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EUROSTAT REVIEW
ON NATIONAL ACCOUNTS
AND MACROECONOMIC
INDICATORS



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**EUROSTAT REVIEW
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AND MACROECONOMIC
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Eurostat plays a central role in providing statistical information on the EU, the euro area and European countries. Indeed, it has a privileged position as a unique resource for the dialogue between researchers and producers of official statistics and it is a point of reference for the communities of data users such as international organisations, Statistical Institutes, Central Banks, analysts and policy-makers. Eurostat has also the capacity to draw empirical, theoretical and policy articles within the scope of National Accounts and macroeconomic indicators, dealing both with users' and producers' interests, presenting subjects of general relevance, of comparative nature, as well as specific country-related or thematic topics.

For these reasons, Eurostat is launching with this publication EURONA, the EUrostat Review On National Accounts and macroeconomic indicators. EURONA is an open access, peer-reviewed, scholarly journal on methodology, techniques, standards, methods and practices on National Accounts and macroeconomic indicators.

EURONA proposes a new approach to scientific journals in these thematic areas. This is primarily because the target readership consists of a high proportion of practitioners, not only researchers. Yet the integrity and success of the EURONA depends on its scientific rigor, but a vital part of its realisation depend on its relevance and how useful reading EURONA is for the community of official statistics. Hence, the articles proposed respond to the needs, challenges and issues that users and producers of official statistics related to National Accounts and macroeconomic indicators encounter.

EURONA is also intended to fill a gap in the expanding fields of National Accounts and macroeconomic indicators, by adopting a scientific approach. It is a journal that reviews and explores all aspects related to new theoretical and experimental findings in statistics, econometrics, economics and any closely related fields. EURONA is therefore a refereed international journal to be of use to all those concerned with research in various fields of, or closely related to, statistics and economics discipline.

EURONA can bring a distinctive (European) perspective to tackle with hitting issues, listening to the oppositional voices and bringing in best practices and innovative perspectives from research and work at national and international level, which in fact promotes sustainable statistical information empowerment.

The choice of National Accounts and macroeconomic indicators is, in some sense, natural due to the fact that they are central in providing economic information to the public, but they are also critical data for supporting decision-making of policy-makers and investors, in addition of being at the basis of most macroeconomic exercises made by analysts. The creation of a specific review on National Accounts and macroeconomic indicators brings to the attention of a large and diverse audience first rate research activities and findings by academics, but also case studies and reflective articles by practitioners. EURONA creates a concrete opportunity to identify, present and discuss both practical and theoretical aspects as well as practices that have an impact on the meaning and understanding of National Accounts and macroeconomic indicators in a globalised economy.

Walter Radermacher

Director-General, Eurostat

Aims and scope

EURONA is an Open Access, peer-reviewed, scholarly journal dedicated to

- Methodologies, techniques and tools related to National Accounts and Macroeconomic indicators; and their use in supporting economic decisions;
- Standards, methods and practices used for the production of National Accounts statistics and Macroeconomic indicators;
- Analytical methods and results in subject fields making use of National Accounts data and Macroeconomic indicators.

EURONA aims to bring a distinctive perspective to tackle with different National Accounts related issues, also listening to oppositional voices and bringing in best practices and innovative perspectives from research and work at national and international level, in order to promote sustainable statistical information empowerment. EURONA's core objective is to provide a platform for the researchers, scholars, producers and users of statistics and other practitioners to come together and share their research findings, thereby facilitating progress and enhancement of National Accounts and Macroeconomic indicators.

EURONA is non-partisan and applies the highest standards to its content - specifically, it emphasises research integrity; high ethical standards; constructive peer-review; validity of the findings; and cutting edge results.

The articles published in EURONA do not necessarily reflect the views or policies of the European Commission or Eurostat.

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EURONA is a new concept in the panorama of scientific journals. Scientific papers are the primary mode of communication in the scientific communities. The National Accounts and Macroeconomic indicators community is an evolving group of experts, practitioners, producers and users of statistics whose interests evolves at quick pace. Therefore, being ‘up-to-date’ on the latest developments in National Accounts and Macroeconomic indicators is paramount to ensure the capability of translating the economic societal phenomena in statistics. EURONA aims at providing a range of opportunities for communication on research according to a modern way of sharing knowledge. EURONA is research, review, case studies, tools, processes and methods translated into articles for the National Accounts and Macroeconomic indicators community and interested newcomers — under a strict policy of scholarship publishing.

EURONA applies the scientific rigour of a scientific journal: highest standards to its content - specifically, it places an emphasis on research integrity; high ethical standards; constructive peer-review; validity of the findings; and cutting edge results. Articles are peer reviewed and key messages are highlighted for potential readers.

EURONA aims at providing highly readable and valuable insights to the statistical research work in National Accounts and Macroeconomic indicators and it aims to become an indispensable reference in this field. EURONA’s intent is to bring together, in a virtual forum, academicians, producers, users, practitioners of Macroeconomic (official) statistics. The ultimate EURONA’s target is ‘good quality statistical information for informed decisions’.

EURONA builds upon the extraordinary knowledge cumulated in national statistical offices and international statistical organisations through the valuable work of their statisticians, the freshness of research projects, the practical work performed by producers and the thematic raised by users.

EURONA is engaged in becoming the gateway to present, share and discuss the ideas, the experience, the knowledge and the know-how that could bring a valuable contribution to the production of National Accounts and Macroeconomic indicators, progressing on quality and keeping up with technology.

The journal’s core objective is to provide a platform for the researchers, scholars, producers of statistics and other practitioners to come together and share their research findings, thereby facilitating progress and enhancement of National Accounts statistics and Macroeconomic indicators.

The first issue of EURONA contains four articles written by eminent experts in the field.

André Vanoli gives a broad historical overview of the great achievements of National Accounts, providing insightful links into economists’ debates regarding the continued usefulness of the accounting approach. The author also looks at some of the main challenges facing National Accounting today, such as welfare, globalisation and environmental concerns.

Dale W. Jorgenson and Daniel T. Slesnick propose innovative measures of individual and social welfare to be incorporated into the system of National Accounts. Since incorporating normative judgements into National Accounts is not uncontroversial the authors propose to start by compiling satellite accounts.

T. Peter Hill deals with the role of intangibles and services in the National Accounting system. The author advocates that, resulting from the IT revolution, intangibles should be made into a third major product category (to distinguish them from both tangible goods and services).

W. Erwin Diewert proposes to further decompose the gross operating surplus to take into consideration pure profits and the value of non-financial capital services as well as financial transactions such as the cost of deposit services and the margins on financial investments and loans.

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National Accounting at the beginning of the 21st century: Wherefrom? Whereto?

André Vanoli ⁽¹⁾

1

After discussing the long period of intermittent national income estimates produced from the second half of the 17th century to the first quarter of the 20th century, this article reviews the great achievements of national accounting in the last century. It insists on three themes: the emergence of an accounting approach applied to the level of a national economy and the economists' debate around it; the long process of international harmonisation leading to a single system of national accounts by the end of the century; and the enormous development of national accounts data produced and their uses. However, in relation to important changes in social concerns in the last quarter of the century, new requirements have appeared; and the interpretation and relevance of national accounts results have been increasingly questioned.

The second part of this article looks at the three main challenges facing national accounting today. The long-lasting welfare measurement dispute is analysed, from Pigou, Hicks and Kuznets to the Stiglitz Report, through Nordhaus and Tobin. Secondly, national accounts have to adapt themselves to a rapidly changing economic world; and particularly to the complexities generated by the puzzle of globalisation. Finally, accounting for environmental issues, more specifically the interaction between economy and nature, and taking care of sustainability concerns represent the most complex new challenge that national accounting is urged to meet. There are two conflicting views in this respect. The first one, based on a theoretical approach to sustainability in the context of an extended/inclusive wealth concept (produced, natural, human and social capital), calls for a fully integrated and comprehensive national accounting framework covering all these dimensions at the same time. This author is sceptical about the feasibility of such an ambitious approach in current ex post national accounting. The alternative more pragmatic view is most probably unavoidable and could be agreed upon for current accounting. It consists in a multiple frameworks approach with various types of link between them. The existence of tensions between 'observation' and 'analysis' should be acknowledged.

(¹) The author thanks the two anonymous referees of the Review and Jacques Magniez for their very helpful comments and suggestions.

Introduction

The purpose of this article is twofold. On the one hand, it provides an overview of the emergence and evolution of national accounting during the 20th century, after a short reminder of the long story of national income estimates. In this respect, it is to a great extent a summary of the book *A History of National Accounting* (Vanoli 2002, 2005). Following a chronological presentation, it provides links to economists' debates regarding the usefulness of the accounting approach. The focus is on the

development of international standards for national accounts until standards converge.

On the other hand, the article describes and discusses the most important challenges facing national accounts today. One is the long lasting welfare measurement dispute. The two other main challenges discussed are globalisation and the possible extension of the national accounts to include interactions between the economy and nature.

Part 1 — History: great achievements

Antecedents

Looking back over the 20th century, one is impressed by the enormous but unequal development of statistical information in nearly all fields of social concern. The achievements of national accounting have been remarkable. At the eve of the Great Depression in the early 1920's, national accounting simply did not exist. Of course early roots can be found in the past. In the case of national accounts, William Petty in 1665 and Gregory King in 1695 in England, soon followed by Boisguilbert in 1697 and Vauban in 1707 in France, produced first estimates of national income. But after this early beginning, estimates of national income were only produced intermittently and developed slowly. Paul Studenski, in his encyclopaedic work *The Income of Nations* (1958), noted that national income had been estimated at least once for only eight countries by the end of the 19th century, and for some twenty countries by 1929.

During this time of development, and using various methods, national income was estimated as a stand-alone measure. Similarly, when the more numerous measures of wealth were produced from 1850, they were unconnected to national income estimates. However, there was an exceptional precursor. Gregory King, in addition to making comparative estimates of income and expenses for

England, France and Holland in 1688 and 1695, made consistent estimates of various economic measures (income, expenses, increase or decrease of wealth, and so on) for England and for a series of years (1688 to 1698). He went so far as to create an account of the population by detailed social groups. Paying his tribute to King in his Nobel Memorial Lecture 1984, Richard Stone regretted that 'after this brilliant start, all thoughts of balanced accounts seem to have evaporated'. This remained the case until the eve of World War II.

As long as attention was focused on the measurement of a single concept such as national income, there was no incentive to thinking in terms of accounting and interrelationships. In practice, estimating the national income of a country consisted of gathering the largest possible amount of data, processing it ingeniously and filling the big gaps in the availability of data. Those were the days of enlightened amateurs. Methods of estimation were diverse, depending on the type of information that was available. Compilers usually combined elements of what will later be called the three approaches to the compilation of national income: output, income and expenditure. However, they were thought of as combined partial methods of estimating national income, not as attempts to measure three interrelated but different concepts and aggregates standing for themselves: income,

production and expenditure. This confusion caused problems later.

From the Great Depression to World War II

The statement by Stone on the lack of attention to balanced accounts should not underplay the progress made during the 1930s. The influence of the First World War on national income estimates was very limited, and it was the 1929 Great Depression that was a turning point.

Firstly, large programs of national income estimates were developed. An official demand originated in the United States Senate in 1932, leading in 1934 to a report prepared by Simon Kuznets and his assistants (National Income 1929-1932) in current prices, by type of economic activity and distributed income. Estimates were then extended to expenditures (final consumption and capital formation) by Clark Warburton. Warburton's 1934 article seems to have been the first use in print of the term gross national product (or gross social product) as the sum of these two final expenditures. A few years later Kuznets also used the expression 'gross national product'.

Other large programs to develop national income estimates were seen in Sweden (National Income in Sweden 1861-1930, published in 1937 by Erik Lindahl, Einar Dahlgren and Karin Koch) and also The Netherlands (Jan Tinbergen) and Denmark (Viggo Kampmann); whereas in the United Kingdom Colin Clark extended his previous 1932 estimates to a fairly comprehensive coverage (National Income and Outlay, 1937).

Secondly, some national income compilers started thinking in terms of national accounting by exploiting analogies to business accounting. Irving Fisher in his theoretical works (1906, 1928) had formerly evoked the extension of the accounting treatment of individuals and businesses to society as a whole, and proposed obtaining in principle the capital and income of society as a combination of balances of businesses and income accounts of individuals. This was however unconnected to

quantitative estimates.

More directly in relation to national income estimates, Morris A. Copeland showed (1932, 1935, and 1937) the benefits of using a double-entry book-keeping system in the estimation of national income. By 1936, another American, Robert F. Martin from the Department of Commerce, presented the idea of an accounting system for the national economy. In France in 1939, André Vincent published his views on the application of accounting principles to the national economy considered as an entity. In The Netherlands, Ed van Cleeff produced estimates for 1938 (published in 1941) within the format of a national accounting system. He presented national accounts 'as the business accounts of the nation' and compared the government 'with the directors of a big firm'. There were two different approaches used in these first presentations of the idea of a system of national accounting during the thirties. The first was mostly operational (Copeland, Martin), emphasising the technical advantages of such an approach for making better estimates of national income. The other one (Vincent, van Cleeff) conveyed, in addition to the former, views on better economic organisation for the nation and an emphasis on planning after the disorders of the Great Depression.

In terms of studies on national income, the 1930s witnessed improvements in methods, the beginning of a trend toward official status, regularity in the publication of series, and the emergence of expenditure aggregates, representing the use of national income for consumption and capital formation. During the second part of the thirties, macroeconomics rather than business accounting was the seminal influence that led to the use of an accounting format at the macroeconomic level.

Thirdly, macroeconomics called for a new concept — the economy of a nation as a whole, with a set of interrelated quantitative measures of basic concepts in monetary terms. The equations that described their mutual relationship were formulated by John Maynard Keynes in his *General Theory of Employment, Interest and Money* (1936). They would become the skeleton of National Accounting.

In brief, the relationships are:

'Income = Value of output = Consumption + Investment

Saving = Income - Consumption

Therefore, Saving = Investment' (Book II, Chapter VI)

Of course, interrelationships in an economy had been present before in economic theories, but this was the first time that such concepts and their statistical representation became central to macroeconomic policies.

World War II

So at the end of the thirties, the way was clear for intellectual, economic and political progress. World War II provided the second decisive turning point in this direction. It witnessed the birth of national accounting as we know it today, and a wide extension of its uses. The impulse came with Keynes being asked by the UK government to tackle issues such as 'How to pay for the war?' and the problem of inflation (1940). An official study was carried out by James Meade and Richard Stone. The outcome was a report ('An Analysis of the Sources of War Finance and Estimate of the National Income and Expenditure in 1938 and 1940' in the April 7, 1941, *White Book*) and a technical article ('The Construction of Tables of National Income, Expenditure, Saving and Investment', *Economic Journal*, June-September 1941). This article presented the accounting structure that Meade and Stone had developed. This framework was incomplete. Though separate estimates for businesses, persons, government and the rest of the world appeared in the tables, the accounts of the sectors were not shown explicitly. Neither the structure of the production system (only the net output of seven broad economic activities) nor the financial transactions were shown. Nevertheless, the set of tables published in 1941 represents a first system of national accounts, providing a framework linking a coherent set of macroeconomic totals.

Stone's 1945 memorandum and the beginning of standardisation

At the end of World War II, Stone presented a proposal for a more elaborate accounting system. The latter served as the basis for a meeting of a subcommittee of statisticians of national income from the League of Nations (Princeton, December 1945). Stone's memorandum was revised after the meeting and published in 1947 by the United Nations, under the title 'Definition and Measurement of National Income and Related Totals', as an appendix to the subcommittee's report. A summary of this accounting framework is given in Vanoli, 2005, pp. 24-25 (the full set of accounts is reproduced pp. 32-40):

'In the presentation of the proposed accounting system, sectors are the result of aggregation of accounting entities according to their function; these accounting entities are the basic economic units that perform the transactions. For each category of accounting entity it might be necessary to establish more than one account. Transactions are classified according to the nature of the counterpart to the money flows. Five main sectors are identified: productive enterprises, financial intermediaries, insurance and social security agencies, final consumers (including the general government) and the rest of the world. The first four are subdivided: business enterprises and persons (home-ownership); banking system and other financial institutions; insurance companies and societies, private pension funds and social security funds; persons and public collective providers. The list of the five sub-accounts is unique, but their size depends on the sub-sectors, and two of them might in some cases be combined. The main accounts used are the following: an operating account, an appropriation account, a revenue account (for current income and expenses of persons and public collective providers), a capital account, and a reserve account.'

The financial transactions are recorded in the reserve account.

'Each transaction is entered twice in the system,

following the double-entry principle, but there is no systematic description of the bilateral relationship between sectors (dummy accounts are therefore implicit). The link between the accounts of each sub-sector is sometimes a complex issue. For instance, for productive enterprises, the surplus of the appropriation account enters the reserve account and then, once combined with the net financial transactions, passes on to the capital account. Another case is that of realised net capital gains, recorded only for business enterprises, which appear in the reserve account, and are transferred to the appropriation account, from where they return to their point of origin as part of the net result of this account, finally to be sent to the capital account with the other financing means.'

The aggregates that Stone described in his memorandum are completely consistent with the system of accounts, but not presented in the accounting scheme itself. They are derived from it. No accounts were presented for the national economy based on addition of sectoral accounts. This duality of system and aggregates will be a source of ambiguities.

Though not including balance sheets, the proposed system was well in advance of its time. The influence of business accounting could be easily detected. For example, sales, purchases and movements of inventories were recorded, although output and intermediate consumption were absent due to a lack of detailed data. An entry was included for bad debts between business enterprises and persons, as well as realised capital gains for business enterprises.

It should be stressed that Stone's 1945 memorandum conceived national accounts as the result of the aggregation of accounting entities and transactions.

In spite of this outstanding 1945 contribution by Stone, neither emerging systems of national accounts at country level nor the first steps towards international standardisation followed his lead, even although Stone himself led the preparation of the first standardised system (OEEC 1952). The subcommittee of experts at the 1945 Princeton meeting, chaired by Stone, indicated 'total agreement' with the Memorandum approach, but considered it impossible to implement a system as

detailed as the one presented in the memorandum appendix. Instead a limited set of tables were recommended, with the emphasis on functionality.

Usefulness of the accounting approach still questioned — Kuznets' position

So, at the beginning of the fifties at the international level, the concept of a system of national accounting appeared rather fuzzy and the use of the word 'accounting' almost inappropriate.

In *Review of Economics and Statistics* (August 1948) Simon Kuznets was critical of the new Income Series published in a Survey of Current Business supplement 1947; his view was that the system of economic accounts did not solve any problem linked to a proper definition of national income (for Kuznets, the purpose of national income was a measure of welfare).

Nevertheless, Kuznets did not deny the usefulness of a system of accounts, and he said:

'... the basic principle and great usefulness of the system of accounts is that it recognises distinct group of transactors; calls for a complete census of transactions of such groups through the accounting period; and, under the double entry system, compels a distinction between transactions that represent "borrowing" (in the widest sense of the word) by the given transactor unit from others and those involving "lending" by it to others' (p. 154);

'the development of entire families of gross totals of volumes of transactions, without any attempt at the "netness" that is associated with national income ... (ibid). All students would welcome a detailed set of accounts that would distinguish groups of business, government, and family units characterised by different pattern of economic behavior; and that would, therefore, show as fully as data permit the input-output or sale-purchase relations among different industries and economic institutions. It is in the direction of developing such fuller reflections of the workings of our economy, with whatever gross

transaction totals can be derived from them, that the emphasis on a system of accounts naturally leads' (p. 155).

Note that, on the same page, Kuznets referred explicitly to Morris A. Copeland for the money approach, and Wassily Leontief for the input-output tables.

The last quotation from Kuznets set precisely the program of development for national accounting in the second part of the century. It is clear from this last quotation that Kuznets' reservations were not against, but in favour of such an orientation. Taken in isolation, his criticism of the U.S. National Income and Product Accounts (NIPAs), from the point of view of national income analysis ⁽²⁾, often led to a misinterpretation of his views.

Strong demand and uses and expansion of the National Accounts

The international standardised system, that played a central role as the implementation of accounts extended to an increasing number of countries, lagged behind that of more advanced national systems. Countries like France, The Netherlands, the United Kingdom, Norway and Sweden tended in the 1950s and 60s to develop their own systems of accounts. For instance, between 1952 and 1956, the British summary tables were presented as a table of sectoral accounts, called social accounts, which presented the accounts by sector (in columns) and by the accounting entries in rows: groups of transactions and balancing items. Odd Aukrust also suggested something similar in a 1949-1950 article. In France René Froment had devised (1945, 1947) the first presentation of something of this kind, which was systematised by the middle of the fifties, under the name of *Tableau économique d'ensemble*, a Quesnay-like title, in the new French system of national accounting.

More generally, the construction of national

accounts at the country level took place in the framework of extensive demand and use, beyond that experienced before and during the war. Many factors were responsible for this demand, notably the reconstruction of economies post-war, anti-inflationary and growth policies, the extended economic and social role of government, and the development of international cooperation and integration. Tools were developed to help decision processes. Keynesian macroeconomic demand management required short-term economic budget forecasts; longer-term projections were needed for indicative planning in industrialised countries; and industrial analysis was required for development policies in the newly emerging independent nations. The development of modelling, input-output analysis, econometric techniques and national accounts estimates reinforced each other. On the whole, in the three decades following the war, national accounting experienced a golden age, not only because it expanded significantly, but also because its extension responded well to the requirements of society.

The long process of international harmonisation

The achievements of this period were accompanied by a long process of international harmonisation and extensions, rendered necessary by the world level coverage of economic analysis and the emergence of country integration in forms such as the European Union. Until the end of the sixties, in the West, a variety of national systems existed that were difficult to reconcile. France had adopted a narrower concept of production, limited to market goods and services. The accounts of countries following the same comprehensive concept of production, including non-market government services, were also not consistent. In the East, the Soviet Union and its satellites followed a restricted concept of material production, limited to goods and the so-called material services (mostly the transport of goods), and a totally different accounting scheme. The main issue at the world level was comparing the accounts of eastern and western countries.

⁽²⁾ 'Indeed, examination of the report fails to convey the impression that the setting up of accounts assisted in any way in solving these problems of definition and distribution. On the contrary, the impression is that these problems were solved without benefit of the system of accounts and that the system of accounts was constructed to fit the solution,' *Review of Economics and Statistics*, August 1948, p. 153).

