the non-market outputs through the example of health. "The benefits to the patient constitute the output associated with (these) input activities." But who is to say what these benefits are for an individual patient? Longer life? Degraded longer life? Without the measuring stick provided through market transactions, we are grasping at straws.

Paragraph 15.121 describes what not to do—do not use inputs as a proxy, and do not use outcome measures affected by context and environment. It does say "What should be measured is the service rendered to the customer." But that is not helpful (unless of course it means to describe the input activities, reflecting the input costs). It is therefore surprising to read the first sentence of paragraph 15.122 which says "In the light of these observations, the 'output volume method' is the recommended method for compiling indicators of volume change of non-market services," especially considering the following cautionary words in paragraph 15.123:

"It is recommended these volume indicators be tested for a substantial period of time with the aid of experts in the domain prior to their incorporation in the national accounts. Expert advice is particularly relevant in the areas of health and education, which usually dominate the provision of individual services. Further, the consequences of the estimates including the implications for productivity measures should be fully assessed before adoption. Unless and until the results of such investigations are satisfactory, it might be advisable to use the second best method, the input method."

The second part of this paragraph reads as if it turns out that the results do not produce the expected productivity answer, go back and try again, or give up. And the expected (or acceptable) productivity answer will most likely be a positive productivity growth, though still less than in the market economy. Any other answer might put the compilers of the data under some pressure. But if government is taken as a collective consumer rather than a producer, it is not obvious that increasing productivity would result. With increasing living standards, households consume more resources per capita and may at the same time even work

less. These "standard improvements" (decrease in household productivity) will spill over into many government non-market services, where standards are improving as society becomes better off—better hospital and school facilities, more staff per patient and per student etc. The standard improvements may to some extent lead to increase in quality (however measured), but to match the increase in the use of inputs fully will require unlikely high rates of quality increases.

Thus the 2008 SNA is extremely unsure about the "best" way to measure government volume output, and the message is so mixed that compilers are left wondering what they should do in practice, and how much effort they should put into pursuing the recommended best method.

Under the ESA 2010 guidance, the use of the "output volume method" is made compulsory[6] for EU Member States. It is argued that in the absence of a unit market price, the unit cost of a non-market service can be considered as the equivalent to the price. In fact, the price of a market product corresponds to the expenditure which the purchaser must incur in order to take possession of it, while the unit cost of a non-market service corresponds to the expenditure which society must incur in order to it is make use of it. It is argued that where it is possible to define units of quantity for non-market services, it is also possible to apply the general principles for calculating volume and price indices. (ESA, 2010 10.29), and the output method consists of calculating volume by applying unit costs of the previous year to the quantities of the current year.

Given the conceptual difficulties and the absence of consensus on output methods adjusted for quality, it has been decided in the European Union that quality adjustments are excluded from the central framework in order to preserve the comparability of the results across countries. Thus, in the field of non-market health and education, the estimates of production and of consumption in volume terms have to be calculated on the basis of direct output measures—not adjusted for quality—by weighing up the quantities produced by the previous year unit costs of those services.

The introduction of the output method as recommended in the 2008 SNA, and as compulsory, though in a truncated form in the 2010 ESA excluding taking into account any changes in quality, reveals a movement towards applying the output method more widely, without a full analysis of the implications

The knowledge dimension, its measurability and how it relates to the production boundary of the SNA, that play an important role in the discussion of R&D above, is also present in the discussion about direct output measures of government non-market output. According to the definition of services in the SNA, it is irrelevant for the measurement whether the doctors' services are providing cures or the teachers' services are providing mental changes in pupils by changing their state of knowledge, as these states of health and knowledge depend on many

[6]Also prior to the adoption of the 2010 ESA, since 2006 the EU member states were required to report the volume of individual government non-market services measured according to the output method. It was the very divergent movements of these results across countries, much of which could be related to implicit or explicit quality adjustments, which are the reason for the ESA 2010 decision to exclude quality adjustments, although this is at odds with basic principles governing volume estimates in national accounts.

other aspects than the activity of the non-market services. Therefore education services might be better described as providing the capability to transfer knowledge to pupils and students. Instruction in general may be regarded as performance-type services (activities) in which teachers inform the pupils and students (Sakuma, 2013). Similarly health services can be seen as providing the capability to cure patients. In both cases the measurement of the resources used, i.e. the input method, is the logical answer.