Not surprisingly, perhaps, an initiative towards international harmonisation was taken by the six countries at that time comprising the Common Market in Europe. A full understanding of the accounts of the Member Countries was a basic requirement of the European Economic Community. At the beginning of the sixties, an effort was made to compare national practices on the basis of a 'sectors accounts scheme' derived from and completing the OEEC Standardised 1952 System. Very soon, however, it appeared that this scheme was lacking; and a more appropriate system was needed. This initiative led some years later to the European System of Accounts (ESA). A report was prepared in 1964: 'Propositions for a national accounting framework for the European Communities' (André Vanoli). The main proposal was the integration of traditional economic accounts, input-output tables and financial accounts in an overall system that would be acceptable to all. This was not immediately achievable, as input-output tables were not accepted as part of the accounts in the Federal Republic of Germany.

The decisive support for an extended integrated system came from Stone. Following a UN request, at the end of 1964 he presented a report proposing drastic changes to the 1952 UN SNA (the latter was nearly identical to the 1952 OECE standardised system).

Stone's report was based on research carried out at Cambridge in the early 1960s by Stone and his colleagues, after a short-lived revival of the idea of planning in the UK. As a result of this research, 'A program for growth' (1962 and following) was published, and comprised a growth model, a social accounting matrix (SAM) and input-output relationships for the period 1954-1966. The Cambridge SAM linked the input-output analysis and institutional sectors' accounts (including financial accounts as a memorandum item).

The second part of the 1960s was a period of intensive parallel discussions both within the European Communities and at the UN. These discussions ended successfully, with the 1968 SNA on one hand; and the first European System of Integrated Economic Accounts (1970 ESA)

on the other hand. Except for the classifications of economic activities and products, differences between them were small, and the ESA was effectively the European Communities' version of the SNA. This was the condition of its acceptability for some countries. However, the fact that it was formally an independent system was important both technically and politically for the future role of the ESA in Europe.

The 1950-1952 OECE/UN standardised system had played an important role in promoting the implementation of national accounts but it was a limited presentation, and the economic accounts were often understood as covering neither the I-O tables nor the financial accounts. After the adoption of the 1968 SNA/1970 ESA, this picture was reversed. The international system then appeared to be well in advance of the practices and statistical capabilities of many countries.

The 1968 SNA

The 1968 SNA was not an attractive and pedagogical presentation of the system for many people. In particular, the use of a matrix format for introducing the general structure of the 1968 SNA, which was inspired by the 1962 SAM, troubled a lot of national accounts' compilers. Input-output analysis was given so much attention in the first chapters of the Book that it gave the impression of an imbalance in the system. Following no mention in the 1950-1952 version, it was felt to be over-emphasised in the 1968 one. The two chapters devoted to it seemed to be directed at the same time toward both national accounts' compilers and people already trained in the field. These chapters were rigorously and clearly drafted. Nevertheless it is probable that few readers were able to master the notions of true factor value, approximate factor value, true basic value and approximate basic value. The 1968 SNA recommended the use of the approximate basic value. The 1993 SNA/1995 ESA would also recommend approximate basic value, calling it 'basic price'. See box 18 'Valuation of transactions on commodities (market goods and services) in the 1968 SNA' in Vanoli 2005).

One of the great achievements of the 1968 SNA was

the differentiation between industries (producers of goods and services for sale at a price normally intended to cover their cost of production) and producers of government services, and the corresponding types of output: commodities on one hand, other goods and services on the other hand. Following the terminology proposed in Vanoli's proposals of 1964, the ESA 1970 retained 'market branches' and 'non-market branches', 'market goods and services' and 'non-market goods and services'. The terminology market/non-market was later used in the 1993 SNA.

The 1968 Blue Book included chapters, more elaborate than in the 1950-1952 version, devoted to the transactors and transactions in the system, followed by the standard accounts and tables. Nevertheless, in the 1968 Blue Book, a very elegant matrix presentation at the beginning coexisted with a dense presentation of a set of standard accounts and twenty-six standard and supplementary tables at the end. Altogether this gave the impression of a daunting system, more complex than it really was.

The 1970 ESA

For its part, the 1970 ESA was a model of clarity. Its drafting has been given a great deal of attention by a high quality team (Vittorio Paretti, Jean Petre, Piero Erba, Hugo Krijnse Locker, etc.). Detailed discussions among the six member countries allowed wordings and treatments in the ESA that were more precise than in the SNA and better adapted to the EEC situation.

The accounting structure was more extensive than in the SNA. Transactions were divided into three broad categories: transactions in goods and services, distributive transactions, and financial transactions. 'Distributive transactions' was a general category that was not identified in the SNA. The sequence of accounts split in two each of the three accounts of the 1968 SNA. A production account (balancing item: value added) and a generation of income account (balancing item: operating surplus) replaced the SNA production account. The income and outlay account was replaced by a distribution of income account (balancing item: disposable income) and a use of income account (balancing item: saving). The

capital finance account, split in two in the SNA, was replaced in the ESA by a capital account (balancing item: net borrowing or net lending) and a financial account (balancing item: net changes in financial assets). The French practice of estimating accounts in volume terms using prices of the previous year was not included. Neither the SNA nor the ESA adopted this practice at that time. They continued to recommend calculating estimates at constant prices of a fixed base-year, until the 1993 SNA move to chain indices.

The main weaknesses of the SNA/ESA remained the absence of balance sheets; fixed capital formation was limited to tangible assets; and the relationship between income and wealth was not fully shown.

However the 1968 SNA/1970 ESA systems of national accounts moved from an approach focused on aggregates to an approach recognising the importance of the accounts themselves.

The 1993 SNA/1995 ESA

A quarter of a century later, a third generation of international standards in the form of the SNA 1993/ESA 1995, finally completed the accounting framework. Full-scale balance sheets were included. The accumulation accounts were completed with the introduction of a revaluation account, recording holding gains and losses, and an account called 'Other changes in volume of assets account', which recorded other types of capital gains and losses. This completion of the accounting structure clarified the relation between income according to the SNA/ESA and changes in wealth (net worth): in addition to the change in net worth due to saving, changes in net worth due to holding gains/losses and to other changes in volume of assets were taken into account.

It is worth noting the explicit presentation of the quadruple entry principle of recording followed by national accounting.

The completion of the accounting structure did not mean that the coverage of capital formation was exhaustive. Intense discussions dealt with the issue of recording some service expenditures as gross fixed capital formation in intangibles rather than as

current transactions. The significant result was that intangible capital formation was accounted for, but only partly. Computer software, literary, artistic and entertainment originals, and mineral exploration expenditures were included in the asset boundary. But there was strong resistance to the idea of including R&D expenditures in GFCF. After having been accepted in March 1988, regrettably this inclusion was rejected in December 1990. It was not until the adoption of the 2008 SNA/2010 ESA that R&D assets were included in the asset boundary of the national accounts.

Another step forward in the 1993 SNA was the introduction of work-in-progress for services.

In the 1993 SNA/1995 ESA, the current accounts were more detailed than before (the 1968 SNA had been criticised for neglecting the analysis of income). A larger number of significant balancing items concerning income were shown. Accounts showing primary income distribution, secondary distribution and redistribution-in-kind appeared. Between operating surplus and saving, accounts showed the balancing items of entrepreneurial income (when relevant), the balance of primary incomes, disposable income and the adjusted disposable income (for social transfers in kind from government to households, such as certain social security benefits, health and education services, etc.). Actual final consumption was thus differentiated from final consumption expenditures.

One important aspect of the increasing wide use of the international system was the extensive involvement of five international organisations (the United Nations, the European Commission, the International Monetary Fund, the World Bank and the Organisation for Economic Cooperation and Development) in the preparation of the 1993 SNA. The 1993 SNA thus became a shared standard among the five organisations and this reinforced its status.

The participation of the IMF should be particularly stressed. The Fund was from the beginning responsible for the international guidelines on government finance statistics and balance of

payments statistics, later on also on monetary and financial statistics, that is, an important part of the economic flows which the SNA covered. However, there were many and significant divergences between the overlapping recommendations included in these various sets of guidelines. The resulting inconveniences had increased as the international relationships had developed at the world level. Finally, the IMF entered fully into the harmonisation process between the SNA and the Fund's manuals on Balance of Payments (complete harmonisation, with the exception of some details, with the 1993 Manual of BOP), on Government Finance Statistics and on Monetary and Financial Statistics.

On the other hand, the close involvement of Europe meant that SNA and ESA were almost identical.

A major regret at the end of the twentieth century was the position of the USA. Despite the deep involvement of the USA in the preparation of the 1993 SNA, and the important role played by Carol Carson, their move to the new standard was not complete and a gradual implementation was undertaken.

The central framework/satellites accounts and additional constructs

The 1993 SNA also introduced additional constructs developed in some countries, in order to broaden the scope of national accounting, without overburdening the fully integrated system itself. In this perspective, the fully integrated system became the 'central framework', whereas the System as a whole was made up of the central framework and additional constructs, mostly called 'satellite accounts'. The idea of satellite accounts originated during the sixties in French national accounting and developed internationally, mostly in fields like health, education, social protection, environmental protection expenditures, etc.

In conclusion, the 'System of National Accounts 1993' was both a presentation of the new complete version of the international system and a clear high level manual on national accounting as a whole.

The Material Product System (MPS) comes to an end

Reconciliation between the SNA and the accounting system prevalent in the Soviet Union and its satellites was a complex issue. Around a narrow concept of production and, as a consequence, a larger redistribution concept of national income, Soviet statisticians had developed a 'System of balances of the national economy', consisting of an articulated and consistent set of balances, accounts and tables. There were two fundamental balances. The first one described the production, consumption and accumulation of social product (table of supply and use of goods and material services). The other, the balance of national income, later called 'financial balance', showed the distribution of primary incomes derived from material production, then the very large redistribution process including the income of persons employed in the non-productive sphere, interest and all types of financial transactions, and lastly, after taking into account the net result of foreign trade, the final uses of material products.

The MPS largely ceased to exist from the beginning of the nineties, after the break-up of the Soviet Union.

Changes in the demand for and uses of accounts

In comparison with the program of the macro representation and measurement of the national economy as a whole, which had emerged during the thirties and the forties, the achievements at the end of the 20th century were beyond the original hopes. However, in the meantime, the economic, social and political conditions in the world had changed dramatically, especially since the mid-seventies. As a result, national accounting had to face new challenges. They are summarized as follows in 'A History of National Accounting':

'Grosso modo, until the first years of the 1970s, the idea of macroeconomic regulation through demand still prevails, even if the economic policy

is everywhere a varying combination of different approaches and techniques (the policy-mix). In a few decades, however, many changes occurred. Generally, economies opened up and were liberalised. One speaks of their internationalisation, shortly later of their globalisation. Certain negative effects of growth are under increased criticism. The long-lasting, largely consensual, objective of growth is questioned (some even plead in favor of "Zero growth", while others have rejected the "consumer society" model). At the same time, many "southern countries" are at pain to promote their development and are unable to control their disequilibria. Individualism is in progress. The productive system (firms, products) becomes increasingly complex.

Transformations accelerate with the first oil crisis. Unemployment soon increases, while at the same time economies see their growth slow down or stagnate and inflation again reaches a two-digit rate in large industrialised countries ("stagflation"). The crisis is structural and the macroeconomic regulation mechanisms break down.

Hence a decline in macroeconomic theories inspired by Keynes and a crisis of macroeconomic models, an increasing preponderance of the neo-classical theories, the weakening of the role of government and the appearance in the foreground of incentive policies based on microeconomic behaviors in a neo-liberal type of approach.

In the new context of the last quarter of the century, national accounting does not seem to be supported any longer by the Keynesian paradigm and will suffer from the discredit of the latter. Some will even consider that it has been overtaken. Nevertheless, the demand for national accounts continues to increase and, as a discipline, from the 1968 SNA/1970 ESA to the 1993 SNA/1995 ESA, national accounting makes considerable progress. The uses and requests that are addressed to it know notable transformations, and stress different aspects, while at the same time new requirements appear that are difficult to satisfy'. 'A History of National Accounting', 2005, pp. 446-447.

Short-term economic analysis and quarterly accounts

The primacy given to short term economic analysis gave rise to an increased demand for quarterly accounts. Timeliness was an import characteristic of their usefulness, with a tendency to focus attention on preliminary figures without attaching enough importance to their accuracy. There was a danger that short-term trends analysis would be preferred to structural information and research based on final annual accounts.

This was avoided for various reasons. The first reason was that the scope of economic research and analysis using national accounts data and possibly their methodologies had developed well beyond the field of short term Keynesian equilibrium policies or medium term development planning using input-output analysis. For instance economic growth and multifactor productivity measurement had become pervasive, often in the context of international comparisons. Such comparisons had even given rise to a new branch of price measurement in the international sphere, purchasing power parities estimates. Inside countries, in particular very large countries but also medium size or sometimes smaller countries, the request for regional accounts had become frequent in relation with internal inequalities; although the actual estimates of rather comprehensive regional accounts or at least some regional aggregates, like GDP or regional income, remained partial.

A second reason was that the coverage of quarterly accounts did not remain as restricted as feared, because quarterly models were increasingly elaborated and used for short term forecasting (up to two years or so ahead). Such models needed to cover such items as household income and consumption, business saving, government receipts and expenditures. This led progressively, with many differences in practice among countries, to the building of quarterly accounts for institutional sectors such as households and government. On the other hand the goods and services part of the quarterly accounts have often been established in

the framework of quarterly input-output tables. It was recognised that the usefulness of quarterly accounts rely on their coherence overtime with the series of final annual accounts. This requires quarterly accounts to be benchmarked to the results of annual accounts for earlier periods, before current quarterly estimates are made.

The institutional role of national accounts develops, especially in Europe

A third reason that timely quarterly accounts did not come to dominate the national accounting scene was the considerable extension of the institutional and political role of national accounting, especially in the European Union. In Europe during the nineties, some of the main ESA/SNA aggregates were placed at the centre of political debate with the creation of economic and monetary Union (EMU) and the introduction of a common currency. Most of the criteria used to decide if countries could join the European Union/EMU, the so-called Maastricht criteria from the treaty signed in February 1992, are defined with reference to ESA measures (ratios of public deficit and public debt to GDP). Some time before, in 1988, the fourth resource of the European budget was defined in reference to the aggregate then called GNP. For many years aggregates such as GDP or GNP had been used for administrative purposes. Examples are the calculation of the contributions of countries to international organisations such as the UN, and the determination of eligibility for loans with lower interest rates from the World Bank. In Europe, regional measures of GDP per capita play a significant role in the allocation of financial support. However, the debate around the Maastricht criteria marked a qualitative jump in the importance of national accounting as seen by governments, officers in charge of budgetary and financial matters and public opinion. Since then the figures for the Government deficit and debt for the European Countries have played an important part in the political debate in the EMU, even for countries that are not members of the Euro zone. Beyond Europe, the ratios of government deficit and debt to GDP became a common tool for the

analysis of economic policy in the context of the financial crisis and recession of the end of the first decade of the 2000s.

The development of institutional and political uses in Europe required, beyond the reference to a common accounting framework, an actual harmonisation of the content of the accounts. This was pursued through various mechanisms. The GNP Committee created in 1989 contributed to improvement of the comparability of estimates. It was renamed in 2003 the GNI Committee, following the change in terminology introduced in the 1993 SNA/1995 ESA. The Committee on Monetary, Financial and Balance of Payments statistics (CMFB), created in 1991 shortly before the Maastricht Treaty, played a monitoring role in the procedure concerning excessive deficits. As will be discussed later, achieving harmonisation was not an easy task. Due to its institutional role through adoption as a European regulation, the 1995 ESA became compulsory for accounts and tables used for the purposes of the Community, and for accounts and tables transmitted to the Community (Council Regulation of 25 June 1996 on the European system of national and regional accounts in the Community). Though the Regulation states that ‘This Regulation does not oblige any Member State to use the ESA 95

in compiling accounts for its own purposes’, the ESA became de facto compulsory for the national accounting systems of all Member States. A similar situation has developed in practice at the world level. The monitoring and intervention function aimed at remedying local and regional crises and at preventing the appearance of systemic crises falls on the IMF, in agreement with the principal economic powers. Hence the IMF’s growing role in the supply by Member States of timely and well-documented harmonised information on their national accounting sources and methods. In the last decade of the 20th century, the IMF set up a system of standards to guide countries in data dissemination. Stress was laid on the information (metadata) concerning the characteristics of the data, their quality, their accessibility and their integrity, in the macroeconomic, financial and socio-demographic fields. The synthesising and structuring role of national accounts is particularly highlighted. So considering both the role of the ESA in Europe and of the SNA worldwide, the standardised system of national accounts SNA/ESA really became universal. Virtually every country in the world implemented it. Of course doing it effectively is a different issue. Balance sheets and the accounts of certain institutional sectors remain under-developed.

Part 2 — The present: big challenges ahead.

From both a technical point of view and the viewpoint of its extended uses, the development of national accounting over the last seventy years has been a success. However, the interpretation of its results and the relevance of these results for adequately representing social concerns have been questioned for the last fifty years or so. Very often Gross domestic Product (GDP), considered the key measure of the system, has been on trial, accused of misleading messages on important social issues.

The welfare measurement dispute

The main problem of interpretation is the measurement of welfare. The question for national

accounts is a double one:

‘Do national income or national product provide a measure of social welfare, Should national accounts attempt to provide such a measure?’

Attempts to answer the question followed two distinct, though often entangled, directions. The first one is centred on the interpretation of market values, in the strict framework of utility theory, the other on the analysis of the final objectives pursued by economic activity. The work of Arthur Cecil Pigou (*The Economics of Welfare*, 1920, Part 1-Welfare and the National Dividend) and John Hicks (*‘The Valuation of the Social Income’, Economica*, May 1940) illustrate the first approach, and the work of Simon Kuznets the second one (a

presentation of his long-held views on ‘National Income and Economic Welfare’, 1949, is reprinted in *Economic Change*, 1954).

Hicks and the Economica Debate

Pigou’s initial attempt to measure welfare through market values took place in a framework of cardinal utility, and was not successful. Hicks continued the debate initiated by Pigou in a more rigorous conceptual framework (indifference curves and ordinal utility), taking into account the attention paid to the Pareto optimum by The New Welfare Economics at the end of the thirties, in order to circumvent the problem of income distribution. Hicks’ 1940 article triggered an intense debate during the forties and the fifties, essentially between theoretician economists, in which Kuznets participated. After Kuznets (1948), national accountants did not participate in a discussion that grew more and more complex (for an invaluable review on this topic, see Amartya Sen ‘The welfare basis of real income comparisons: a survey’, *Journal of Economic Literature*, March 1979). Based on this work and the work of Ingvar Ohlson (*On national accounting*, 1953), *A History of National Accounting* concluded (pp. 296-297):

‘From this attempt [Hick’s one], and from the long discussion that followed, it is only possible to conclude that, unless assuming very peculiar conditions that do not realistically reflect the states of the economy, it is not possible to translate the observed changes in the sets of goods and services, even strictly limited to market ones, into a measure of welfare, understood as a change in satisfaction or utility for society as a whole. Even the direction of the change, positive or negative, is, strictly speaking, dubious’.

This conclusion seems to have been the position of national accounting for the past seventy years. Hicks concluded in 1975 (‘The scope and status of welfare economics’, *Oxford Economic Papers*, no. 3):

‘We have indexes of production; we do not have — it is clear we cannot have — an Index of Welfare’.

Kuznets and the end goals of economic activity

Kuznets’ approach was very different from that of Hicks. His view was that national income, as he had calculated it, was not a measure of welfare. However, according to him, the purpose of national income estimates should be the measure of welfare. He argued that the end-goal of economic activity was to satisfy the needs of individual consumers. He thus proposed to include in the field of national income the domestic services households performed for themselves (in contrast, he was much more doubtful regarding the inclusion of leisure). Conversely, he was in favour of excluding from national income everything that did not result in a flow of goods and services to consumers. He thus concluded that the largest part [in his time] of the result of government activities (services provided to producers, but also what corresponds to the preservation and extension of the social framework, public administration, defence, justice, international relations, etc.) should not be included in national income. He also excluded a significant part of consumer expenditures. Beyond rather simple cases such as transport between home and work, he excluded what he called ‘the inflated costs of urban civilisation’ (for instance banking services, trade union dues, costs linked to life in cities or ‘occupational expenses’). For 1929, in the USA, he estimated these inflated costs of urban civilisation represented about 20-30% of consumer expenditure.

What Kuznets excluded from national income as ‘non-final’ expenditures were deemed to be of an intermediate character. It is important to note what this approach meant. ‘Intermediate’ did not mean, as is usual in national accounting, ‘what is used to produce other goods and services’ but ‘what is not used directly for the satisfaction of consumers’. In this approach, a part of economic activities simply vanished.

Finally, Kuznets’ approach to the scope and measurement of national income has not been attractive to national accountants for two reasons. On one hand, it explicitly implied introducing ethical considerations in defining what was

satisfying the needs of individual consumers. On the other hand, with the resulting extended notion of intermediate expenditures, it was not compatible with the concept of an integrated system of national accounts. This difference of views with respect to the measure of national income was one of the reasons why Kuznets and the US Department of Commerce disagreed.

The position of national accountants was clear from the very beginning. The aggregates of national accounts measure economic production and the corresponding income, as well as the different uses (consumption, fixed capital formation, ...) of goods and services that have been generated by production activities. National accountants, since Hicks, stressed that these aggregates were not designed to measure welfare and that changes in volume could not be interpreted as changes in welfare of the society as a whole.

Two streams of research emerged among scholars.

Nordhaus and Tobin 'measures of economic welfare' and other indicators

Firstly, from the beginning of the seventies, in the light of the negative implications of economic growth, a remarkable revival of the Kuznets' approach took place. The most famous study was the experimental 'measure of economic welfare' (MEW) elaborated by William Nordhaus and James Tobin and presented in 'Is growth obsolete?' (1970). In this approach, the purpose was not to compile an indicator of welfare in the general sense, but to measure economic welfare, or more modestly, the set of goods and services contributing to economic welfare. This was achieved by a series of reclassifications (for instance from government final expenditure to government intermediate consumption or regrettable necessities), additions (mainly household activities and leisure) and subtractions (negative amenities of urbanisation).

Many indicators have been proposed in the following decades. Some have more specific objectives, like the Index of Social Health of the Fordham Institute for Innovation in Social Policy

in the late eighties, which is a synthetic social indicator combining 'physical data', without any monetary valuation. Some others follow Kuznets, Nordhaus and Tobin, in search of a monetary global indicator with wider ambitions, like the Genuine Progress Indicator, 1995, of the Redefining Progress organisation. The latter is especially interesting due to its coverage. It includes negative adjustments for income inequalities, social costs (crimes, road traffic injuries, family breakings, unemployment cost), environmental costs (diverse pollution costs, environmental degradation), etc. For the US, in 2000, the genuine progress indicator was estimated to be 2630 billion in dollars of 1996, compared to total personal consumption in the national accounts of 5153 billion. The 'index of economic well-being' of Osberg and Sharpe, proposed a composite index combining in a non-monetary way, monetary and non-monetary elements.

Weitzman theoretical elaboration

Secondly, a stream of theoretical research dealt with the issue of welfare in the wider context of environmental and sustainability issues. The most quoted paper is the article by Martin L. Weitzman ('On the welfare significance of national product in a dynamic economy', *Quarterly Journal of Economics*, vol. 90, 1976). Weitzman sought to justify an interpretation of net domestic product in terms of both welfare and sustainability. His strict reasoning framework is far from real world conditions: assumptions include that the economy moves along a competitive path, the representative consumer maximises his utility over time, the capital market is competitive with perfect anticipations, the concept of capital is generalised so that all sources of economic growth are identified and attributed to a form of capital. In a later paper (1997), in collaboration with Karl-Gustaf Löfgren, the very restrictive 1976 assumption of absence of technical progress was dropped.

GDP on trial

Towards the end of the 20th century and in the beginning of the 21st century, a passionate public

debate developed on the limitations of the system of national accounts as provider of measures of economic performances, social progress and sustainable development. Unfortunately, there was an excessive focus on a single measure of production, namely GDP. A dispassionate analysis of the questions concerned did not take place. This was partly due to the fact that, in comparison with previous decades, the knowledge of national accounting beyond the circle of national accountants was limited.

In spite of national accountants' repeated statements that the purpose of GDP or NDP was not to measure welfare, much effort had been expended by analysts to 'demonstrate' that GDP was not a relevant tool to measure welfare/well-being. In fact, what many critics had in mind was to question the place given to economic growth and consumption in the concerns of our societies, as well as the damaging consequences for the natural environment and people's well-being. The debate has been transferred from a criticism of society's goals to a debate on the measuring tool of the production aggregate.

It is true that, during the long process of extension and harmonisation of the national accounting framework, the substance of the accounts changed dramatically from the original focus on national income. The aggregate product became the most important one, on a par with the expenditure aggregate. The income aggregate not only lost the position of being the primary aggregate, but also was often given a secondary position. People continued to speak of 'three approaches to the measurement of GDP', similarly to the 'three approaches to the measurement of national income'. This was unfortunate. Actually Gross Domestic Product (GDP), Gross National Income (GNI), and 'Gross National Expenditure (GNE) are three different, though interrelated concepts. Each of them can be the most relevant one depending on the circumstances. For instance the Fourth resource of the European communities' budget is based on GNI. In the Maastricht criteria GNI was arguably more suitable than GDP as the denominator of ratios such as the government deficit and debt ones.

Clarification by the Stiglitz, Sen, Fitoussi Report

Clarification was provided by the Commission on the Measurement of Economic Performance and Social Progress, created in February 2008 following a request by the President of the French Republic, at that time Nicholas Sarkozy, and whose report, properly known as the Stiglitz-Sen-Fitoussi Report, but usually referred to as the Stiglitz Report, was issued in September 2009. The main points of that report will now be considered.

Terminological issues: 'well-being' or 'quality of life' vs. 'welfare'

The first point is related to the terminology used in the report. The report has as a central concept 'quality of life' or equivalently 'well-being'. The term 'welfare' is generally avoided in the report. Indeed, in recent decades, the term 'well-being' has been increasingly used to convey a rather different meaning than the traditional term 'welfare' in economics. Unlike welfare, the term 'well-being', as used in research work (see for instance Osberg and Sharpe), does not propose an aggregated measure in monetary terms through modifications and complements to the national accounts income or consumption aggregates. The report does not strictly speaking define 'quality of life/well-being'. Instead it talks about the multi-dimensional character of what gives life its value, taking into account all its complexity in answering the question: 'What is quality of life?'

Essential distinction between means (resources and other means) and well-being

From the perspective of the present paper, the crucial point in the report is the essential distinction drawn between means and well-being.

Means include resources. They include marketed and non-marketed resources whose estimates in monetary terms, for instance through contingent valuation procedures, will differ across individuals. Many determinants of well-being are aspects of people's life-circumstances (health, social networks, quality of institutions, quality of paid work, leisure

time and personal activities, etc.), which cannot be described as resources with imputable prices, even if people do make trade-offs among them.

Well-being is the result of the transformation of the whole means referred to above. Means are transformed into well-being in ways that differ across people.

Translated into the national accounting language, the position of the Commission set out in the above paragraphs (see p. 41, part I, chapter 2 of the report) can be reworded as:

‘GDP, or National income or Final consumption belong to the domain of means, not of results in terms of the measurement of well-being’

Focusing on well-being indicators

In addition to the clarification showing that most of the recent ‘welfare dispute’ around GDP was misguided, the report’s conclusion meant that it was not possible to avoid the problem illustrated in the seventies by the social indicators movement. Let’s simply recall that multiple social indicators then appeared to be necessary; and that no simple way existed to derive from them any composite aggregated welfare indicator avoiding ethical choices. Similar conclusions are valid for the measurement of quality of life/well-being in the recent ‘Beyond GDP’ movement. Concerning the developed countries, the main initiatives taken over the past few years have been by the OECD. In 2011, the OECD launched a ‘Better Life Initiative’. The purpose is to combine data and research in order to provide the first collection of internationally comparable well-being indicators tailored to the needs and concerns of developed countries. This initiative is explicitly based on a framework drawn from the Stiglitz Report. The coverage is world-wide, proposing a core set of universal well-being dimensions that could be adapted to the priorities of different countries and regions of the world. The 4th OECD World Forum on Statistics, Knowledge and Policy was organised in October 2012 around the topic ‘Measuring Well-Being for Development and Policy making’.

Making better use of modern national accounting potentialities: accounts are important, not only aggregates

On accounting issues, a great merit of the Stiglitz Report was to recommend making better use of modern national accounting through an understanding of what the SNA/ESA covers. Stressing the potential uses, especially for the assessment of standards of living (on the side of resources/means), was particularly important because the knowledge of the SNA/ESA is generally limited among economists, and its implementation by statistical offices is often partial.

The Commission emphasised the diversity of aggregates in the present national accounts, specifically aggregates net of fixed capital consumption, like NDP or, more in line with the Commission’s perspective on standards of living, the net income and notably the net national disposable income and the real net national disposable income which takes into account the changes in the terms of trade.

Where the Commission recommended focusing on the household perspective, it stressed the importance in the SNA/ESA of the accounts themselves and the accounting structure, beyond the aggregates of most public interest. The Commission recommended implementing elements of modern national accounts that many countries do not yet have. Attention was brought, not only to the disposable income of households, but also to actual disposable income and actual final consumption, two new concepts introduced in the SNA 1993/ESA 1995. These concepts take into account in the redistribution process: social transfers in kind received by households, primarily from Government, for instance in the case of education and health services. These concepts allow a better representation of standards of living, which is significant for internal comparisons within a country and even more for international comparisons, such as between Europe and the US.

Also on living standards measurement, the Commission recommended measuring in a standard way the sporadic estimates made in the

past of the non-market households' production of services for own use (rendered to other members of the household). For many years, there has been no objection in principle from national accountants to carrying this out in a satellite account. The issue is to include it as part of a regular program of work, occurring once every five years.

In contrast, assigning a monetary value to leisure and including it in income and in production as well as in household final consumption remains a challenge even for a satellite account. There are different views expressed in the Commission Report. Chapter 1 of Part II (see paragraphs 128-129) sets out arguments for assigning a monetary value to leisure, whilst giving due weight to the difficulties of measurement. Chapter 2 of Part II (top of page 212) is more negative about this idea (I personally share this second view).

Household accounts by sub-categories and distributional considerations

Much more importantly, with regard to households, the Commission strongly underlined the importance attached to measures of the distribution of income and consumption, so as to better assess the standards of living of the population. Considerations on distribution, inequality and equity were also a recurring theme in Chapters 2 on quality of life assessment.

Traditionally, national accounts deliver results concerning the household population as a whole or, very rarely, some of its major sub-groups, whereas the micro data of household statistical surveys enable distributional analyses, but results for the whole household sector are less exhaustive than those of national accounts.

Reconciling and integrating micro data and macro results is thus a promising and difficult challenge for both household survey statisticians and national accounts compilers. Fortunately, an ambitious work in this area was undertaken some time ago in France and demonstrated the feasibility of such

a project (results for 2003 published in 2009⁽³⁾). Following the Commission's recommendations, the OECD and Eurostat are developing an international program of this kind. Articulating the distribution of income and consumption with the distribution of wealth through household balance-sheets is an essential dimension to be considered.

As this type of work is extremely burdensome and complex, it would probably be unrealistic to expect results every year. A five-year or at most three-year interval program seems more reasonable.

Sub-sectoring the market sectors of enterprises?

Paradoxically, market enterprise sectors are at risk of becoming neglected in current national accounts. I use the word 'paradoxically' because modern societies are characterised by a prevalence of market economic activities and the fact that businesses, especially big businesses, play a leading role in economic innovation and competition. This follows recent developments giving prominence to government accounts at various levels and to household accounts with subcategories for analysing income and wealth distribution, standards of living and consumption and, beyond national accounts figures, well-being/quality of life.

There is a need to present the accounts of market enterprises at a sub-sector level, and to articulate the micro and macro levels. This has been an outstanding issue for a long time. French national accounts published such accounts in the past. This was achieved thanks to the existence in France of official business accounting standards facilitating the comparability of micro business accounts and official statisticians having access to the individual data held by the income tax administration.

Specific recommendations regarding key sector accounts or foreign-owned enterprises, were given in the SNA 1968 and the 1993 SNA, but not implemented widely. By the end of the 20th century,

⁽³⁾ Jérôme Accardo, Vanessa Bellamy, Georges Consalès, Maryse Fesseau, Sylvie Le Laidier, Emilie Raynaud, 'Les inégalités entre ménages dans les comptes nationaux. Une décomposition du compte des ménages', *L'économie française*, Comptes et dossiers, Edition 2009, INSEE, pp. 77-101.

the UN undertook a methodological analysis of the establishment of corporations' accounts, mainly non-financial corporations. In spite of some very good UN publications, there was no response to this initiative.

The lack of an immediate reaction is partly due to the fact that the issue had become more complex. There are, at least, three types of problem: a problem of business accounting standards, a problem of statistical units and a more general problem of representation of the working of the globalised production system.

International business accounting standards have developed and have been officially adopted in Europe at the level of groups of corporations. When they are applied to independent corporations or unincorporated businesses, there may be inconsistencies between national business accounting standards and those of the International Accounting Standard (IAS)/International Financial Reporting Standards (IFRS),

At the same time, the relevant institutional statistical unit at the enterprise level has been reshaped, or is in the process of being reshaped in many countries, moving away from the notion of legal entity unit towards a more economically significant unit that results from the breakdown of a group of corporations between a number of operational divisions, whatever their formal legal structure may be.

While this type of breakdown, at a kind of 'meso' level, is necessary to analyse the economic behaviour of businesses, it is a big challenge for national accounts not to lose in this process the possibility of observing the elementary flows associated with the technical characteristics of the production system. This problem is not new. Traditionally, in national accounting, if there was a well-specified articulation in the system, between the working of functional 'establishment type' statistical units in the production process and the role of 'institutional type' statistical unit in the process of income distribution and wealth accumulation, this articulation remained basically formal. In the light of globalisation, there is a need for a more integrated representation and analysis,

taking into account both technical and financial interrelationships

Indeed, as production, trade, accumulation and consumption become global activities, the overall challenge for national accounting (see below) is how to adequately represent and measure this process reflecting the global and national, technical and financial dimensions.

Facing a changing world

At the very beginning of this paper, I stressed the remarkable achievements of national accounting since the eve of the Great Depression. This judgment is certainly valid in absolute terms and in relation to the state of the national economies as it was during the decades immediately preceding and following World War II. However the world economy has changed significantly since then.

Firstly, the economic characteristics of nations have evolved radically in terms of institutional structures; functional mechanisms; sets of goods and services supplied and used in the context of continuous innovation; the respective roles of tangible and intangible assets in capital formation; financial arrangements becoming more complex and extensive; and increased liberalisation.

Secondly, the interdependence between national economies and the increasing role of multinational corporations questions the significance and feasibility of the partition into national economies.

Thirdly, the interactions between economies and the state of the natural environment have received more attention. Initially, the main concern was the depletion of natural resources, especially non-renewable resources. Progressively however attention became focused on the degradation of natural assets, including shared world assets such as the climate, and the resulting consequences on the services provided by the various types of ecosystems, and more generally on the sustainability of development and human life.

If the achievements of national accounting are judged in terms of these changes in the state of the world economy and the emerging focus

on environmental and sustainability issues, the assessment is less satisfactory. The relevance and quality of the representation and measures offered by the national accounts must be assessed according to the type of issues concerned.

Adaptation capability

To a large extent, improvements in the various versions of the SNA/ESA Central Framework were to better reflect the core system of economic transactors and transactions, and the evolution of economic life at the level of national economies and their relationship with the rest of the world. The main improvements have covered the following:

- dual approach: institutional units and sectors on one hand; establishment-type units and industries on the other hand;
- distinguishing market and non-market industries and products;
- the classifications of activities and products reflecting the increasing complexity of the product-mix in economies;
- more detail on the distribution of primary income and redistribution of income, including social transfers in kind;
- extension of the asset boundary to include intangible assets;
- the importance given to the analysis of financial institutions and financial accounts;
- the inclusion of balance sheets and completion of accumulation accounts in order to show adequately the relationship between income and changes in net worth.

Certain issues have been difficult to solve and a step-wise process followed. This was particularly the case in the definition and measurement of the output and uses of insurance services, and financial intermediation services not directly charged to customers, that have to be indirectly measured. These questions were on the agenda of the preparation of all versions of the SNA/ESA.

Some issues remain unsolved for the time being,

and three of them deserve to be mentioned.

The traditional treatment of education expenditures is to classify them as current expenditures in the SNA/ESA. Would it be possible to imagine for education a treatment parallel to the one now given to Research and Development expenditures and the corresponding assets in the 2008 SNA/2010 ESA? In other words, could a concept of 'educational capital' be introduced, leaving to a possible satellite account the aim of measuring human capital as understood by economists?

Another unsolved issue, in spite of the limited progress achieved since the Atkinson's Review recommendations (2004), is estimation of the volume change of the output of government non-market services based on indicators of output, even if the current value of these services is measured as the costs of inputs. Progress in this direction has been limited to education and health services, where similar problems have to be solved for both market and non-market services. No comprehensive solution of this issue seems near for national accounts.

Last, but not least on a conceptual basis, is the issue of the services that are apparently delivered to people free of charge and are financed generally through advertising expenditures. Flows of this kind have grown enormously with the expansion of the information technology and the internet social communication systems that now flourish.

To my surprise, military durables such as weapon systems have been included in the asset boundary according to the 2008 SNA/2010 ESA, giving rise to GFCF expenditures, asset accumulation and consumption of fixed capital. During the half century from the forties to the eighties when national accounting was ruled by successive versions of the international standards, there was general acceptance that all military expenditures should be treated as current consumption expenditures. Balance sheets compilers possibly recorded stocks of military durables as a memorandum item in their tables. When transactions in second-hand military durables were observed, marginal entries were recorded in order to allow for the financial flows generated by such transactions.

Though the concept underlying the initial SNA treatment does not seem to have been set out, it seemed obvious at the end of World War II: military activities require the use of economic resources that are no longer available for non-military economic activities; those resources are part of the final collective current uses of goods and services.

However, during the nineties, another analysis was promoted and ultimately introduced in the 2008 SNA. It was based on two arguments. One is trivial: if military durables exist and are in use for more than a year, they are assets. The second one argues that military durables are fixed assets engaged in the production of national security or more precisely deterrence. I believe that the latter argument is based on confusion between a service as part of the output of goods and services in the SNA/ESA sense and a function which is linked to the purpose of expenditure in the SNA/ESA sense of the functions of government or household expenditures.

This innovation in the SNA/ESA is ill-advised. It does not add anything to the analysis of economic activity and, on the contrary, it will be a source of confusion. The crucial question is to decide if military operations in which weapon systems are actually used can be considered processes of production in the SNA/ESA sense. My answer to this question is definitely 'no'. I submitted a full set of arguments, and they can be found together with a response from a member of the Advisory Expert Group for the SNA 2008, on the United Nations website (<http://unstats.un.org/unsd/nationalaccount/AEG/comments/m1%28c%29uk.pdf>). The case for the inclusion of military equipment in GFCF was set out for instance in a paper by Brent Moulton of the US BEA (The system of national accounts for the new economy - what should change? RIW June 2004) (4).

My view is that in order to provide an extended analysis of military expenditures and activities, beyond the few figures featuring traditionally in the Central Framework, this objective would have

better be pursued by designing a satellite account for military activities. A nice opportunity was lost to use the accounting system as a whole and its flexibility, without overburdening and confusing the Central Framework itself.

A similar remark can be made in relation to a different issue raised during the preparation of the 2008 SNA. It was sometimes proposed to include total factor or multifactor productivity estimates in the SNA Central Framework, more specifically in the sequence of accounts itself. A more limited proposal was to include only capital services as an entry in the central accounts, not to include a proper measure of multifactor productivity (this issue is discussed in the paper by Moulton referred to above) Productivity estimates and analysis use the concept of capital services, derived from a theoretical approach, whilst the SNA traditionally makes use of a more neutral and descriptive terminology, such as gross operating surplus and then property or entrepreneurial income. Finally nothing was changed in this respect in the central framework by the 2008 SNA. It is proposed (chapter 20) that 'for those offices interested, a table supplementary to the standard accounts could be prepared to display the implicit services provided by non-financial assets' (\$20.1) I do not contend the use of the concept of capital services in productivity measurement. The question is whether productivity measurement, notably multifactor productivity measurement, belongs to the field of 'observation', or the field of 'analysis'.

The puzzle of globalisation

The globalisation of the world economy has raised more complex issues than are met when analysing national economies. Some problems had been identified before the concept of globalisation became prevalent during the last decades of the 20th century. They were linked to the behaviour of multinational enterprises, their changing organisational arrangements and the issue of transfer prices being different from market prices to minimise taxation of profits. With the liberalisation of international economic flows and countries like China increasing their role on the

(4) See also André Vanoli, 'Accounting for Military Activities in Peace-Time and War-Time. Is war a process of economic production?', Paper prepared for the 29th General Conference of the International Association for Research in Income and Wealth, August 20-26, 2006, <http://www.iariw.org>

world economic scene, the scale of the problem expanded enormously. As a recent UN publication ('The impact of globalization on National accounts', 2011), strikingly stated it:

'In national account terms, globalization is the process of replacing national economic structures and transactions by international ones. Corporations organise their production and marketing at a global level, with vertical production processes spanning several countries' (paragraph 1.2).

One should not forget either that the process of globalisation also covers financial structures and flows, 'special purpose entities', and tax havens abroad, all of which play a significant role.

This UN publication resulted from the work (2007-2010) of a United Nations Economic Commission for Europe (UNECE) led Expert Group on the Impact of Globalization on National Accounts (GGNA). Two linked approaches are considered. On one hand, the accounts of multinational enterprises are analysed, setting out the difficulties in allocating output, value added and income flows to national economies. On the other hand, issues concerning trade in goods and services (goods sent abroad for processing, merchanting, international transactions in intellectual property products) and the combination of corporate activities in what is now called 'global manufacturing' or 'global production' (including the issue of 'factoryless' production) are considered.

This extremely useful book illustrates very well the huge challenges that national accounts are nowadays facing in respect of the globalisation process. For national accounting purposes, the complexity of the problem has been increased by certain important changes introduced by the 2008 SNA as compared to the 1993 treatment. The 1993 SNA, followed the same principle of previous international standards with respect to external trade statistics; that is, imports and exports of goods are recorded when they physically cross the border of an economy, even when there is no associated change of ownership. At that time, the IMF accepted this solution, different from the change of ownership principle. The convention was adopted that where goods were exported for processing abroad, a change of

ownership was imputed. The rationale behind the 1993 SNA/BOP treatment was to give priority to the consistency with the existing national accounts input-output tables and analysis, where reflecting physical processes was a high priority. Substituting the physical crossing of the border principle by the change of ownership principle as decided by the 2008 SNA has large implications for the definition and measurement of external trade in goods and external trade in services respectively, and for the representation of production activities.

The criterion of the ownership of materials used in the SNA 2008 and BPM 6 raises a number of issues. For instance, according to the UN 2011 publication, the USA concluded that 'A strict adherence to the international recommendation to classify FGPs [factoryless goods producers] according to ownership of materials is impractical'. Was such an abrupt change necessary given the consequent breaking of national accounting input-output series over time? The arguments in the 2008 SNA (see paragraphs 14.37 to 14.43) that suggest the physical or technological process of production has lost its importance are not convincing. They seem laborious and tell only part of the story; for example environmental concerns require the physical processes to receive increased importance.

Reading the 2011 UN publication on Globalization reveals that such an analysis would have been desirable well before taking the far-reaching decisions to move away from the long tradition of practice followed by the SNA/ESA. In the process of long-term national accounts improvement, a phase of experimentation can be very useful, or even compulsory, when the decisions can change main features of the System of Accounts.

Turning to the challenge ahead, tackling the big issues calls for extensive international cooperation and exchange of data and experience. Ideally the objective would be to build up the accounts of multinational enterprises at the world level and then allocate building blocks to the relevant national economies. This, perhaps utopian view, requires strong pressure from governments and society at the world level.

Beyond solving the difficulties that globalisation

brings to building the national accounts of countries, there is another challenge to be met. National accounting can also provide a representation of the globalisation process and its main aspects. Steps in this direction have already been achieved through recent statistical research, notably regarding value added chains in world trade. The purpose of such a representation would be to cover adequately the main relevant aspects of globalisation, both physical and technical, organisational and financial, and the associated control mechanisms. It could not be attempted inside the limits of the Central Framework of the 2008 SNA. A set of interrelated accounts and matrices are necessary in order to enable ways of looking at the economic and social reality. Matrices of world trade could be produced according to various criteria:

- the traditional one of the physical crossing of a nation's borders;
- according to the change of ownership criterion;
- according to the chain of value added analysis; and
- according to the carbon content and/or other significant environmental variables.

Labour force accounts, drawn up according to the educational qualification of people and their geographical distribution, could be built up at the world level. In the context of this global statistical and accounting analysis, purchasing power parities (PPPs) probably would be used intensively. More generally the estimates and analysis of international prices require improvement.

The relationship between the economy and nature and sustainability issues

The relationship between economic activities and the natural environment has posed another challenge for national accounting for decades. Raised at the beginning of the seventies, essentially in relation to the extraction and use of non-renewable resources, it later on extended to the degradation of natural assets and became prominent in the context of climate change.