6. Concluding Remarks

In this paper it has been argued that extensions of the SNA to include the creation and use of knowledge, and the provision of government services in volume terms through output-related indicators, represent fundamental changes to the system. These changes undermine its reliability and move the SNA from a multipurpose system to a system specialized for productivity analysis. The changes affect the interpretation of major concepts such as GDP and NDP. Both the extensions discussed represent major research and policy areas, with methodological and theoretical foundations and data requirements beyond the compass of national accounts. These extensions can only be implemented in the national accounts in a simplified and inflexible manner. The resulting measures cannot provide a basis for informed decisions by policy makers.

As these themes are far from settled conceptually, and empirical measurement methods are still at an experimental stage, all the conditions are present for dealing with the capitalization of knowledge products and volume of government output and related productivity analysis in satellite accounts, rather than integrating them into the core system of national accounts. Several countries developed R&D satellite accounts prior to the capitalization of R&D in the 2008 SNA and their experiences illustrate the extent of the conceptual and practical problems.

The satellite approach was accepted by the EU statistical community during the updating of the ESA, and the ESA 2010 text was written and approved on the assumptions that R&D was not capitalized in the core accounts, but should be recorded in a satellite account until "a sufficiently high level of reliability and comparability of the estimates across Member States has been achieved" (ESA, 2010 3.22).

For direct government output measures, the relationship between activities, output and outcome can be analyzed in a satellite system under alternative assumptions, including the elusive question of quality.

To support productivity analysis, a solution comparable to the one that has emerged for environment accounting would be preferable. The System of Environmental-Economic Accounting (SEEA) has been adopted as a separate statistical standard and supplemented with SEEA Applications and Extensions (UN, 2014b). Within the SEEA framework, environmental analysts can postulate theories, and impute transactions to develop models informing key policy decisions without affecting the SNA. A similar approach for productivity would serve both the national accounts and productivity analysis better. Such a system could in time contain all dimensions of the productivity issue, including an extended

asset boundary corresponding to the KBC items and alternative measurement methods. By this approach dedicated users would lose the "trade mark" effect of the SNA to lend support to their data and analysis, but recognize that the wealth of data existing outside the system of national accounts can most usefully be retained there. The pragmatic solution outlined in section 4.3 to deal with the appearance of knowledge assets through the "other changes in volume" account can be seen as the link between a satellite system for KBC and the national accounts in the same way as other changes in volume of land is a link between the SEEA and the SNA.

Our answer to the question raised by the Paris conference on the future of the SNA: "W(h)ither the SNA?", is to reconsider the treatment of the knowledge economy in the national accounts, which would include re-establishing the core national accounts without capitalizing knowledge as produced output, and withdraw the recommendation to extend the measurement boundary to include estimating the volume of government services through delivery-related indicators. As a consequence of the payments for access to intellectual property being reclassified from a service transaction to property income, the major distortions to the GDP measure caused by multinational enterprises' tax-minimizing behavior are resolved.

There will always be a clash between the extent of measurement of the economy, and the reliability of the measures produced. Different users of national accounts have different priorities: Governments look for reliable figures recorded in a system of accounts which measure an economy according to widely accepted principles of accounting. This enables decisions on economic policy to be taken on what is accepted as an informed basis. Economic analysts support government in taking good decisions through research and the building of models of how the economy works, and deriving policy recommendations. Recent changes to the accounting system in 2008 SNA have moved the accounts too close to the world of research and hypotheses, and this has reduced the reliability and general applicability of the published accounts, and compromised their status as official statistics.

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