In the field of national accounting, the problem has been on the agenda since the publication, in 1993, of the first version of a UN Handbook 'Integrated Environmental and Economic Accounting', generally referred to as the SEEA. A second version was published in 2003 jointly by the UN, the European Commission, the IMF, the OECD and the World Bank. The first volume of a third version was finished in 2012, and a consultation draft of a second volume on ecosystem accounting was circulated by the end of the same year. This second volume was presented to the UN Statistical Commission in February 2013. If some parts of the information system for the environment have been well developed, for instance the satellite account on the environmental protection expenditures, very little has been carried out to date in terms of implementing the main approaches of the SEEA as such. This situation illustrates the complexity of the issues raised.

Extraction of natural resources

The issue of how to handle the depletion of non-produced, non-renewable natural resources through the extraction process should have been solved in the SNA/ESA Central Framework itself, even before environmental concerns were raised. Market prices for the extracted resources at the well-head generally existed. From those transaction prices, the resource rent included in the market values (later on described as the intrinsic value of the natural resource 'in the ground before extraction') was computable and the question could have been asked 'how should this rent be treated in national accounts?' However the full market value of the extracted resources was included in the output of the concerned economies, without any adjustment made to GDP or NDP or both. There was unease that something was recorded as production, contributing to GDP when the counterpart of the extraction was a decrease in the stock of assets, that is, the wealth of the extracting economies. Nevertheless all versions of the SNA/ESA, including the 2008/2010 ones, kept the resource rent included in both GDP and NDP.

There were basically two options to proceed. The first

one, which I promoted, was to treat the extracted part of the natural resource as the disposal (sale) of a slice of an existing asset by the owner to the extractor. This would reduce both GDP and NDP by the amount of the intrinsic value ‘in the ground’ of the extracted quantities. A number of related accounting adjustments would have to be done. The second option was to treat the depletion amount analogously to the consumption of fixed capital, reducing NDP, but leaving GDP unchanged.

This second solution is the one presented in the first volume (SEEA Central Framework) of the SEEA 2012 (see Table 6.2.3 SEEA Central Framework sequence of economic accounts, p. 224). Gross Value Added, GDP and Gross operating surplus are unchanged from the traditional SNA/ESA, whereas all the traditional net balancing items and aggregates, calculated by deducting the consumption of fixed capital from the gross values, are further adjusted downwards by deducting also the depletion of natural resources.

Most probably this issue will be put on the research agenda for a future SNA/ESA revision. It will be necessary to decide between the two options above.

Bio-physical environment — Ecosystem services and assets

Accounting for natural resources that can be ‘extracted’ raises some difficult issues. However it is facilitated by the type of natural resources in question (physical goods) and the availability of transaction prices.

Other aspects of the relation between economic activities and nature are much more difficult to account for. On the one hand, the bio-physical environment delivers free of charge ecosystem services to both economic producers and final consumers. On the other hand, excessive pressures exerted by production or consumption economic activities, beyond the regenerating capacity of nature, can result in the degradation of the bio-physical environment. In turn, a degraded bio-physical environment loses part of its capacity to provide the economy with ecosystem services. Regarding the whole body of the relations between

economic activities and the natural environment, there has been a long debate about what national accounting should do. What should be measured in physical and/or monetary terms, in order to integrate economic and environmental accounts?

From the beginning, compilers of national accounts have been very cautious about extending monetary estimates to phenomena in all fields of human concern (economic, natural, human, social) where there are no observable prices. In contrast environmental economists have suggested methods that permit estimates of monetary values for both non-market services delivered by the environment and the natural assets providing them.

Progressively during the last two decades, the focus has moved from the assessment of the degradation of natural assets in physical terms, as in the Millennium Ecosystem Assessment (MEA), to the measurement of ecosystem services, in monetary terms, as in the project ‘The Economics of Ecosystems and Biodiversity (TEEB)’, and therefore of ecosystem assets themselves.

The crucial issue however is to know if the so-called monetary estimates resulting from this type of research work are compatible with the market/transaction values on which the SNA/ESA is based and with which the SEEA aims to be consistent. In other words, can these estimates be considered ‘transaction value equivalents’?, which is a necessary condition to combine them with SNA/ESA values.

Moreover the attention given to the concept of sustainable development, beyond the concept of economic growth as currently measured by GDP, led most economists to stress the necessity of putting the analysis and measurement of sustainability in the framework of the extended wealth approach, covering both all types of capital/assets (produced, natural, human, social) and all types of income/services from these assets. Actual implementation of the extended wealth approach to the measurement of capital can be step-wise and focused on changes in wealth, as in the adjusted net saving calculated by the World Bank, or aiming directly at a full coverage of the value of the stocks themselves, as in the recent ‘Inclusive Wealth Report 2012’. This latter report is intended to be

the first of a biennial series. In all cases however the coverage remains partial.

In the light of this research and political governance issues, what are the implications for the future of national accounting? Most probably, decision-makers or opinion builders in international circles hope that national accounting will be in a position to elaborate and actually estimate 'sustainable net domestic product (SNDP)'. In the context of the researchwork referred to above, many environmental economists encourage such expectations when they propose adjusting national accounting figures, either in the direction of sustainability analysis or more modestly in producing national accounting aggregates 'adjusted for the environment', as the 1993 SEEA described it. Other economists seem well aware of the insurmountable obstacles that national accountants would face if trying to currently estimate sustainable aggregates that depend on long term complex modelling (see the Stiglitz Report). They do not underestimate the difficulties to be solved when trying to measure the relations between the economy and nature at the macro level. Hence the very cautious conclusions of the Stiglitz Report. After having stressed the point that, in the context of sustainability assessment, 'we need projections, not only observations' (p. 263), the report goes on to say that the task 'goes much beyond the normal job of statisticians and/or economists'; entails prior responses to normative questions'; and thus 'strongly differs from standard statistical activities' (p. 264). The Commission recommends a dashboard on sustainability with a number of monetary and physical indicators.

SNA/ESA possible extension of the central framework: the degradation of natural assets?

Considering that estimates in monetary terms for ecosystem services and assets should be compatible with the market/transaction valuation principle of the SNA/ESA/SEEA, is it possible to imagine an extension of the present SNA/ESA that would include a representation of important aspects of the relationship between the economy as it is portrayed in the standard national accounts and the natural

environment?

My own view is that, apart from the simpler question of the extraction of market natural resources, priority should be given to the estimation, both in physical and monetary terms, of the degradation of natural assets due to production and consumption activities. This is on the one hand a crucial aspect of the relationship between the Economy and Nature. On the other hand, estimating the costs of avoiding the degradation or restoring the degraded natural assets, although difficult, provides transaction value equivalents compatible with the SNA/ESA/SEEA valuation principle.

The 1993 SEEA proposed to treat these 'imputed maintenance costs' as additional consumption of fixed capital, reducing NDP. Such a solution was generally rejected because making an ex post static adjustment of this kind was judged inappropriate. It was thought that adding costs of production implied a change in the price system and consequently in the system of quantities, etc.

A better suggestion consists of leaving the SNA/ESA costs of economic production and GDP/NDP/disposable income unchanged on one hand, and adjusting the value of final demand on the other hand, in order to incorporate in the latter the estimated value of the current degradation of natural assets due to economic activity. The next section discusses this further.

An accounting suggestion

In contrast with the usual representation that treats nature as a part of an enlarged economy, in this suggestion 'Economy' and 'Nature' are thought of as two different entities, included in a super-entity called 'Planet'.

To start with, I shall consider a closed Economy.

Suppose the annual amount of the degradation is estimated by the costs incurred in order to avoid it or restore the degraded natural assets. Let's call these costs 'unpaid ecological costs'. 'Unpaid' means that these ecological costs are not included in the 'paid economic costs' of the SNA/ESA flows of goods and services. If we add the unpaid ecological

costs to the paid economic costs on final demand, we get the final demand valued at ‘total costs (paid economic costs ‘plus’ unpaid ecological costs)’. As long as degradation of natural assets occurs, the value of final demand at total costs according to this definition is greater than the SNA value of final demand. So the saving of the Economy is reduced by the amount of the unpaid ecological costs. To rebalance the accounts, a capital transfer is recorded from Nature to the Economy, equal in value to the unpaid ecological costs, that is, to the value of the degradation of natural assets. In the balance-sheet of Nature, this degradation is recorded as a stock of negative natural assets. The accumulation overtime of these negative natural assets is a measure of the ecological debt of the Economy towards Nature. In the accounts, capital transfers in the other direction, that is, from the Economy to Nature can occur if previously degraded natural assets are restored by the Economy, the ecological/environmental debt varying accordingly.

In open economies, international flows of unpaid ecological costs have to be taken into account, as well as domestic, foreign and global Natural assets. Estimating these unpaid ecological costs is not an easy task, of course. It would be especially useful for environmental policies if these costs were allocated between the different products composing final demand according to their direct and indirect degradation of natural assets.

The accounting design proposed above is simple; a full-scale implementation at the world level would be a very complex task, requiring extensive international cooperation. The purpose was to suggest a way of extending the SNA/ESA in order to incorporate crucial figures describing the relationship between Economy and Nature, without entering the debate on controversial measures, such as valuation of the whole of ecosystem assets. The core representation of the ‘Economy’ according to the SNA/ESA is not changed in the above proposal. This would allow the extended Central Framework to show both the usual measurement of growth, a generally required current aggregate of production, and a crucial aspect of the relationship between economic activities and natural assets.

Leaving aside the issue of practicality and feasibility of the approach, the main objection to this approach may be that it is not in line with the extended wealth approach favoured by economists. However, the approach is not in fact inconsistent with the concept of extended wealth. The focus here is on the degradation of natural assets, that is, a change in the state/stock of these assets instead of on the stock of ecosystem assets as a whole. Admittedly the suggested measurement method can be judged heterodox, as it does not propose to measure the degradation of Nature by the value of the loss in the ecosystem assets capacity to provide ecosystem services. However one can put the question ‘Is the standard economic approach to the measurement of the value of capital fully relevant, both conceptually and in practice, to the valuation of ecosystem capital/assets?’. Additionally it can be argued that the maintenance cost method is also a measure of the loss of capacity to provide ecosystem services, looked at from the supply side in transaction value equivalents.

What is the outlook for ‘integrated environmental and economic accounting’? Tensions between ‘observation’ and ‘analysis’

At this stage, it is difficult to guess what will be possible in the future of ‘integrated environmental and economic accounting’.

Full integration, including complete ecosystem monetary accounting, in a future version of the SNA/ESA, seems out of reach. Partial integration may be possible depending on the priorities chosen and the level of ambition. A suggestion in this direction was presented above.

In current national accounting work, methodological reflection is necessary in order to better analyse the process of internalisation of the ecological costs when they become (paid) economic costs. It is well-known that estimating the full costs which have been internalised to date in order to avoid or repair damages to natural assets is not feasible. Even estimating the total costs internalised in the current period is not easy, despite the progress

made in accounting for environmental protection expenditures. However it would be very useful for environmental policy analysis and the information of the public at large to improve our knowledge in this field. There are two aspects to consider. One is to get better estimates of the internalisation process, when it happens, in current values. Another one is to find a satisfactory way of breaking up the change in nominal value of products impacted by the internalisation process into a volume (quantity and quality) change and a true price change. The estimate of the change in quality is potentially conflicting between the usual individual utility point of view and the social (collective) utility view which often gives rise to compulsory measures. Partial, unsatisfactory and probably incoherent decisions were taken in the past. Apparently, there was never a comprehensive study of this issue that needs to be revisited systematically. Beyond the central framework, satellite accounting looks more promising, in tackling the relative objectives and possibilities for physical accounting and monetary accounting respectively, as far as ecosystems are concerned.

Conclusion

After the great achievements of the last century, very broad expectations of national accounting have been developed in various circles. National accounts were supposed to adapt themselves in order to measure welfare and social progress; and to integrate economic and environmental accounting, everything being estimated in monetary value and put in the perspective of long term sustainability. In this context all sources of welfare have to be covered in an extended wealth approach, which the national accounting central framework is urged to adopt.

However, it is most improbable that the central framework of the SNA/ESA could in the future follow such an ambitious approach. Instead of staying in the present ambiguous situation where too much is expected, giving rise to ill-founded criticisms, it would be preferable to make a distinction between what national accountants

Outside the field of accounting, research by environmental economists will continue to provide results, mostly valid in micro contexts, which are aimed at helping policy decisions in areas such as development projects which raise conflict between interested parties. However, these research results probably would not be fit for macro estimates in national accounting.

In order to help assess the sustainability of development, composite indexes of the change in total wealth, based on physical data weighted in various ways, will probably continue to expand their coverage and improve their quality. However, even when using monetary weights, it is unlikely that estimated prices will be available which reflect the scarcity of different kinds of assets, such as natural assets.

Full integration of sustainability assessments requires long term projection models and analysis. The distance between these theoretical models and their possible implementation is enormous, like in the Stern Review Report: The Economics of Climate Change (2006), and the integrated environmental - economic accounting approach referred to earlier.

can measure in the perspective of observation in terms of transaction equivalent values and what can be attempted by researchers and analysts through theoretical approaches.

The borderline is not always clear-cut between 'observation' on the one hand and 'analysis' on the other (in a paper written some years ago, I elaborated paragraphs written by Richard Stone in the 1968 SNA, paragraphs 1.96 and ss., where he made the distinction between an observation and an inference) ⁽⁵⁾. Nevertheless when measurements depend on theoretical assumptions that are at odds with important characteristics of the real-world economy, they are not good candidates for integration in the national accounts. Similarly

⁽⁵⁾ See André Vanoli, 'The New Architecture of the U.S. National Accounts and its Relationship to the SNA', *The Review of Income and Wealth*, December 2010, with a Reply by D.Jorgenson, S. Landefeld and W. Nordhaus]

estimated values, although expressed in monetary terms, that may not be considered transaction equivalent values cannot be integrated either.

My guess is that sometime in the future, as far as national accounting 'observation' is concerned, it will be agreed that a single fully integrated national accounting framework is not a relevant answer to the measurement, both in physical and/or value terms, of all stocks and flows that are covered by the concept of extended/ inclusive wealth (produced, natural, human, social).

In broad terms, four main frameworks can be distinguished from an information system point of view.

Such an agreement would probably imply some adaptation of the terminology. Particularly, the present SNA/ESA would preferably be called the System of National Economic Accounts and European System of Economic Accounts respectively⁽⁶⁾; that is, the present national accounting would be explicitly called 'national economic accounting'. As discussed earlier in this paper, it would integrate a convenient treatment of the extraction of marketed natural resources, an issue which is covered by the SEEA-CF 2012, and would develop mainly in order to introduce distributions and take account of globalisation. As a reminder, a number of satellite accounts are connected to the central framework of the SNA/ESA and can accommodate various topics.

Other accounting frameworks to be considered are ecosystem accounting (preferably called Nature's accounting), still in a phase of experimentation (see for instance the SEEA-EEA 2012), and human capital stock estimates which have already a rather long background.

A fourth framework to complete the picture is not an accounting framework. It deals with the assessment of well-being/quality of life and may cover various approaches in line with the followings of the Stiglitz's Commission recommendations and research work developed during the last decade. Presumably the measurement and analysis of so-

called social capital should be considered in this context.

In the above picture, environmental accounting is transversal. It covers mainly Nature's accounting, including the measurement of changes in the state of natural assets caused by economic activities. It also cover modules possibly included in other frameworks. For instance a module on environmental health damages can be part of (satellite) health accounts. Or inequalities as regards environmental amenities or nuisances have to be considered for the assessment of well-being/ quality of life of various segments of the population. More generally various types of links have to be delineated between the diverse frameworks listed above. The potential importance of one of them was stressed in the second part of this article, when the estimation of unpaid ecological costs, the related Ecological debt and the possible valuation of final demand at total costs were suggested. In so doing national economic accounts and nature's accounts would be significantly connected..

Even if an agreement of the type evocated in the previous paragraphs is reached, tensions between 'observation' and 'analysis' will not disappear. However the debate around national accounts could be dispassionate, accepting the idea that long term forecasting of sustainability and ex post accounting in the current period cannot be accommodated in exactly 'the same pot'.

One implication of the above statement should be made very clear. It refers to the distinction between means (resources and other means) and well-being in the Stiglitz Commission's report. Well-being is the result of the transformation of means by people. The implication is that by measuring means, one does not measure well-being by the same token. In contrast, in neo-classical economics, the measurement of means and the measurement of welfare are narrowly connected. This was actually the main conceptual basis for the welfare measurement debate around the GDP aggregate.

Whatever path is chosen, great integration around the concept of extended/inclusive wealth or a multiple frameworks approach, the extension of the concerns of society at the world level in the last

⁽⁶⁾ The expression 'Economic Accounts' was sometimes used in the past. The first version of the ESA was called 'Europeas System of Integrated Economic Accounts'.

three or four decades (sustainable development with intragenerational and intergenerational equity) has significant consequences for statistical systems.

Accounting systems have to be developed in fields like the state of natural assets that are much less familiar to statisticians. The circle of participants in these present debates is wide and diverse. It notably includes many experts of scientific disciplines on one side and a lot of environmental economists and specialists of long term modelling coming from the academic community on the other side. The decision processes are often influenced by interventions of

the civil society, for instance through the action of non-government organisations, and expectations of the governing bodies of international or supranational institutions.

There are problems of governance of official statistical systems in relation with the emerging new fields of social concerns, in a context of tightened resources and when the requirements for economic statistics and accounts also increase for instance in relation with distributional considerations and globalisation

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Measuring social welfare in the National Accounts

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2

We define measures of social welfare in terms of social welfare functions and show how to incorporate these measures into systems of national accounts. Our measure of potential social welfare is based on personal consumption expenditures. Actual social welfare depends on the distribution of these expenditures over the population. Inequality depends on the difference between actual and potential social welfare. We illustrate the implementation of these measures of social welfare by incorporating them into the U.S. National Income and Product Accounts and the Integrated Macroeconomic Accounts for the United States.

Introduction

At the Conference on Research in Income and Wealth in April 2004, Jorgenson, J. Steven Landefeld, William D. Nordhaus, and their co-authors proposed *A New Architecture for the U.S. National Accounts* ⁽¹⁾. The initial step in implementing the new architecture was the Integrated Macroeconomic Accounts for the United States, developed by the Bureau of Economic Analysis (BEA) and the Board of Governors of the Federal Reserve System (FRB) ⁽²⁾. These accounts were intended to link the U.S. National Income and Products Accounts (NIPAs) to the System of National Accounts (SNA) used internationally. In this paper we employ the Integrated Macroeconomic Accounts as the starting point for measuring social welfare ⁽³⁾.

Our measure of potential social welfare is based on personal consumption expenditures. The concept of personal consumption expenditures is the same in the Integrated Macroeconomic Accounts and the NIPAs. Actual social welfare depends on the distribution of consumption over the population and we refer to this as the *standard of living*. Our measure of *inequality* depends on the difference between potential and actual social welfare ⁽⁴⁾. We illustrate the implementation of these measures of social welfare by incorporating them into the Integrated Macroeconomic Accounts and the NIPAs ⁽⁵⁾.

In September 2009 Joseph E. Stiglitz, Amartya K. Sen, and Jean-Paul Fitoussi presented *The Report by the Commission on the Measurement of Economic Performance and Social Progress* to the former President of France, Nicolas Sarkozy ⁽⁶⁾. The *Report* called for a shift in the focus of economic measurement from production toward ‘people’s well-being’. The *Report* contained twelve specific recommendations, including the use of consumption, income, and wealth, rather than production, for this purpose.

The recommendations of the Stiglitz-Sen-Fitoussi Report are complementary to those of the nearly contemporaneous 2008 System of National Accounts (2009) as well as the closely related European System of Accounts 2010 (2013) ⁽⁷⁾. Both accounting systems include concepts of consumption, income, and wealth.

In response to the Stiglitz-Sen-Fitoussi Report the OECD has established two international expert groups. The International Expert Group on Micro Statistics on Household Income Consumption and Wealth is chaired by the Australian Bureau of Statistics and will develop new international standards and guidelines for microeconomic data on income, consumption, and wealth ⁽⁸⁾. The International Expert Group on Disparities in the National Accounts is chaired by Eurostat and will consider the role of

⁽¹⁾ Jorgenson, Landefeld, and Nordhaus (2006), eds., *A New Architecture for the U.S. National Accounts*, Chicago, University of Chicago Press.

⁽²⁾ Albert M. Teplin, Rochelle Antoniewicz, Susan Hume McIntosh, Michael Palumbo, Genevieve Solomon, Charles Ian Mead, Karin Moses, and Brent Moulton (2006), ‘Integrated Macroeconomic Accounts for the United States: Draft SNA-USA’, in Jorgenson, Landefeld, and Nordhaus (2006), eds., pp. 471-540.

⁽³⁾ Plans for developing these accounts are discussed by Marco Cagetti, Elizabeth Holmquist, Lisa Lynn, McIntosh, and David Wasshausen (2014), ‘The Integrated Macroeconomic Accounts of the United States’, in Jorgenson, Landefeld, and Paul Schreyer (2014), eds., *Measuring Sustainability and Progress*, Chicago, University of Chicago Press.

⁽⁴⁾ For more details see Jorgenson (1990), ‘Aggregate Consumer Behavior and the Measurement of Social Welfare’, *Econometrica*, Vol. 58, No. 5, September, pp. 1007-1040, Slesnick (1998), ‘Empirical Approaches to the Measurement of Welfare’, *Journal of Economic Literature*, Vol. 36, No. 4, December, pp. 2108-2165, and Jorgenson and Slesnick (2014), ‘Measuring Social Welfare in the U.S. National Accounts’, in Jorgenson, Landefeld, and Schreyer (2014), eds.

⁽⁵⁾ See Jorgenson (1997b), ‘Measuring Social Welfare’, *The MIT Press*, Cambridge and Slesnick (2001), ‘Consumption and Social Welfare: Living Standards and Their Distribution in the United States’, *Cambridge University Press*, Cambridge.

⁽⁶⁾ Stiglitz, Sen, and Fitoussi (2010), *Mismeasuring Our Lives: Why GDP Doesn't Add Up*, the New Press, New York. See: <http://www.stiglitz-sen-fitoussi.fr/en/index.htm>.

⁽⁷⁾ United Nations (2009), ‘2008 System of National Accounts’, New York, United Nations. See: <http://unstats.un.org/unsd/nationalaccount/sna2008.asp> Eurostat (2013), ‘European System of Accounts’, Luxembourg, European Union. See: http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=KS-02-13-269

⁽⁸⁾ Organisation for Economic Co-operation and Development (2013a), *Framework for Statistics on the Distribution of Household Income, Consumption, and Wealth*, Paris, Organisation for Economic Co-operation and Development, and Organisation for Economic Co-operation and Development (2013b), *Guidelines for Micro Statistics on Household Wealth*, Paris, Organisation for Economic Co-operation and Development.

distributional statistics in the national accounts ⁽⁹⁾.

The new architecture for the U.S. national accounts includes a clear distinction between production and welfare, a key concern of the Stiglitz-Sen-Fitoussi Report. By augmenting personal consumption expenditures with its distribution over the population, we are able to incorporate measures of the cost and standard of living and inequality into the NIPAs without altering the accounting structure or conceptual framework of the accounts. Similarly, by including output, as measured by the gross domestic product (GDP), and input, as measured by gross domestic income (GDI), we can incorporate measures of output, input, and productivity in the national accounts, as pointed out in Chapters 19 and 20 of the 2008 SNA. This also requires no change in the accounting structure or the conceptual framework of the NIPAs.

In Section 2 we introduce measures of individual and social welfare. Our measures of individual welfare incorporate three types of information. Personal consumption expenditures represent the size of the household budget. We express the household's consumption in constant prices. We then divide real consumption by household size. Finally, we express individual welfare as the logarithm of real consumption per capita, so that increments of individual welfare are equal to proportional increases in consumption. These features are commonly employed in the literature on consumer behavior.

We consider a class of social welfare functions that combines the mean of individual welfare with a measure of dispersion that gives additional weight to equity considerations. We emphasize that the validity of social welfare evaluations depends on the normative conditions of horizontal and vertical equity, as well as information on consumer prefer-

ences. To illustrate these ideas we consider two limiting cases of our class of social welfare functions. A utilitarian social welfare function depends only on the mean of individual welfare and gives minimum weight to equity. An egalitarian social welfare function incorporates a measure of dispersion that gives maximum weight to equity.

In Section 3 we summarize the new architecture for the U.S. national accounts. We link our measure of welfare to personal consumption expenditures and our measure of production to the GDP in the NIPAs. In Section 4 we present measures of inequality and the standard of living that include the distribution of personal consumption expenditures over the population. We incorporate these measures of social welfare into the Integrated Macroeconomic Accounts and the NIPAs. While the Consumer Price Index (CPI) produced by Bureau of Labor Statistics (BLS) can be interpreted as a measure of the cost of living, the CPI is not included in the NIPAs. The Bureau of the Census generates official statistics on the standard of living, poverty, and inequality. However, these statistics are not integrated with the NIPAs. In Section 5 we discuss possible extensions of the national accounts to include measures of subjective well-being and nonmarket activities.

At a conceptual level our welfare measures are consistent with the 2008 SNA, the ESA 2010, and the proposals of the Stiglitz-Sen-Fitoussi Report. We conclude by recommending that national statistical agencies in Europe and around the world experiment with the implementation of welfare measures within the ESA 2010 and the 2008 SNA. This can be done without changing the accounting structure or the conceptual framework of these accounting systems. The availability of properly constructed welfare measures is essential for addressing concerns about the possible confusion between measures of output, such as GDP, and measures of welfare, such as the standard of living.

⁽⁹⁾ Maryse Fesseau, Florence Wolff, and Maria Liviana Mattonetti (2013), 'A Cross-Country Comparison of Household Income, Consumption and Wealth between Micro Sources and National Accounts Aggregates', OECD Statistics Working Paper. See: http://www.oecd-ilibrary.org/economics/a-cross-country-comparison-of-household-income-consumption-and-wealth-between-micro-sources-and-national-accounts-aggregates_5k3wdjrn7mv-en. Fesseau and Mattonetti (2013), 'Distributional Measures Across Household Groups in a National Accounts Framework: Results from an Experimental Cross-Country Exercise on Household Income, Consumption, and Saving', OECD Statistics Working Paper. See: http://www.oecd-ilibrary.org/economics/distributional-measures-across-household-groups-in-a-national-accounts-framework_5k3wdjq775f-en.

Measuring individual and social welfare

Introduction

Despite the exclusion of social welfare from the national accounts, welfare measurement is well-established in both economic theory and economic statistics. Sen's (1970) magisterial *Collective Choice and Social Welfare* was a crucial turning point in the theory of social choice⁽¹⁰⁾. Sen greatly broadened the scope of welfare measurements by mapping out alternatives to the traditional assumptions of ordinal measures of individual welfare that are not comparable among individuals. This led to an explosion of research on 'possibility theorems' during the following decade, summarized and extended by Kevin W. S. Roberts (1980)⁽¹¹⁾.

Statistical measures of inequality based on social welfare functions have been proposed by Anthony B. Atkinson and Serge C. Kolm⁽¹²⁾. These measures have been widely employed in economic statistics, for example, by Atkinson and Andrea Brandolini (2010)⁽¹³⁾. The social welfare functions were given a rigorous foundation in the theory of social choice summarized by Roberts (1980).

Following the elaboration of new conceptual possibilities for welfare measurement, we developed an econometric methodology to eliminate an important gap between the theory of social choice and measures of welfare used in economic statistics. This arises from the fact that surveys of consumer expenditures are based on households rather than individuals. Our approach to welfare measurement is summarized in Jorgenson's (1990) Presidential Address to the Econometric Society, Slesnick's (1998) survey article in the *Journal of Economic Lit-*

erature, Slesnick's (2001) book, and Jorgenson and Slesnick (2014).

Aggregation and social welfare

Econometric models of consumer behavior have long been used in measuring individual welfare⁽¹⁴⁾. The challenge we faced was to extend this approach to social welfare. Aggregation over individuals is the key to social welfare measurement. Jorgenson, Lawrence J. Lau and Thomas M. Stoker (1997) showed how to recover models of individual consumer demand that underlie their model of aggregate consumer demand. In Jorgenson and Slesnick (1984) we derived cardinal measures of individual welfare that are interpersonally comparable from these models of individual demand. We introduced the normative assumptions employed by Roberts (1980) and aggregated our measures of individual welfare to obtain a measure of social welfare⁽¹⁵⁾.

Our final step was to convert individual and social welfare into money measures appropriate for the national accounts, using the individual expenditure function introduced by Lionel W. McKenzie (1957) and the social expenditure function originated by Robert A. Pollak (1981)⁽¹⁶⁾. These conceptual tools made it possible for us to develop a 'dashboard' of detailed measures of social welfare, as later recommended by Stiglitz, Sen, and Fitoussi (2010). We developed measures of welfare for groups within the population and showed how to aggregate them into overall measures of social welfare.

⁽¹⁰⁾ Sen (1970), *Collective Choice and Social Welfare*, San Francisco, Holden-Day.

⁽¹¹⁾ For a summary of the framework used for our social welfare measures, see: Roberts (1980), 'Possibility Theorems with Interpersonally Comparable Welfare Levels,' *Review of Economic Studies*, Vol. 47, No. 147, January, pp. 409-420.

⁽¹²⁾ Atkinson (1970), 'On the Measurement of Inequality,' *Journal of Economic Theory*, Vol. 2, No. 3, September, pp. 244-263. Kolm (1969), 'The Optimal Production of Social Justice,' in Julius Margolis and Henri Guitton, eds., *Public Economics*, London, Macmillan, pp. 145-200.

⁽¹³⁾ Atkinson and Brandolini (2010), 'On Analyzing the World Distribution of Income,' *World Bank Economic Review*, Vol. 24, No. 1, January, pp. 1-37.

⁽¹⁴⁾ See Angus Deaton and John Muellbauer (1980), 'Economics and Consumer Behavior,' Cambridge, *Cambridge University Press*, UK, Chapter 9, pp. 214-240, and Slesnick (1998).

⁽¹⁵⁾ Jorgenson, Lau, and Stoker, 'The Transcendental Logarithmic Model of Aggregate Consumer Behavior,' *The MIT Press*, Ch. 8 in Dale W. Jorgenson (1997a), *Aggregate Consumer Behavior*, Cambridge, MA, pp. 203-356. Jorgenson and Slesnick (1984), 'Aggregate Consumer Behavior and the Measurement of Inequality,' *Review of Economic Studies*, Vol. 51, No. 3, July, pp. 369-392.

⁽¹⁶⁾ McKenzie (1957), 'Demand Theory without a Utility Index,' *Review of Economic Studies*, Vol. 24, No. 65, June, pp. 185-189. Pollak (1981), 'The Social Cost of Living Index,' *Journal of Public Economics*, Vol. 15, No. 3, June, pp. 311-336.

Household equivalence scales

Our empirical research used observations on households from the Consumer Expenditure Survey (CEX), conducted by BLS on a quarterly basis since 1980⁽¹⁷⁾. An important feature of the CEX, like other consumer expenditure surveys, is that observations are available for households, but not for individuals. To generate interpersonal comparisons based on households, we employed a long-established concept in economic statistics, household equivalence scales⁽¹⁸⁾.

The concept of household equivalence scales has been used to establish family needs for income support programs and assess the cost of additional children. We derived household equivalence scales econometrically from household expenditure functions. These household equivalence scales, like traditional scales, depend on the demographic characteristics of households. Unlike traditional scales, our household equivalence scales also depend on prices faced by households.

The introduction of household equivalence scales into the measurement of social welfare bridged the gap between the economic theory and economic statistics. The conceptual basis for this link was established by Arthur Lewbel (1989) in a paper on the economic theory of household equivalence scales⁽¹⁹⁾. Lewbel began by clarifying the role of aggregation over households in deriving cardinal measures of individual welfare that are interpersonally comparable.

Lewbel demonstrated that household equivalence scales can be identified under the assumptions that these scales are independent of household welfare, depending only on household characteristics and prices. These are precisely the assumptions employed in our household equivalence scales. Using

the possibility theorems summarized by Roberts (1980), Lewbel combined these household equivalence scales with cardinal measures of individual welfare to obtain measures of individual welfare that are cardinal and interpersonally comparable, using Jorgenson and Slesnick (1984, 1987) as an illustration.

Social welfare functions

In Jorgenson and Slesnick (2014) we present money measures of individual and social welfare. We assume that household expenditures are allocated to maximize a household welfare function. As demonstrated by Pollak (1981), the household behaves in the same way as an individual maximizing a utility function. We treat households as individuals in measuring social welfare. All subsequent references to individuals are to households considered as consuming units.

In order to implement money measures of individual and social welfare empirically, we require individual welfare functions that reflect the preference orderings of individual consuming units⁽²⁰⁾. We represent these orderings by real-valued individual welfare functions. For this purpose we employ an updated version of the econometric model of consumer behavior in the U.S. presented by Jorgenson and Slesnick (1987)⁽²¹⁾. Our measure of social welfare is based on preferences over social states by all individuals. We represent a social ordering by means of a real-valued social welfare function, defined on the distribution of individual welfare over the population.

To represent social orderings in a form suitable for measuring social welfare we consider a class of social welfare functions incorporating a notion of horizontal equity. We require that individuals with identical individual welfare functions enter the social welfare functions in the same way. We also incorporate a notion of vertical equity by requiring that the social welfare functions are equity-regarding in the sense of Peter J. Hammond (1977). This imposes a version of Hugh Dalton's (1920) princi-

⁽²⁰⁾ Implementation of measures of individual and social welfare is discussed by Slesnick (2001), pp. 201-214, and Jorgenson and Slesnick (2014).

⁽²¹⁾ This model was updated by Slesnick (2001), p. 96.

⁽¹⁷⁾ In 2013 BLS approved a redesign of the CEX proposed by the Gemini Project. For details see: <http://www.bls.gov/ce/geminiproject.htm#news>

⁽¹⁸⁾ See Jorgenson and Slesnick (1987), 'Aggregate Consumer Behavior and Household Equivalence Scales', *Journal of Business and Economic Statistics*, Vol. 5, No. 2, April, pp. 219-232. 'Alternative approaches to household equivalence scales are summarized' by Slesnick (2001), pp. 88-121, and OECD (2013a), pp. 152-157.

⁽¹⁹⁾ Lewbel (1989), 'Household Equivalence Scales and Welfare Comparisons', *Journal of Public Economics*, Vol. 39, No. 3, August, pp. 377-391.

ple of transfers: A transfer from a household with a higher welfare level to a household with a lower welfare level that does not reverse their relative positions must increase the level of social welfare ⁽²²⁾.

Our system of aggregate demand functions is obtained by summing over individual demand systems. These individual demand systems are estimated from cross section data on quantities consumed, total expenditure, and attributes of households such as demographic characteristics. The aggregate quantities consumed depend on the attributes and total expenditure of individual consuming units through summary statistics of the joint distribution of the total expenditure and attributes. We refer to the restrictions on individual consumer behavior required to obtain a model of aggregate consumer behavior that depends only on summary statistics as exact aggregation restrictions.

We exploit the exact aggregation restrictions in constructing cardinal measures of individual wel-

fare and defining interpersonal comparability in terms of household equivalence scales.

We combine cardinal and interpersonally comparable measures of individual welfare with assumptions on horizontal and vertical equity to obtain a class of social welfare functions. We consider two limiting cases of these social welfare functions. We first consider a ‘utilitarian’ social welfare function that reduces to an average of welfare levels over all consuming units. This gives the least possible weight to equity considerations. We then augment the mean of individual welfare with a measure of dispersion that gives additional weight to equity considerations. We consider the limiting case that gives the greatest weight to equity and refer to this as the ‘egalitarian’ social welfare function. We present measures of social welfare for both utilitarian and egalitarian social welfare functions in order to highlight the role of normative considerations in social welfare measurements.

Measuring welfare in the National Accounts

Introduction

We next consider the measurement of social welfare in the national accounts. The first issue to be addressed is, why incorporate welfare into the national accounts? The advantages stem from the accuracy and reliability of estimates carried out within a system of national accounts. In addition, the results can be reported with other estimates from the national accounts on a regular basis – annually, quarterly, or even monthly.

An important advantage of measuring welfare within the national accounts is the establishment of international standards like those that underlie the 2008 SNA and ESA 2010. The resulting uniformity of methods is essential for international comparability.

As an illustration, the World Bank’s estimates of poverty and inequality are valuable in comparing economic performance and social progress across countries ⁽²³⁾. These estimates are based on hundreds of micro-economic data sets for different countries providing information on income and consumption for individuals and households. The estimates also incorporate purchasing power comparisons of production in the World Bank’s International Comparisons Project ⁽²⁴⁾.

The 2008 SNA rules out a welfare interpretation of the national accounts. However, systems of satellite accounts, such as environmental accounts, are often given a welfare interpretation ⁽²⁵⁾. Based on experience with the 2008 SNA and ESA 2010 and their

⁽²²⁾ Dalton (1920), ‘The Measurement of the Inequality of Income’, *Economic Journal*, Vol 30, No. 119, September, pp. 361-384, and Hammond (1977), ‘Dual Interpersonal Comparisons of Utility and the Economics of Income Distribution’, *Journal of Public Economics*, Vol. 7, No. 1, February, pp. 51-71.

⁽²³⁾ See Shaohua Chen and Martin Ravallion (2013), ‘More Relatively-Poor People in a Less Absolutely-Poor World’, *Review of Income and Wealth*, Vol. 59, Issue 1, pp. 1-28.

⁽²⁴⁾ World Bank (2008), ‘Global Purchasing Power Parities and Real Expenditures: 2005 International Comparison Program’, Washington, DC, World Bank. See: http://siteresources.worldbank.org/ICPEXT/Resources/ICP_2011.html

⁽²⁵⁾ See 2008 SNA (2009), Ch. 2, pp. 12-13, and Ch. 29, pp. 534-538. This issue will be discussed in more detail below.

predecessors, the incorporation of welfare measures into the national accounts will require lengthy international consultations.

In August 2008, four years after the meeting of the Conference on Research in Income and Wealth devoted to the new architecture, Jorgenson presented an update of the prototype system of national accounts he had developed with Landefeld. The occasion was Jorgenson's Richard and Nancy Ruggles Memorial Lecture to the 30th General Conference of the International Association for Research on Income and Wealth ⁽²⁶⁾.

Jorgenson linked the new architecture to the Integrated Macroeconomic Accounts developed by the BEA and the FRB. Jorgenson presented GDP as a measure of production and personal consumption expenditures as a measure of potential social welfare.

Income and product

The Domestic Income and Product Account for the new architecture is presented in Table 1. We show how the concepts of Gross Domestic Product and Gross Domestic Income are derived from the concepts used in the NIPAs. The key innovation in the new architecture is the inclusion of prices and quantities of capital services for all productive assets in the U.S. economy. Our imputations for capital services are not available in the NIPAs and represent important components of input and output in the new architecture. The measures of output, input, and productivity conform to the standards presented in the Schreyer's (2001) *OECD Productivity Manual* ⁽²⁷⁾.

Table 1 begins with Gross Domestic Product, as defined in the NIPAs, and makes a series of adjustments to bring the definition into conformity with the new architecture. The first step is to add imputations for flows of capital services excluded from the NIPAs. These include the services of durables generated by households and institutions and the ser-

vices of durables, structures, inventories, and land generated by governments. Consumption of fixed capital on these assets must be eliminated in order to avoid double counting. Finally, taxes included in capital services must be added and other indirect taxes eliminated to arrive at the concept of Gross Domestic Product used in the new architecture.

Similarly, Gross Domestic Income in the Factor Outlay account of the new architecture is derived from national income, as defined in the NIPAs. The first step, as before, is to add imputations for capital services not included in the NIPAs. Adjustments for consumption of fixed capital and taxes are required to arrive at the concept of Gross Domestic Income used in the new architecture.

Estimates of capital services like those used in the new architecture are discussed in Chapter 20 of the 2008 SNA:

'By ... associating estimates of capital services with the standard breakdown of value added, the contributions of both (labor) and capital to production can be portrayed in a form ready for use in the analysis of productivity in a way entirely consistent with the accounts of the SNA (28).'

Jorgenson concluded that the Domestic Income and Product Account of the new architecture is consistent with the 2008 SNA at a conceptual level. The volume measure of input is a quantity index of capital and labor services, while the volume measure of output is a quantity index of investment and consumption goods. Productivity is the ratio of output to input.

The process that led to the 2008 SNA was formally initiated by the United Nations Statistical Commission in March 2004, almost simultaneously with development of the new architecture for the U.S. national accounts. Issues related to the measurement of capital were assigned to an Expert Group, designated Canberra II after the site of the initial meeting in Canberra, Australia. The incorporation of the price and quantity of capital services into the 2008 SNA was recommended by the Canberra II Expert Group and approved by the United Nations Statistical Commission at its February-March 2007

⁽²⁶⁾ Jorgenson (2009), 'A New Architecture for the U.S. National Accounts', *Review of Income and Wealth*, Vol. 55, No. 1, pp. 1-42.

⁽²⁷⁾ Schreyer (2001), 'Measuring Productivity', Paris, Organisation for Economic Co-operation and Development.

⁽²⁸⁾ 2008 SNA (2009), Ch. 20, p. 415.

meeting. Schreyer, then head of national accounts at the OECD, prepared an OECD Manual⁽²⁹⁾ on *Measuring Capital*. Schreyer's *Manual* provided detailed recommendations on methods for the construction of prices and quantities of capital services.

An interpretation of output, input, and productivity can be provided by the production possibility frontier introduced by Jorgenson (1966)⁽³⁰⁾:

$$Y(I,C) = AX(K,L),$$

Gross Domestic Product in constant prices Y consists of outputs of investment goods I and consumption goods C . These products are components of Gross Domestic Product and are produced from capital services K and labor services L . The factor services are components of Gross Domestic Income in constant prices X and are augmented by multifactor productivity A .

Under the assumption that product and factor markets are in competitive equilibrium, the share-weighted growth of outputs is the sum of the share-weighted growth of inputs and growth in multifactor productivity:

$$\bar{w}_I \Delta I + \bar{w}_C \Delta \ln C = \bar{v}_K \Delta \ln K + \bar{v}_L \Delta \ln L + \Delta \ln A,$$

where w and v denote average shares of the outputs and inputs, respectively, in the value of GDP.

Table 3 presents the sources of U.S. economic growth during 1948-2010 and various sub-periods. For the period as a whole the contribution of capital services accounted for 51.6 percent of economic growth. Labor services contributed 31.6 percent, while multifactor productivity growth contributed only 19.0 percent. The first sub-period ends with the business cycle peak in 1973. After strong output and productivity growth in the 1950s, 1960s and early 1970s, the growth of GDP dropped from 3.95 percent from 1948-1973 to only 2.68 percent from 1973 through 1995.

A powerful resurgence in U.S. economic growth began in 1995 but ended abruptly in 2000 with

the dot-com crash. U.S. economic growth surged to 4.14 percent during the period 1995-2000. This reflected the investment boom of the late 1990s, as businesses, households, and governments poured resources into plant and equipment, especially computers, software, and communications equipment. After the dot-com crash in 2000 GDP growth slowed to 2.87 percent per year and the relative importance of investment in information technology declined sharply.

The results presented in Table 3 highlight the importance of the new architecture. In the absence of an integrated production account the analysis of sources of economic growth would have had to rely on a mixture of estimates from different sources, combined with estimates of missing information, such as growth in labor input per hour worked. Different analysts could readily produce conflicting interpretations of events such as the spurt in productivity growth after 1995 and the collapse of output and productivity growth during the Great Recession.

The Domestic Income and Product Account of the new architecture has been disaggregated to the level of 65 industries by Susan Fleck, Steven Rosenthal, Matthew Russell, Erich Strassner, and Lisa Usher (2014)⁽³¹⁾. Jorgenson, Mun S. Ho, and John D. Samuels (2014) have extended this industry-level account to cover the period 1947-2010, using the methodology of Jorgenson, Ho and Kevin J. Stiroh (2005)⁽³²⁾. Jorgenson and Schreyer (2013) have shown how to integrate the industry-level production account of Jorgenson, Ho, and Samuels (2014) into the 2008 SNA⁽³³⁾.

Industry-level production accounts have been incorporated into the national accounts in five European countries, Australia, Canada, and the United

⁽²⁹⁾ Schreyer (2009), 'Measuring Capital', Paris, Organisation for Economic Co-operation and Development.

⁽³⁰⁾ Jorgenson, 'The Embodiment Hypothesis', *Journal of Political Economy*, Vol. 74, No. 1, February, pp. 1-17.

⁽³¹⁾ Fleck, Rosenthal, Russell, Strassner, and Usher (2014), 'A Prototype BEA-BLS Industry-Level Production Account for the United States', Jorgenson, Landefeld, and Schreyer (2014), eds. For data covering 1998-2010, see: http://www.bea.gov/industry/pdf/Prototype%20BEA-BLS%20Industry-Level%20Production%20Account%20for%20the%20United%20States%201998-2010_Final.pdf

⁽³²⁾ Jorgenson, Ho, and Samuels (2014), 'A Prototype Industry-Level Production Account for the United States, 1947-2010', *Journal of Policy Modeling*, Vol. 36, No. 3, May-June.

⁽³³⁾ Jorgenson and Schreyer (2013), 'Industry-Level Productivity Measurement and the 2008 System of National Accounts', *Review of Income and Wealth*, Vol. 59, No. 6, pp. 185-211.

States. The EU KLEMS project has developed systems of production accounts for the economies of 25 of the 28 European Union (EU) member states⁽³⁴⁾. For major EU countries this project includes accounts for 72 industries, covering the period 1970-2005. The World KLEMS Initiative will extend the EU KLEMS framework to important developing and transition economies, including Argentina, Brazil, Chile, China, India, Indonesia, Mexico, Russia, Turkey, and Taiwan⁽³⁵⁾.

Income and expenditures

We employ the Domestic Income and Expenditures Account presented in Table 2 in measuring individual and social welfare in the new architecture. The starting point for the income side of this account is Gross Domestic Income from the Income and Production Account described above. This is adjusted to include production taxes and the surplus of government enterprises and exclude subsidies, as defined in the NIPAs. Adding receipts from the rest of the world and eliminating payments, including taxes and transfers, to the rest of the world, generates Gross Income. Our final step is to subtract our imputation for depreciation to generate Net Income in the new architecture.

In the new architecture Domestic Expenditures are defined as the sum of personal consumption expenditures, government consumption expenditures, and net investment expenditures. The definition of personal and government consumption expenditures in the NIPAs must be adjusted to include flows of capital services that are excluded from the NIPAs. Gross investment is reduced by depreciation to obtain the concept of net investment in the new architecture. Consumption and investment expenditures, as defined in the Income and Expenditures account, must be carefully distinguished from

outputs of consumption and investment, as defined in the Income and Product account.

The key accounting identity for the Domestic Income and Expenditures Account is that net income is equal to net expenditures. Net income includes gross income from sales of capital and labor services from the Domestic Income and Product Account, less depreciation. Net income also contains net receipts from the rest of the world, including taxes and transfers. Net expenditures are the sum of personal consumption expenditures, government consumption expenditures, and net investment expenditures.

Economic growth creates opportunities for both present and future consumption.

These opportunities are generated by expansion in the supply of capital and labor services, augmented by changes in the level of living:

$$Z(C,I) = BW(L,N),$$

Net Domestic Expenditures in constant prices Z consist of consumption expenditures C and investment expenditures I , net of depreciation. These expenditures are generated by Net Incomes in constant prices W , comprising labor incomes L and property incomes N , net of depreciation.

The level of living B must be carefully distinguished from multifactor productivity A . An increase in the level of living implies that for given supplies of the factor services that generate labor and property incomes, the U.S. economy generates greater opportunities for present and future consumption. The share-weighted growth of expenditures is the sum of the share-weighted growth of incomes and growth in the level of living:

$$\Delta \ln C + \bar{w}_I \Delta \ln I = \bar{v}_L \Delta \ln L + \bar{v}_N \Delta \ln N + \Delta \ln B,$$

where w and v denote average value shares for expenditures and incomes, respectively.

Table 4 presents a decomposition of the uses of economic growth for the period 1948-2010. The growth rate of expenditures is a weighted average of growth rates of personal consumption expenditures, government consumption expenditures, and net investment expenditures. The contribution of each

⁽³⁴⁾ The EU KLEMS project was completed on June 30, 2008. A summary of the findings is presented by Marcel P. Timmer, Robert Inklaar, Mary O'Mahony, and Bart van Ark (2010), 'Economic Growth in Europe: A Comparative Industry Perspective', Cambridge, *Cambridge University Press*, and Matilde Mas and Robert Stehrer (2012), eds., 'Industrial Productivity in Europe: Growth and Crisis', Cheltenham, UK, Edward Elgar. For current data, see: www.euklems.net/.

⁽³⁵⁾ Jorgenson (2012), 'The World KLEMS Initiative', *International Productivity Monitor*, Fall. See: <http://www.csls.ca/ipm/24/IPM-24-Jorgenson.pdf> Jorgenson summarizes the prototype industry-level production account for the United States developed by Jorgenson, Ho, and Samuels (2014).

category of expenditures is the growth rate weighted by the relative share. Similarly, the contributions of labor and property incomes are the growth rates weighted by the relative shares. Growth in the level of living is the difference between growth rates of expenditures and incomes.

The growth of expenditures largely reflects the pattern of output growth, but averaged 0.25 percent lower for the period 1948-2010. Strong growth in

expenditures during the period 1948-73 was followed by a slowdown after 1973. A sharp revival occurred after 1995, but the boom was followed by another slowdown after 2000 and a collapse after 2005. Personal consumption expenditures, a key component of our measure of potential welfare, greatly predominated as a source of growth in net expenditures.

Standard of living and its cost

Introduction

In this Section we integrate distributional measures for personal consumption expenditures into the U.S. national accounts for the period 1948-2010. Jonathan Fisher, David Johnson, and Timothy Smeeding (2012) provide a detailed survey of the recent literature on the measurement of inequality in consumption and income⁽³⁶⁾. Their estimates of inequality employ data from the Consumer Expenditure Survey (CEX) and cover the period 1984-2010. Other recent and comprehensive studies of welfare measurement based on the CEX include Orazio Attanasio, Eric Hurst, and Luigi Pistaferri (2012), Bruce Meyer and James Sullivan (2009), and Dennis Fixler and Johnson (2014)⁽³⁷⁾.

Egalitarian versus utilitarian

We next implement the approach to normative economics presented in Section 2. Our measure of potential social welfare is personal consumption expenditures from the Domestic Income and Expenditures Account, expressed in constant prices per household equivalent member. Actual social welfare also depends on the distribution of personal

consumption expenditures over the population.

We decompose our measure of social welfare into the product of efficiency and equity components. We first determine the maximum level of welfare that can be attained through lump-sum redistributions of aggregate total expenditure. Expenditure must be distributed so as to equalize individual expenditure per capita, so that the social welfare function reduces to average individual welfare. This is our measure of efficiency. We define equity as the ratio of the index of social welfare to this index of efficiency. We present indexes for utilitarian and egalitarian social welfare functions.

In the first column of Table 5 we present personal consumption expenditures for the U.S. in nominal terms for the period 1948-2010. In the second column of Table 5 we present the social cost-of-living index. We divide consumption in nominal terms by the social cost-of-living index to obtain personal consumption expenditures in constant prices of 2005 in the third column.

The social cost-of-living index is defined implicitly by our efficiency index and must be carefully distinguished from the implicit deflator for personal consumption expenditures in the NIPAs. In the fourth column of Table 5 we present the number of household equivalent members of the U.S. population. We divide personal consumption expenditures in real terms by the number of household equivalent members to express real consumption in per capita terms. This results in our measure of potential so-

⁽³⁶⁾ See Fisher, Johnson, and Smeeding (2012), 'Inequality of Income and Consumption: Measuring the Trends in Inequality from 1985-2010 for the Same Individuals', 32nd General Conference, *International Association for Research in Income and Wealth*, Boston, MA, August, pp. 6-9.

⁽³⁷⁾ See Attanasio, Hurst, and Pistaferri, 'The Evolution of Income, Consumption, and Leisure Inequality in the U.S., 1980-2010', *NBER Working Paper*, No. 17982, April; Meyer and Sullivan (2009), 'Five Decades of Consumption and Income Poverty', *NBER Working Paper*, No. 14827, March; Fixler and Johnson (2014), 'Accounting for the Distribution of Income in the U.S. National Accounts in Jorgenson, Landefeld, and Schreyer (2014), eds. This list is illustrative rather than exhaustive.

cial welfare.

In Table 6 we present indexes of the U.S. standard of living for utilitarian and egalitarian social welfare functions. In the first column of Table 6 we present the equity index evaluated for the egalitarian social welfare function. The egalitarian index of the standard of living given in the second column is the product of this equity index and personal consumption expenditures per capita in constant prices from Table 5. Similarly, the utilitarian standard of living presented in the fifth column of Table 6 incorporates the utilitarian equity index in the fourth column, evaluated for the utilitarian social welfare function.

Finally, in the third column of Table 6 we present the egalitarian index of relative inequality. This is defined as the proportional loss in money metric social welfare due to an unequal distribution of household welfare. Like the familiar Gini coefficient, this index of relative inequality lies between zero and one with zero defining perfect equality. We present the utilitarian index of relative inequality in the sixth column of Table 6.

Efficiency and equity

In Table 7 we present average growth rates for personal consumption expenditures in constant prices per household equivalent member, our measure of efficiency, for the postwar period 1948-2010 and for five sub-periods. We also present growth rates of egalitarian and utilitarian measures of equity and

the standard of living. The average annual growth rate of efficiency for the period as a whole was 2.16 percent. The average growth rate of the egalitarian measure of the standard of living was 2.34 percent, reflecting a modest gain in equity of 0.17 percent per year. For the utilitarian measure of the standard of living the growth rate was 2.24 percent and the growth rate of equity was only 0.08 percent.

The growth rate of efficiency was highest during the period 1948-1973. Since this is the only period when the growth of equity was positive, the growth rates of the standard of living for both egalitarian and utilitarian measures were also highest. The growth rate of efficiency dropped during the sub-period 1973-1995. Combined with the modest declines in equity, this resulted in a substantial decline in the growth rates of egalitarian and utilitarian measures of the standard of living.

The differences between growth rates of the egalitarian and utilitarian measures of the standard of living illustrate the importance of value judgments in measuring social welfare. However, the qualitative picture is very similar for the two measures. High growth rates during 1948-1973 were followed by lower and relatively stable growth rates for 1973-2005, and by a collapse during the Great Recession period 2005-2010. For both measures the investment boom of 1995-2000 was largely offset by an accelerated decline in equity. Finally, substantial declines in equity contributed to the collapse of the standard of living during the Great Recession.

Conclusion

We recommend that national statistical agencies in Europe and around the world should incorporate measures of individual and social welfare into systems of national accounts within the framework of the ESA 2010 and the 2008 SNA. This process could begin with a satellite system for measuring social welfare that would include the two polar opposite social welfare functions that we have considered. The egalitarian social welfare function gives maximum weight to equity considerations, while the utilitarian social welfare functions gives maximum

weight to efficiency.

The satellite system for measuring social welfare could include a breakdown of our measures of social welfare by family size, age of head, region, race, and urban vs. rural residence and gender of head. A breakdown of potential social welfare, our measure of efficiency, would be provided by personal consumption expenditures per household equivalent member. Using data sets on consumption from sources such as the World Bank and the

Luxembourg Income Study, together with prices of consumption from sources like the World Bank's International Comparison Project, the satellite system could provide international comparisons⁽³⁸⁾.

Incorporating normative judgments into the national accounts is a substantial departure from a long tradition. This tradition, as reflected in SNA 2008, excludes normative judgments that are essential for interpreting distributional information. The traditional view is that economists have little to contribute to these judgments. Our view is that the development of the economic theory of social choice and its many applications has made many economists expert in using normative perspectives in the evaluation of economic policy. These perspectives should be reflected in systems of national accounts.

The strengths of the traditional approach to the national accounts could be preserved by presenting distributional information in a satellite system and presenting alternatives like egalitarian and utilitarian measures of equity. Well-established aggregates from the national accounts, such as the GDP and personal consumption expenditures should be retained in the core system of national accounts. These are essential for developing and interpreting distributional information within the framework of the national accounts.

Finally, the boundary of social welfare could be extended to include nonmarket goods and services and measures of subjective well-being. This would be a natural second stage in the implementation of measures of social welfare within the national accounts, since it would require substantial modifications in the conceptual framework for the national accounts. It would be impossible to implement the resulting measures of social welfare within a satellite system that would preserve the core system of national accounts. Measures of output like the GDP and measures of consumption like personal consumption expenditures would have to be replaced by extended measures the output and consumption

⁽³⁸⁾ See the following for data from the World Bank: <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTPOVERTY/EXTPA/0,,contentMDK:20202198~menuPK:435055~pagePK:148956~piPK:216618~theSitePK:430367,00.html> For data from the Luxembourg Income Study, see: <http://www.lisdatacenter.org/>.

that incorporate nonmarket sources of information.

A comprehensive review of nonmarket accounts is provided by Katharine B. Abraham and Christopher Mackie (2005, 2006) and their co-authors⁽³⁹⁾. W. Erwin Diewert and Schreyer (2014) provide a model of household production and consumption and an international comparison⁽⁴⁰⁾. Michael B. Christian (2014) presents human capital accounts for the United States and Gang Liu (2014) gives these accounts for 16 countries, including 15 OECD members⁽⁴¹⁾. Nicholas B. Muller, Robert Mendelsohn, and Nordhaus (2011) have constructed a system of environmental accounts for the United States⁽⁴²⁾. Allison B. Rosen and David M. Cutler (2007) have proposed a system of national health accounts for the United States⁽⁴³⁾. Finally, Alan B. Krueger (2009) and his co-authors present a detailed system of National Time Accounting. This includes both market and nonmarket uses of time, combined with evaluations based on measures of subjective well-being⁽⁴⁴⁾.

⁽³⁹⁾ Abraham and Mackie (2005), eds., *Beyond the Market: Designing Nonmarket Accounts for the United States*. Washington, DC, National Academies Press. A summary is provided by Abraham and Mackie (2006), 'A Framework for Nonmarket Accounting,' in Jorgenson, Landefeld, and Nordhaus (2006), eds., pp. 161-192. The conceptual basis for nonmarket accounting is discussed by Nordhaus (2006), 'Principles of National Accounting for Nonmarket Accounts,' in Jorgenson, Landefeld and Nordhaus (2006), pp. 143-160. Abraham (2014), 'Expanded Measures of Economic Sustainability and Welfare,' in Jorgenson, Landefeld, and Schreyer (2014), eds., presents a survey of expanded measures of welfare.

⁽⁴⁰⁾ Diewert and Schreyer (2014), 'Household Production, Leisure, and Living Standards,' in Jorgenson, Landefeld, and Schreyer (2014), eds.

⁽⁴¹⁾ Christian (2014), 'Human Capital Accounting in the United States: Context, Measurement, and Application,' and Liu (2014), 'Measuring the Stock of Human Capital for International and Intertemporal Comparisons,' in Jorgenson, Landefeld, and Schreyer (2014), eds.

⁽⁴²⁾ Muller, Mendelsohn, and Nordhaus (2011), 'Environmental Accounting for Pollution in the United States,' *American Economic Review*, Vol. 100, No. 3, August, pp. 1649-1675. Additional results are given by Muller (2014), 'Towards the Measurement of Net Economic Welfare: Inter-temporal Environmental Accounting in the United States,' in Jorgenson, Landefeld, and Schreyer (2014), eds.

⁽⁴³⁾ Rosen and Cutler (2007), 'Measuring Medical Care Productivity: A Proposal for U.S. National Health Accounts,' *Survey of Current Business*, Vol. 87, No. 6, June, pp. 54-58.

⁽⁴⁴⁾ See Krueger (2009), *Measuring the Subjective Well-Being of Nations: National Accounts of Time Use and Well-Being*, Chicago, *University of Chicago Press*.

Table 1: Product and Income Account, 2010

| Output | | | |
|--------|--|------------------------------|----------|
| Line | Product | Source | Total |
| 1 | Gross Domestic Product (NIPA) | NIPA1.1.5 line1 | 14 526.5 |
| 2 | + Services of consumers' durables | our imputation | 1 396.6 |
| 3 | + Services of household land (net of BEA estimate) | our imputation | 174.6 |
| 4 | + Services of durables held by institutions | our imputation | 49.9 |
| 5 | + Services of durables, structures, land, and inventories held by government | our imputation | 500.4 |
| 6 | + Private land investment | our imputation | 0.0 |
| 7 | + Government land and inventory investment | our imputation | -62.6 |
| 8 | - General government consumption of fixed capital | NIPA3.10.5 line5 | 278.6 |
| 9 | - Government enterprise consumption of fixed capital | NIPA3.1 line38-3.10.5 line 5 | 55.4 |
| 10 | - Federal taxes on production and imports | NIPA3.2 line 4 | 101.5 |
| 11 | - Federal current transfer receipts from business | NIPA3.2 line16 | 48.7 |
| 12 | - S&L taxes on production and imports | NIPA3.3 line 6 | 952.6 |
| 13 | - S&L current transfer receipts from business | NIPA3.3 line18 | 50.3 |
| 14 | + Capital stock tax | - | 0.0 |
| 15 | + MV tax | NIPA3.5 line28 | 9.1 |
| 16 | + Property taxes | NIPA3.3 line8 | 430.6 |
| 17 | + Severance, special assessments, and other taxes | NIPA3.5 line29,30,31 | 74.5 |
| 18 | + Subsidies | NIPA3.1 line25 | 57.3 |
| 19 | - Current surplus of government enterprises | NIPA3.1 line14 | -15.7 |
| 20 | = Gross Domestic Product (New Architecture) | | 15 685.5 |
| Income | | | |
| Line | Income | Source | Total |
| 1 | + Consumption of fixed capital | NIPA5.1 line13 | 1 874.9 |
| 2 | + Statistical discrepancy | NIPA5.1 line26 | 0.8 |
| 3 | + Services of consumers' durables | our imputation | 1 396.6 |
| 4 | + Services of household land (net of BEA estimate) | our imputation | 174.6 |
| 5 | + Services of durables held by institutions | our imputation | 49.9 |
| 6 | + Services of durables, structures, land, and inventories held by government | our imputation | 500.4 |
| 7 | + National Income Adjustment for Land Investment | our imputation | -62.7 |
| 8 | - General government consumption of fixed capital | NIPA3.10.5 line5 | 278.6 |
| 9 | - Government enterprise consumption of fixed capital | NIPA3.1 line38-3.10.5 line5 | 55.4 |
| 10 | + National income | NIPA1.7.5 line16 | 12 840.1 |
| 11 | - ROW income | NIPA1.7.5 line2-3 | 189.4 |
| 12 | - Sales tax | Product Account | 638.9 |
| 13 | + Subsidies | NIPA3.1 line25 | 57.3 |
| 14 | - Current surplus of government enterprises | NIPA3.1 line14 | -15.7 |
| 15 | = Gross Domestic Income (New Architecture) | | 15 685.4 |

Table 2: Domestic Income and Expenditures, 2010

| Income | | | |
|--------------|---|----------------------------|----------|
| Line | Income | Source | Total |
| 1 | + Gross income (NIPA) | Product Account | 15 685.4 |
| 2 | + Production taxes | Product Account | 638.9 |
| 3 | - Subsidies | NIPA3.1 line25 | 57.3 |
| 4 | + Current surplus of government enterprises | NIPA3.1 line14 | -15.7 |
| 5 | = Gross domestic income at market prices | | 16 251.3 |
| 6 | + Income receipts from the rest of the world | NIPA1.7.5 line2 | 702.9 |
| 7 | - Income payments to the rest of the world | NIPA1.7.5 line3 | 513.5 |
| 8 | - Current taxes and transfers to the rest of the world(net) | NIPA4.1line25 | 151.6 |
| 9 | = Gross Income (New Architecture) | | 16 289.1 |
| 10 | -Depreciation | our imputation | 2 776.3 |
| 11 | = Net income (New Architecture) | | 13 512.8 |
| Expenditures | | | |
| Line | Expenditures | Source | Total |
| 1 | + Personal consumption expenditures | | 10 781.1 |
| 2 | PCE nondurable goods(NIPA) | NIPA2.3.5 line6 | 2 301.5 |
| 3 | PCE services(NIPA) | NIPA2.3.5 line13 | 6 858.5 |
| 4 | PCE services less space rental value of inst building and nonfarm dwellings | our imputation | 5 729.2 |
| 5 | Services of consumers' durables | our imputation | 1 396.6 |
| 6 | Services of structures and land | our imputation | 1 303.9 |
| 7 | Services of durables held by institutions | our imputation | 49.9 |
| 8 | + Government consumption expenditures | | 2 663.9 |
| 9 | Government consumption nondurable goods | NIPA3.10.5 line8 | 271.1 |
| 10 | Government intermediate purchases, durable goods | NIPA3.10.5 line7 | 75.6 |
| 11 | Government consumption services total | | 369.1 |
| 12 | Government consumption services | NIPA3.10.5 line9 | 758.1 |
| 13 | Less sales to other sectors | NIPA3.10.5 line11 | 389.0 |
| 14 | Services of durables, structures, land, and inventories held by government | our imputation | 500.4 |
| 15 | Less government enterprise consumption of fixed capital | NIPA3.1line38-3.10.5 line5 | 55.4 |
| 16 | Government compensation of employees, excluding force account labor | NIPA3.10.5 line4-10 | 1 503.1 |
| 17 | + Gross national investment | our imputation | 2 844.0 |
| | + Depreciation | our imputation | 2 776.3 |
| 18 | = Net Domestic Expenditures (New Architecture) | | 13 512.8 |

Table 3: Contributions to Output and Income, 1948-2010

| Output | 1948-2010 | 1948-1973 | 1973-1995 | 1995-2000 | 2000-2005 | 2005-2010 |
|---|------------------|------------------|------------------|------------------|------------------|------------------|
| Gross Domestic Product | 3.18 | 3.95 | 2.68 | 4.14 | 2.87 | 0.94 |
| Contribution of Consumption | 2.29 | 2.79 | 1.96 | 2.33 | 2.26 | 1.27 |
| Contribution of Investment | 0.89 | 1.16 | 0.72 | 1.81 | 0.61 | -0.33 |
| Income | 1948-2010 | 1948-1973 | 1973-1995 | 1995-2000 | 2000-2005 | 2005-2010 |
| Gross Domestic Income | 2.59 | 2.93 | 2.52 | 3.49 | 2.05 | 1.07 |
| Contribution of Capital Services | 1.64 | 1.88 | 1.40 | 2.20 | 1.58 | 1.05 |
| Contribution of Labor Services | 0.95 | 1.06 | 1.12 | 1.29 | 0.24 | 0.03 |
| Multifactor Productivity | 0.59 | 1.02 | 0.16 | 0.65 | 0.83 | -0.14 |

Table 4: Contributions to Income and Expenditures, 1948-2010

| Average Annual Growth Rates | | | | | | |
|---|------------------|------------------|------------------|------------------|------------------|------------------|
| Income | 1948-2010 | 1948-1973 | 1973-1995 | 1995-2000 | 2000-2005 | 2005-2010 |
| Domestic Income | 2.24 | 2.70 | 2.15 | 3.02 | 1.14 | 0.68 |
| Contribution of Labor Income | 1.08 | 1.19 | 1.29 | 1.48 | 0.28 | 0.02 |
| Contribution of Net Property Income | 1.16 | 1.51 | 0.86 | 1.54 | 0.86 | 0.66 |
| Level of Living | 0.74 | 1.03 | 0.56 | 0.90 | 1.17 | -0.46 |
| Expenditures | 1948-2010 | 1948-1973 | 1973-1995 | 1995-2000 | 2000-2005 | 2005-2010 |
| Net Expenditures | 2.99 | 3.73 | 2.71 | 3.91 | 2.31 | 0.23 |
| Contribution of Consumption | 2.82 | 3.34 | 2.44 | 3.34 | 2.72 | 1.50 |
| Contribution of Personal Consumption | 2.36 | 2.69 | 2.07 | 3.12 | 2.45 | 1.12 |
| Contribution of Government Consumption | 0.46 | 0.65 | 0.37 | 0.21 | 0.27 | 0.37 |
| Contribution of Net Investment | 0.16 | 0.39 | 0.27 | 0.57 | -0.42 | -1.27 |

Table 5: Personal Consumption expenditures, 1948-2010

| | Personal Consumption Expenditures (billions) | Cost Living Index (2005 = 1.0000) | Real personal Consumption Expenditures (billions of 2005 \$) | Number of Household Equivalent Members (millions) | Real personal Consumption Expenditures Equivalent Members (thousands of 2005 \$) |
|------|--|-----------------------------------|--|---|--|
| 1948 | 176.1 | 0.1483 | 1 187.7 | 247.4 | 4.80 |
| 1949 | 179.2 | 0.1472 | 1 217.8 | 245.8 | 4.96 |
| 1950 | 191.3 | 0.1490 | 1 284.0 | 248.1 | 5.17 |
| 1951 | 210.1 | 0.1563 | 1 344.3 | 250.8 | 5.36 |
| 1952 | 223.5 | 0.1597 | 1 399.8 | 252.6 | 5.54 |
| 1953 | 235.8 | 0.1634 | 1 443.1 | 256.1 | 5.64 |
| 1954 | 244.5 | 0.1654 | 1 478.0 | 262.3 | 5.63 |
| 1955 | 261.4 | 0.1678 | 1 557.9 | 269.8 | 5.77 |
| 1956 | 274.8 | 0.1702 | 1 614.4 | 272.4 | 5.93 |
| 1957 | 290.4 | 0.1750 | 1 659.5 | 276.0 | 6.01 |
| 1958 | 302.0 | 0.1783 | 1 693.6 | 280.4 | 6.04 |
| 1959 | 323.2 | 0.1827 | 1 768.9 | 280.2 | 6.31 |
| 1960 | 337.8 | 0.1861 | 1 815.2 | 290.9 | 6.24 |
| 1961 | 350.3 | 0.1883 | 1 860.0 | 296.1 | 6.28 |
| 1962 | 370.1 | 0.1916 | 1 932.0 | 295.2 | 6.55 |
| 1963 | 388.5 | 0.1943 | 1 998.9 | 295.3 | 6.77 |
| 1964 | 417.5 | 0.1982 | 2 105.8 | 298.3 | 7.06 |
| 1965 | 449.8 | 0.2024 | 2 221.7 | 298.1 | 7.45 |
| 1966 | 486.9 | 0.2080 | 2 340.2 | 299.2 | 7.82 |
| 1967 | 514.3 | 0.2130 | 2 414.4 | 303.5 | 7.96 |
| 1968 | 558.6 | 0.2210 | 2 528.1 | 306.5 | 8.25 |
| 1969 | 606.7 | 0.2312 | 2 624.0 | 309.8 | 8.47 |
| 1970 | 654.1 | 0.2417 | 2 706.2 | 312.9 | 8.65 |
| 1971 | 703.6 | 0.2526 | 2 785.1 | 317.6 | 8.77 |
| 1972 | 771.0 | 0.2628 | 2 934.1 | 320.7 | 9.15 |
| 1973 | 847.1 | 0.2755 | 3 075.2 | 328.5 | 9.36 |
| 1974 | 932.2 | 0.3011 | 3 095.7 | 329.5 | 9.39 |
| 1975 | 1 036.5 | 0.3265 | 3 174.3 | 332.7 | 9.54 |
| 1976 | 1 156.7 | 0.3490 | 3 314.2 | 335.0 | 9.89 |
| 1977 | 1 283.0 | 0.3727 | 3 442.8 | 339.0 | 10.16 |
| 1978 | 1 434.3 | 0.3985 | 3 599.6 | 342.4 | 10.51 |
| 1979 | 1 599.5 | 0.4298 | 3 721.3 | 350.6 | 10.61 |
| 1980 | 1 775.2 | 0.4712 | 3 767.1 | 352.0 | 10.70 |
| 1981 | 1 969.3 | 0.5153 | 3 822.0 | 348.7 | 10.96 |

Table 5 (continued): Personal Consumption expenditures, 1948-2010

| | Personal Consumption Expenditures (billions) | Cost Living Index (2005 = 1.0000) | Real personal Consumption Expenditures (billions of 2005 \$) | Number of Household Equivalent Members (millions) | Real personal Consumption Expenditures Equivalent Members (thousands of 2005 \$) |
|----------------------------------|---|--|---|--|---|
| 1982 | 2 118.6 | 0.5474 | 3 870.2 | 344.6 | 11.23 |
| 1983 | 2 317.9 | 0.5749 | 4 031.6 | 342.5 | 11.77 |
| 1984 | 2 524.2 | 0.6008 | 4 201.5 | 355.6 | 11.82 |
| 1985 | 2 720.8 | 0.6183 | 4 400.7 | 360.6 | 12.20 |
| 1986 | 2 876.0 | 0.6318 | 4 551.8 | 353.1 | 12.89 |
| 1987 | 3 092.6 | 0.6545 | 4 725.3 | 364.9 | 12.95 |
| 1988 | 3 344.1 | 0.6811 | 4 910.1 | 375.2 | 13.09 |
| 1989 | 3 593.7 | 0.7097 | 5 063.4 | 375.3 | 13.49 |
| 1990 | 3 848.6 | 0.7412 | 5 192.6 | 377.0 | 13.78 |
| 1991 | 4 025.9 | 0.7671 | 5 248.3 | 388.5 | 13.51 |
| 1992 | 4 270.7 | 0.7902 | 5 404.2 | 385.3 | 14.03 |
| 1993 | 4 491.3 | 0.8057 | 5 574.3 | 389.1 | 14.32 |
| 1994 | 4 759.0 | 0.8248 | 5 770.0 | 393.8 | 14.65 |
| 1995 | 5 001.9 | 0.8422 | 5 939.2 | 410.9 | 14.45 |
| 1996 | 5 295.4 | 0.8631 | 6 135.4 | 411.6 | 14.91 |
| 1997 | 5 588.1 | 0.8794 | 6 354.7 | 422.0 | 15.06 |
| 1998 | 5 888.7 | 0.8835 | 6 665.1 | 423.3 | 15.75 |
| 1999 | 6 267.9 | 0.8955 | 6 999.2 | 435.0 | 16.09 |
| 2000 | 6 720.3 | 0.9150 | 7 344.9 | 445.2 | 16.50 |
| 2001 | 7 020.8 | 0.9270 | 7 573.4 | 449.8 | 16.84 |
| 2002 | 7 312.7 | 0.9376 | 7 799.5 | 453.8 | 17.19 |
| 2003 | 7 662.7 | 0.9534 | 8 036.9 | 460.8 | 17.44 |
| 2004 | 8 086.0 | 0.9731 | 8 309.7 | 467.8 | 17.76 |
| 2005 | 8 620.1 | 1.0000 | 8 620.1 | 472.0 | 18.26 |
| 2006 | 9 118.1 | 1.0245 | 8 900.1 | 476.6 | 18.67 |
| 2007 | 9 618.3 | 1.0535 | 9 130.1 | 481.4 | 18.97 |
| 2008 | 10 008.0 | 1.0894 | 9 186.6 | 489.5 | 18.77 |
| 2009 | 10 019.0 | 1.1062 | 9 057.5 | 496.1 | 18.26 |
| 2010 | 10 383.1 | 1.1273 | 9 210.4 | 501.6 | 18.36 |
| Average Annual Growth (%) | 6.47 | 3.22 | 3.25 | 1.12 | 2.13 |

Table 6: Standard of living, 1948-2010

| | Egalitarian | | | Utilitarian | | |
|------|--|-----------------------------------|------------------------------|--|-----------------------------------|------------------------------|
| | Standard of living (thousand of 2005 \$) | Equity Index (2005 = 1.000) | Relative Inequality Index | Standard of living (thousand of 2005 \$) | Equity Index (2005 = 1.000) | Relative Inequality Index |
| 1948 | 2.56 | 0.881 | 0.4658 | 3.58 | 0.941 | 0.2538 |
| 1949 | 2.64 | 0.880 | 0.4666 | 3.69 | 0.940 | 0.2547 |
| 1950 | 2.84 | 0.905 | 0.4516 | 3.92 | 0.955 | 0.2423 |
| 1951 | 2.94 | 0.904 | 0.4517 | 4.06 | 0.955 | 0.2422 |
| 1952 | 3.05 | 0.906 | 0.4504 | 4.20 | 0.956 | 0.2418 |
| 1953 | 3.07 | 0.899 | 0.4548 | 4.25 | 0.951 | 0.2454 |
| 1954 | 3.07 | 0.897 | 0.4559 | 4.25 | 0.950 | 0.2463 |
| 1955 | 3.14 | 0.896 | 0.4570 | 4.35 | 0.948 | 0.2476 |
| 1956 | 3.27 | 0.911 | 0.4475 | 4.50 | 0.957 | 0.2403 |
| 1957 | 3.31 | 0.907 | 0.4500 | 4.56 | 0.955 | 0.2425 |
| 1958 | 3.34 | 0.912 | 0.4471 | 4.59 | 0.957 | 0.2404 |
| 1959 | 3.64 | 0.952 | 0.4229 | 4.91 | 0.981 | 0.2219 |
| 1960 | 3.75 | 0.990 | 0.3998 | 4.97 | 1.003 | 0.2045 |
| 1961 | 3.77 | 0.990 | 0.3997 | 5.00 | 1.003 | 0.2044 |
| 1962 | 3.96 | 0.999 | 0.3944 | 5.23 | 1.008 | 0.2004 |
| 1963 | 4.13 | 1.006 | 0.3900 | 5.43 | 1.012 | 0.1973 |
| 1964 | 4.33 | 1.013 | 0.3859 | 5.69 | 1.015 | 0.1945 |
| 1965 | 4.60 | 1.018 | 0.3825 | 6.02 | 1.018 | 0.1922 |
| 1966 | 4.85 | 1.023 | 0.3796 | 6.33 | 1.021 | 0.1904 |
| 1967 | 4.96 | 1.028 | 0.3769 | 6.46 | 1.023 | 0.1886 |
| 1968 | 5.16 | 1.032 | 0.3741 | 6.71 | 1.025 | 0.1868 |
| 1969 | 5.32 | 1.036 | 0.3716 | 6.90 | 1.027 | 0.1852 |
| 1970 | 5.46 | 1.040 | 0.3691 | 7.06 | 1.029 | 0.1837 |
| 1971 | 5.56 | 1.046 | 0.3660 | 7.18 | 1.031 | 0.1817 |
| 1972 | 5.82 | 1.050 | 0.3635 | 7.50 | 1.034 | 0.1799 |
| 1973 | 6.08 | 1.071 | 0.3507 | 7.75 | 1.044 | 0.1719 |
| 1974 | 6.06 | 1.064 | 0.3547 | 7.76 | 1.041 | 0.1743 |
| 1975 | 6.13 | 1.060 | 0.3570 | 7.86 | 1.038 | 0.1761 |
| 1976 | 6.34 | 1.057 | 0.3588 | 8.14 | 1.037 | 0.1775 |
| 1977 | 6.49 | 1.053 | 0.3613 | 8.33 | 1.034 | 0.1795 |
| 1978 | 6.69 | 1.049 | 0.3640 | 8.60 | 1.031 | 0.1818 |
| 1979 | 6.72 | 1.044 | 0.3672 | 8.66 | 1.028 | 0.1843 |
| 1980 | 6.74 | 1.039 | 0.3701 | 8.70 | 1.025 | 0.1869 |

Table 6 (continued): Standard of living, 1948-2010

| | Egalitarian | | | Utilitarian | | |
|------|--|-----------------------------------|------------------------------|--|-----------------------------------|------------------------------|
| | Standard of living (thousand of 2005 \$) | Equity Index (2005 = 1.000) | Relative Inequality Index | Standard of living (thousand of 2005 \$) | Equity Index (2005 = 1.000) | Relative Inequality Index |
| 1981 | 6.99 | 1.051 | 0.3626 | 8.98 | 1.033 | 0.1807 |
| 1982 | 7.19 | 1.056 | 0.3596 | 9.23 | 1.035 | 0.1785 |
| 1983 | 7.42 | 1.040 | 0.3693 | 9.57 | 1.025 | 0.1869 |
| 1984 | 7.35 | 1.025 | 0.3783 | 9.53 | 1.016 | 0.1936 |
| 1985 | 7.55 | 1.020 | 0.3815 | 9.81 | 1.013 | 0.1961 |
| 1986 | 8.02 | 1.026 | 0.3778 | 10.40 | 1.017 | 0.1934 |
| 1987 | 8.09 | 1.030 | 0.3753 | 10.47 | 1.019 | 0.1914 |
| 1988 | 8.08 | 1.018 | 0.3825 | 10.49 | 1.010 | 0.1984 |
| 1989 | 8.48 | 1.037 | 0.3713 | 10.94 | 1.022 | 0.1893 |
| 1990 | 8.62 | 1.032 | 0.3744 | 11.12 | 1.018 | 0.1925 |
| 1991 | 8.51 | 1.039 | 0.3698 | 10.99 | 1.026 | 0.1862 |
| 1992 | 8.78 | 1.032 | 0.3741 | 11.34 | 1.019 | 0.1916 |
| 1993 | 9.03 | 1.040 | 0.3697 | 11.64 | 1.025 | 0.1872 |
| 1994 | 9.30 | 1.047 | 0.3654 | 11.94 | 1.028 | 0.1848 |
| 1995 | 9.16 | 1.046 | 0.3661 | 11.78 | 1.028 | 0.1848 |
| 1996 | 9.40 | 1.040 | 0.3693 | 12.11 | 1.024 | 0.1877 |
| 1997 | 9.36 | 1.025 | 0.3785 | 12.13 | 1.015 | 0.1946 |
| 1998 | 9.82 | 1.028 | 0.3767 | 12.70 | 1.017 | 0.1934 |
| 1999 | 9.86 | 1.010 | 0.3875 | 12.81 | 1.004 | 0.2039 |
| 2000 | 10.11 | 1.011 | 0.3871 | 13.16 | 1.005 | 0.2025 |
| 2001 | 10.28 | 1.007 | 0.3894 | 13.38 | 1.002 | 0.2053 |
| 2002 | 10.74 | 1.030 | 0.3752 | 13.86 | 1.016 | 0.1936 |
| 2003 | 10.70 | 1.012 | 0.3865 | 13.95 | 1.008 | 0.2000 |
| 2004 | 10.99 | 1.021 | 0.3811 | 14.25 | 1.011 | 0.1978 |
| 2005 | 11.07 | 1.000 | 0.3936 | 14.49 | 1.000 | 0.2067 |
| 2006 | 11.35 | 1.002 | 0.3923 | 14.82 | 1.001 | 0.2061 |
| 2007 | 11.52 | 1.002 | 0.3924 | 15.04 | 0.999 | 0.2072 |
| 2008 | 11.33 | 0.996 | 0.3963 | 14.84 | 0.996 | 0.2095 |
| 2009 | 11.10 | 1.003 | 0.3919 | 14.51 | 1.002 | 0.2053 |
| 2010 | 10.93 | 0.982 | 0.4049 | 14.40 | 0.988 | 0.2158 |

Table 7: Contributions to growth of the standard of living, 1948–2010

| EGALITARIAN | 1948-2010 | 1948-1973 | 1973-1995 | 1995-2000 | 2000-2005 | 2005-2010 |
|--------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Standard of Living | 2.34 | 3.45 | 1.87 | 1.96 | 1.82 | -0.27 |
| Efficiency | 2.16 | 2.67 | 1.97 | 2.65 | 2.03 | 0.11 |
| Equity | 0.17 | 0.78 | -0.11 | -0.68 | -0.21 | -0.37 |
| UTILITARIAN | 1948-2010 | 1948-1973 | 1973-1995 | 1995-2000 | 2000-2005 | 2005-2010 |
| Standard of Living | 2.24 | 3.09 | 1.90 | 2.20 | 1.93 | -0.12 |
| Efficiency | 2.16 | 2.67 | 1.97 | 2.65 | 2.03 | 0.11 |
| Equity | 0.08 | 0.42 | -0.07 | -0.44 | -0.10 | -0.23 |

Intangibles and services in economic accounts

T. Peter Hill

3

The paper is essentially a plea for greater conceptual clarity and precision and more rigorous definitions of basic concepts in the SNA. It focuses on 'intangible' goods and assets, as these are inherently difficult to describe or define. For two centuries it has been common practice for economists to describe services as being intangible or immaterial goods even though they have nothing in common. Now, there is tendency to confuse intangibles with services. However, intangibles and services have become far too important in modern economies to be systematically misclassified. The paper proposes a new definition for intangible goods and goes on to examine their most important economic characteristics. In the 2008 SNA, the term 'intangible fixed asset' was replaced by the term 'intellectual property product', but this was simply a renaming exercise and not a substantive change. The final section of the paper argues that information and knowledge are two very important but quite different concepts that must be clearly differentiated from each other. Only one of the two, namely information, qualifies as an intangible asset and it is desirable to discourage the common practice of using 'knowledge' loosely as a catch-all term to cover all kinds of intangibles.

Keywords: intangible goods, services, information, knowledge, intellectual property products.

Introduction and background

This paper focuses on intangible goods and intangible assets and their economic properties. As a result of recent advances in information technology (IT), intangible goods have come to play a major role in the functioning and growth of both developed and developing economies. Intangible goods need to be appropriately defined and classified and their production and use need to be recorded in the national accounts in an economically realistic and analytically appropriate way. However, the concept of an intangible good has proved to be difficult and elusive and has caused problems, especially because of a long standing tendency to confuse intangibles with services.

In the recent revisions of the SNA, it was recognised that there were still some major outstanding unresolved issues involving assets. This led to the establishment of the Canberra Group on the Measurement of Nonfinancial Assets after the 1993 revision. The Canberra Group concluded, amongst other things, that expenditures on Research and Development should be classified as gross fixed capital formation. This treatment has long been advocated by many users of national accounts. It was finally adopted by the UN Statistical Commission in 2007 and subsequently incorporated in the 2008 revision of the SNA.

The capitalisation of R&D removed an anomaly left by the 1993 SNA in which artistic and literary intangibles were recognised as fixed assets but scientific and technological intangibles produced by R&D were not. The failure to capitalise R&D in the 1993 SNA was mainly due to practical concerns expressed by many countries that they did not have the appropriate methodology or statistical capacity to measure it properly.

These concerns did not disappear when the decision to capitalise R&D was taken as part of the 2008 revision of the SNA. International statistical agencies were also concerned that the estimates of R&D made by different countries would not be internationally comparable. The OECD and Eurostat therefore decided to set up task forces to develop guidelines for compiling capital measures of R&D and subsequently for other kinds of intangibles also. The work of OECD Task Force on R&D and Other Intellectual Property Products culminated in a *Handbook on Deriving Capital Measures of Intel-*

lectual Property Products (OECD, 2010). The Handbook makes a major contribution to the literature on intangibles (or intellectual property products as the Manual calls them), at least from a national accounts' perspective. The Handbook deliberately concentrates on practical measurement problems, but inevitably gets involved in some of the underlying conceptual and theoretical issues also.

The present paper is largely consistent with the Handbook, but it focuses on basic conceptual rather than practical measurement issues. It argues that the most important economic properties of intangible goods can only be explained by invoking and emphasising their essential intangibility. However, the 2008 SNA decided to dispense with the term 'intangible'. Paragraph A3.52f of the 2008 SNA states:

"The term "intangible fixed assets" has been renamed as "intellectual property products". The word "products" is included to make clear that it does not include third party rights which are non-produced assets in the SNA."

This was meant simply to be a change of name. The entity to which it refers, described as an 'intangible fixed asset' in the 1993 SNA, was not changed in the process. Renaming 'intangible fixed assets' as 'intellectual property products' has its pros and cons. The term 'intellectual property', IP, has a long history dating back at least to the late 19th century. The United International Bureaux for the Protection of Intellectual Property, the precursor of the current World Intellectual Property Organisation, WIPO, was established in Berne in 1893. Potentially, the SNA can benefit by tapping into the substantial literature already existing on IP. WIPO, now an agency of the United Nations, has its own 'Intellectual Property Handbook' which can be accessed on the WIPO website. This Handbook states on page 1 that

"Intellectual property (IP) refers to creations of the mind such as inventions; literary and artistic works; designs; and symbols, names and images used in commerce ... IP is protected in law by, for example, patents, copyrights and trademarks ..."

Thus, like the SNA, the WIPO draws a distinction between 'intellectual property products' and intellectual property rights. Its Handbook does not use the term 'intellectual property products', however,

which are described simply as ‘intellectual property’, or IP. It is explained on page 2 of the Handbook that intellectual property rights can be divided into two categories

‘Industrial Property includes patents for inventions, trademarks, industrial designs and geographical indications.

Copyright covers literary works (such as novels, poems and plays), music, artistic works (e.g. drawings, paintings, photographs and sculptures) and architectural design. Rights related to copyright include those of performing artists in their performances, producers of phonograms in their recordings, and broadcasters in their radio and television programs.’

Page 3 clarifies that.

‘Intellectual property rights are like any other property right. They allow creators, or owners, of patents or trademarks or copyrighted works to benefit from their own work or investment in a creation.’

The literature on IP is more concerned with IP rights — how to secure them and how to enforce them — than with the nature and characteristics of the IP itself. It seems to be addressed primarily to lawyers rather than economists.

As already noted, the term ‘intellectual property product’ in the SNA is simply a new name introduced in the 2008 revision for the entity previously described as an ‘intangible fixed asset’. The term ‘intangible fixed asset’ is preferred here because, as explained later, it is precisely the intangibility of an intangible asset that explains its special economic properties and determines how it should be treated in the accounts.

Although an intangible asset may be regarded as a somewhat elusive concept the term is still commonly used and seems unlikely to drop out of general usage. It seems more likely that it will continue to be used alongside the term intellectual property,

as illustrated by the passage quoted below which is extracted from a paper contributed by the UK Minister for Intellectual Property⁽¹⁾, Lord Younger, to a special supplement on Intellectual Property published by the *London Times* (31 March, 2014).

‘Forging the right intellectual property (IP) regime is key. As a nation, our total investment in intangible assets is vast and growing rapidly. Today we invest far more in intangibles than we do in physical assets such as buildings and equipment. And we know this expenditure is making a difference to our economic performance with intangible assets responsible for 20 per cent of the UK’s productivity growth during the past ten years.

Just over half of this investment in intangibles is linked to the development of IP assets - the patents that cover new technologies, the trademarks that help new brands to flourish, the designs that shape our spaces and services, the copyrights that underpin so much of our creative output.’

This passage clearly illustrates the convenience and clarity gained by being able to use ‘intangible assets’ in conjunction with ‘intellectual property rights’ or IP assets. It also illustrates the convenience of being able to contrast investment in intangibles with investment in tangible fixed assets.

It is argued here that it is important to have appropriate terminology to describe economic phenomena and events, including basic economic concepts such as goods, services and assets. There is a tendency for the meaning of these elementary concepts to be treated as self evident and not requiring serious discussion or proper definition. Two widely used concepts that have suffered greatly as a result are ‘intangibles’ and ‘services’ which have been persistently mixed up with each other in economic literature. Although this paper is primarily concerned with intangibles rather than services, it is necessary to give some consideration to services also in order to place the issues involved in context.

⁽¹⁾ Because of the increasing importance of intellectual property, the UK government has established the post of Under Secretary of State for Intellectual Property in the Department for Business, Innovation and Skills.

The residual definition of services

Because of the difficulty of finding a satisfactory definition of services some economists have backed away from the problem altogether arguing that services are so vague and heterogeneous as to be incapable of being defined satisfactorily. They therefore define services negatively as consisting of all products that are not goods. For example, Simon Kuznets in his book on *Modern Economic Growth* (1966) writes (p. 143):

'The services sector comprises a variety of economic activities ... They have one basic feature in common: none of the activities represents in any significant way the production of commodities; each renders a product that is intangible and not easily embodied in a lasting and measurable form. For this reason, and despite the magnitude of the services sector, the measurement of its output is most subject to error, and data and knowledge are far too scanty to permit adequate analysis.'

This passage probably gives a fair representation of how many economists and others such as journalists continue to view services. And Kuznets is undoubtedly right that many services present formidable measurement problems.

Another illustration of the residual approach is provided by the way in which services are described in the authoritative *Concise Encyclopedia Britannica* (p. 1725) which reads as follows:

'Economists divide the products of all economic activity into two broad categories, good and services. Industries that produce goods (tangible goods) include agriculture, mining, manufacturing and construction. Service industries include everything else: banking, communications, wholesale and retail trade, all professional services, ... and all government services. The proportion of the world economy devoted to services rose rapidly in the 20th century...'

One problem with this kind of residual definition of service activities is that it is negative and uninformative: it gives no indication about the characteristics of service activities other than the fact that they do not produce commodities (i.e. tangible goods).

However services have become far too important to be dismissed in this way. The most striking feature of recent economic growth, especially in developed countries, has been the relatively rapid growth of service industries. Defined residually, service industries produce more than two thirds of the total GDP of some countries: that is, the total GDP originating in service industries is more than double the combined GDP of the tangible goods industries — agriculture, mining, manufacturing, construction and utilities. At the same time, as a result of the revolution in information technology, IT, the production and use of intangible goods, or intellectual property products, seems also to have been growing very rapidly.

Because of the traditional confusion between and services and intangibles the rapid growth of intangibles is often viewed as contributing to the growth in service production whereas it actually contributes to the growth of goods production.

The traditional dichotomy which divides outputs into only two major categories, namely material goods and services, dates back more than two centuries. It is outdated and needs to be replaced by a taxonomy in which three main categories of output are distinguished, namely tangible goods, intangible goods and services⁽²⁾. Intangibles and services are quite different from each other conceptually need to be clearly differentiated from each other in economic accounts and economics generally. The inadequacy of the existing treatment of intangibles in national accounts has obliged users and researchers to develop their own estimates of intangible assets that differ conceptually from those in the national accounts⁽³⁾.

Service activities do not have to be defined residually. In fact, the basic concept of a service is relatively simple and well understood by most people.

⁽²⁾ See Hill J.T.P., 'Tangibles, intangibles and services: a new taxonomy for the classification of output', *Canadian Journal of Economics*, Vol. 32, No. 2, April 1999, pp. 426-446)

⁽³⁾ See Roth F. and Thum A-E, 'Intangible capital and Labor productivity', *Review of Income and Wealth*, series 59, No. 3, September 2013, pp. 486-508. The authors observe in their conclusions that 'The current accounting framework seems to be inaccurate as it depicts levels of capital investment within European economies that are too low...' However the framework may already be greatly improved in many countries as a result of the guidance provided by the OECD 2010 Handbook.

For example, according to the *Oxford Dictionary of English* (OED), p. 1624, a service is generally understood to mean:

‘the action of helping or doing work for someone’

This simple definition captures the essential idea underlying the concept of a service activity, namely that it is an action involving two persons or economic units, one of whom works for, or helps, the other.

The role of goods and services in the definition of economic production

The boundary of economic production delineates the set of activities that constitute production in an economic sense from other activities in which economic units may engage. The scope of the entire system of economic accounts in the SNA and ESA is determined by the way in which the production boundary is defined. The production boundary determines not only the size of GDP but also the coverage of the entire sequence of accounts in the SNA that follow on from the production account. The reason why it is important to have satisfactory and economically appropriate definitions of goods (both tangible and intangible) and services is that these definitions effectively fix the boundary of production of the SNA. Paragraph 6.10 of the 2008 SNA states

‘Production can be described in general terms as an activity in which an enterprise uses inputs to produce outputs.’

A more precise definition is given in Paragraph 6.28 of the 2008 SNA:

‘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.’

This makes the definition of a productive activity depend on the nature of the outputs from the activity. These must be goods or services according to the SNA. However, the early versions of the SNA did not try to explain what are the distinguishing features of goods and services. Until the 1993 and 2008 revisions of the SNA, goods and services were tacitly treated as if they were elementary or primary concepts whose meanings are self evident and so well known as not to require serious discussion or justification, even though the SNA normally takes care to ensure that its concepts are carefully and precisely defined.

In the 1970 revision of the ESA which followed the 1968 revision of the SNA, the output from a process of production, was defined simply as follows (paragraph 304):

‘Output comprises the goods and services produced by resident producer units during a given period.’

Definitions of goods and services including intangible goods are elaborated in more detail in a later section of this paper. First, however, it is useful and illuminating to examine how the notion that services are intangible goods came to be so deeply embedded in economic literature and ordinary usage.

The origins of the fallacy that a service is an intangible good

In order to define the boundary of economics as a scientific discipline, classical economists considered it necessary to determine what kinds of products should be counted as goods and services. Current thinking about the nature of goods and services continues to be heavily influenced by the writings of classical economists on this subject ⁽⁴⁾.

The discussions were triggered by Adam Smith’s famous and controversial distinction between productive and unproductive labour which provoked a long debate among classical economists about the nature of goods and services and the definition of the production boundary which continued throughout the 19th century.

These discussions were influenced by the views of the Mercantilists. They tended to attach more importance to the ‘stocks’ of wealth than ‘flows’ of income or output.

⁽⁴⁾ This section draws heavily on Hill (1999) pp. 429-437 which contains more extensive quotations from the writings of Smith, Say, Mill and other 19th century economists on these fundamental conceptual issues.

It is noteworthy that Adam Smith's classic book is entitled the *Wealth of Nations* and not the 'Output of Nations'.

Adam Smith (1776) defined the production boundary by restricting economic production to the production of commodities, a 'productive' activity being essentially one that produced outputs that are capable of increasing the stock of material wealth. He wrote:

'the labour of the manufacturer fixes and realises itself in some particular subject or vendible commodity, which lasts for some time at least after that labour is past. It is, as it were, a certain quantity of labour stocked and stored up to be employed, if necessary, upon some other occasion.'

'The labour of the menial servant, on the contrary, does not fix or realise itself in any particular subject or vendible commodity ... The sovereign, for example, with all the officers both of justice and war who serve under him, the whole army and navy, are unproductive labourers. Their services, how honourable, how useful, or how necessary soever, produce nothing for which an equal quantity of service can afterwards be procured ... In the same class must be ranked ... churchmen, lawyers, physicians, men of letters of all kinds: players, buffoons, musicians, opera singers, opera dancers, ... the work of all of them perishes in the very instant of its production.'

It should be noted that Smith used the term 'commodity' and not 'good'. The term 'good' did not come into use until the end of the 19th century, as explained below.

The terms 'productive' and 'non-productive' are not simply technical economic terms. They are widely used in ordinary speech where they carry emotive overtones, a productive activity being interpreted as one that is desirable and worthwhile whereas an unproductive activity is liable to be interpreted as one that is trivial or futile.

Smith's contention that service producers are not productive could therefore be viewed as being somewhat provocative. It was soon challenged by J. B. Say in his *Traité D'Economie Politique* ⁽⁵⁾. Say invoked the example of a physician

'who prescribes a remedy and takes his leave without depositing any product that the invalid ... can transfer to a third party or even keep for the consumption of a future day. Has the industry of the physician been unproductive? Who can for a moment suppose so? The patient's life has been saved perhaps. Was this product incapable of becoming an object of barter? By no means: the physician's advice has been exchanged for a fee; but the want of this advice ceased the moment it was given. The act of giving was its production, of hearing its consumption, and the consumption and production were simultaneous. This is what I call an immaterial product.'

Thus, it was Say who was responsible for describing services as 'immaterial products'. He explained that he was not comfortable with the adjective 'immaterial' but could not find a better alternative ⁽⁶⁾: his observation that the consumption and production of a service are simultaneous is an important and influential insight which is still respected today.

Whereas a good must have been produced before it can be delivered to a consumer, a service must be delivered as it is produced. However the consumer may continue to benefit from the provision of the service long after it has been provided. To take a simple example, if a good is transported to another location where it is more useful to its owner, the owner will continue to benefit long after the actual process of transportation is completed. The patient in Say's example also continues to benefit from the physician's advice or treatment long after it was provided. Most services do not disappear the moment they have been produced. Despite Smith's assertion to the contrary, some services may well 'fix themselves' in a vendible commodity or a person depending on the nature of the service provided.

J. S. Mill in his *Principles of Political Economy* (1848) backed Smith's distinction between productive and unproductive labour by arguing that what is produced is not utility but wealth. He wrote:

'Productive labour means productive of wealth'

He points out that this raises another question, namely what is wealth and whether it consists only of material products.

He goes on to argue that, *in principle*, human capital

⁽⁵⁾ Paris, 1803, First American Edition 1821, *Reprints of Economic Classics*, 1964, (New York: Augustus M, Kelly).

⁽⁶⁾ See Hill (1999) p. 430

ought to be included in wealth.

‘The skill, and the energy and perseverance, of the artisans of a country are reckoned part of its wealth no less than their tools and machinery. According to this definition we should regard all labour as productive which is employed in creating permanent utilities, whether embodied in human beings or in any other animate or inanimate objects.’

However, Mill finally rejected this broader definition of wealth because he thought that the inclusion of human capital in wealth would ‘create confusion’ as ‘wealth is normally understood to refer to material products only’. He concluded that:

‘when speaking of wealth I understand by it only what is called material wealth and by productive labour only those kinds of exertion which produce utilities embodied in material objects.’

These quotations from Mill once again illustrate the extent to which conclusions on important substantive issues may be affected by terminology and language.

15 years later, Nassau Senior in his *Political Economy* (1863) wrote:

‘Products divided into services and commodities — products have been divided into material and immaterial, or, to express the same distinction in different words, into commodities and services. This distinction seems to have been suggested by Adam Smith’s well known division of labour into productive and unproductive. Those who thought the principle of that division convenient, feeling at the same time the difficulty of terming unproductive the labour without which all other labour would be inefficient, invented the term services or immaterial products to express its results.’

Senior later concludes as follows:

‘Service and Commodity Discriminated — But, objecting as we do to a nomenclatures which should consider producers as divided, by the nature of their products, into producers of services and producers of commodities, we are ready to admit the convenience of the distinction between services and commodities themselves, and to apply the term service to the act of occasioning an al-

teration in the existing state of things and the term commodity to the thing altered, the term product including both commodities and services.’

Senior’s description of a service activity as ‘the act of occasioning an alteration in the existing state of things’ is substantively exactly the same as the definition of a ‘change-effecting’ service given in paragraphs 6.17 and 6.18 of the 2008 SNA.

The last economist to be considered in this brief historical review is Alfred Marshall. It is noticeable that the term ‘good’ does not appear in any of the quotations given above. As pointed out by Milgate in Palgrave’s *New Dictionary of Economics* (1987) p. 548, the term ‘commodity’ was generally used instead and Marshall seems to have been the economist who first proposed using the term ‘good’. The term ‘service’ was actually well entrenched in economic literature long before the term ‘good’.

In Chapter II on *Wealth* of Book II of Marshall’s *Principles of Economics* (1890) he writes:

‘All wealth consists of desirable things; that is, things which satisfy human wants directly or indirectly, but not all desirable things are reckoned as wealth. In the absence of any short term in common use to represent all desirable things, or things that satisfy human wants, we may use the term Goods for that purpose.’

Later, Marshall argues:

‘When a man’s wealth is spoken of simply and without any interpretation clause in the context, it is to be taken to be his stock of two classes of goods. In the first class are those material goods to which he has (by law or custom) private rights of property, and which are therefore transferable and exchangeable...

Services and other goods, which pass out of existence in the same instant that they come into, are, of course, not part of the stock of wealth.

... In the second class are those immaterial goods which belong to him, are external to him and serve directly as the means of enabling him to acquire material goods ...

This use of the term wealth is in harmony with the usage in ordinary life: and, at the same time, it includes those goods, and only those, which clearly

come within the scope of economic science, as defined in Book I; and which may therefore be called economic goods.'

A little later Marshall makes the following observations about intangible assets or the 'non material elements of wealth':

'German economists often lay stress on the non material elements of national wealth; and it is right to do this in some problems relating to national wealth, but not in all. Scientific knowledge indeed, wherever discovered, soon becomes the property of the whole civilised world, and may

be considered as cosmopolitan rather than as specially national wealth. The same is true of mechanical inventions and of many other improvements in the arts of production; and it is true of music.'

Thus, whereas at the beginning of the 19th century Say originally categorised services as being immaterial products, by the end of the 19th century Marshall categorised 'improvements in the arts of production' 'mechanical inventions' and musical compositions as being intangible assets. Real progress had been made.

The properties of tangible and intangible goods

Goods

The following definition of an economic good is intended to cover both tangible and intangible goods. It is a generalized version of the definition of a tangible good given in the 2008 SNA.

'Goods are produced entities for which a demand exists, over which ownership rights may be established and whose ownership can be transferred from one institutional unit to another by engaging in transactions on markets.'

'Exchangeability' is a key defining characteristic of an economic good. It implies not only that economic goods must be entities over which it is possible to establish ownership rights but also that these rights can be exchanged between different institutional units. Otherwise, it would not be possible for them to be traded on markets and they would be of limited interest for purposes of economic analysis.

'Independent existence', in order to be exchangeable, a good must exist independently of its owner. The 'separability' of a good from its owner is a second key characteristic of a good which may seem obvious for a tangible good, but may not be so for some kinds of intangible goods.

Tangible goods

The SNA adopts a more restrictive definition of a good than that just given by effectively requiring all goods to be tangible. Paragraph 6.15 of the 2008

SNA defines goods as follows:

'Goods are physical, produced objects for which a demand exists, over which ownership rights can be established and whose ownership can be transferred from one institutional unit to another by engaging in transactions on markets.'

Restricting goods to physical object means that intangible goods risk being classified residually as services.

Intangible goods

An intangible good is a more subtle and complex concept that is not easy to define. A suggested definition is as follows.

'An intangible good is an abstract entity that can be used for purposes of production or consumption, such as an item of information, an idea, a plan, or an instruction, that is produced as the output from a process of creative or innovative intellectual activity. It must be possible to establish the right of ownership over the entity which must be recorded and stored in a form that makes it capable of being easily retrieved by its owner and also communicated to, and assimilated by, other persons or units.'

An abstract entity exists in thought but not in space. It is not an object with physical dimensions such as length, height or weight. It is literally intangible. According to the 2008 SNA the term 'intellectual

property product' is meant to be no more than an alternative name for an intangible asset. In principle, therefore, the definition of an intangible good just proposed should be equally applicable to an 'intellectual property product'. In the literature on IP, an intangible good would be more likely to be described as an individual piece of intellectual property, such as a particular invention (as distinct from an individual IP right, such as a patent). The crucial issue, however, is not so much the exact wording of its definition but the economic characteristics and properties of an intangible good.

In order to be generally intelligible and useful an intangible must be recorded in some kind of 'language' or symbols using characters, letters or other notation that persons other than its creator can understand. The production of an intangible is not completed until it has been recorded and stored on some physical medium or tangible object which is described here as a 'host'.

The distinction between an intangible and the host on which it is stored is quite fundamental as a host must be a tangible physical good. The classic example of a host is paper on which intangibles such as news items, stories, historical or scientific facts, instructions, laws, or musical compositions may be recorded. When paper acts as the host the distinction between the intangible and the host is very familiar and very obvious. For example, the paper on which a newspaper is printed acts as the host, while the contents of the paper, which may be broadly characterised as 'information', constitute the intangible. In general, many other media besides paper may act as hosts. In ancient times, intangibles in the form of laws were even engraved on 'tablets of stone'. Today silicon chips act as the hosts for vast numbers of intangibles.

The physical host on which a specific intangible is first recorded is generally described as the 'original copy'. It is possible that the intangible may intended for own use by its creator in which case it may need to be stored on only a single host, but many types of intangibles, such as literary creations or recordings of musical performances are produced with the specific intention of producing multiple copies and disseminating them as widely as possible. Once an original has been produced it is usually possible to produce further copies each of which may cost only a tiny fraction of the cost of producing the original. For example, once the proofs for the first copy of a book or newspaper have been finished millions of

copies may be printed.

An intangible and its hosts are quite different products as a host must be a physical object. They are outputs from quite different processes of production which take place at different times. The first is the creation of the intangible itself while the other is the production of copies stored on physical hosts. For example, printing more copies of an encyclopaedia does not increase the 'size' of the intangible, i.e., the amount of information and facts contained in each copy of the encyclopaedia. Instead, it increases the availability and accessibility of the intangible to users. In general, the 'size' of an intangible is independent of the number of copies of the original host that are produced.

As the contents of an intangible may be stored on different kinds of hosts the same intangible can be transferred from one kind of host to another. For example the contents of a printed book may be transcribed onto electronic media such as disks that can be 'read' by computers, just as hard copies of the contents of a document stored on a computer may be printed on paper. The availability of an intangible may be increased enormously by making it freely available online but this does not enlarge the size of the intangible itself.

Because an intangible good has no physical dimensions it is not possible to have a cardinal measure of its size or quantity. An intangible can nevertheless be modified or enlarged but only by engaging in further creative or innovative work that improves the quality of the intangible or enlarges its scope. The SNA itself provides an example. The SNA is a large and complex intangible which is recorded on paper and in machine readable form. Disseminating more copies of the SNA Manual either in printed or electronic form has no effect on the intangible itself, the SNA. However, its 'size' has in fact been progressively increased over the years, by engaging in periodic revisions which improve the quality of the System and extend its scope ⁽⁷⁾.

One extremely important property of an intangible is that it exists independently of whatever host or hosts on which it may be stored. As it is not a physical good, it cannot deteriorate as a result of the passage of time or through wear and tear (although

⁽⁷⁾ Recommendation 2 of the OECD 2010 Manual states that: 'Intellectual property products are not subject to wear and tear but they can be subject to amendment and or augmentation. Substantial, planned improvements should be recorded as gross fixed capital formation, while minor improvements are better recorded as intermediate consumption'

its value will tend to decline, mainly as a result of obsolescence). Once produced it continues to exist indefinitely. It therefore qualifies as a durable good according to the SNA provided it is used repeatedly or continuously for purposes of production or consumption over a long period of time, typically a year or more. If it is used for purposes of production it must be classified as a fixed asset: if used by a household for purposes of final consumption, it is classified as a consumer durable

Just as the production of intangibles and their hosts are two quite different processes of production, the acquisition of intangibles and their hosts constitute two different kinds of capital formation, intangible investment and tangible investment respectively. When economic units use intangibles for purposes of production they actually consume the capital services provided by the hosts or copies, which are tangible fixed assets. The stock of an intangible is independent of both the number of physical hosts on which it is stored and the rate at which they are used up. It was stressed earlier that the size or quantity of an intangible is not increased by producing more hosts or copies. Conversely, its size is not reduced by consuming or using up existing hosts.

These results reflect another important economic characteristic of an intangible, namely that it is partly a public good. It does not possess all the attributes of a public good, but it has one key characteristic, namely that it is not rivalrous in consumption, a property which is widely recognised in the literature on Intellectual Property. For example, if the number of readers of a particular book increases, this does not reduce the scope for other potential readers to enjoy reading the book. The contents of the book, which constitute the intangible asset, are not affected by the number of people who read it.

Intangibles and knowledge

Intangibles can be stored not only on physical objects such as disks but also in the human mind. All intangibles must be such that they can be understood and appreciated by the human mind. Indeed many intangibles come into existence as creations of the mind which can be stored on physical hosts only after they have been created. However, not all intangibles can be appropriately described as creations of the mind.

‘Information’ is used here as a collective or generic

term to cover those intangibles that are not purely intellectual creations: for example, information in the form of scientific facts and historical records as well as data bases. The collection, assembly and recording of such information usually require considerable human involvement. Even numerical data bases require humans to plan them, to carry out surveys or other types of investigative activity, to collate and classify the results and record them in suitable machine readable form. Thus, information is not a pure creation of the human mind in the way that a musical composition or a literary work is. It must have a firm objective basis.

The value of information has been greatly enhanced by major advances in computer technology which enable vast quantities of data to be stored, processed and analysed on even relatively small computers. It seems to have become common for the term ‘information’ to be used as a collective term to cover all kinds of intangibles including those that are purely intellectual creations, although the precise meaning of ‘information’ in popular jargon such as ‘information technology’ or ‘information economy’ is usually not very clear.

A human mind acquires and stores information by the process of learning. A person’s knowledge consists mainly of the stock of information that the person has assimilated by study and learning. Other types of knowledge consist of the skills and experience acquired by practice and training.

Information and knowledge are quite different, though related, concepts.

‘Information’ is objective. It qualifies as an economic good because it exists independently of the economic units that happen to own or possess it, which means that it is separable from its owner and therefore exchangeable and tradable.

‘Knowledge’, on the other hand, is subjective and personal and can only exist in the mind of some person or persons. It is not separable from the person who has acquired it so that knowledge cannot be transferred, or transplanted, from one mind to another in the way that information can be transferred or copied from one computer to another. Knowledge has to be learned and cannot be acquired by engaging in market transactions with other persons.

The distinction between information and knowledge made here is fully in accord with the way in

which these terms are generally understood. For example, according to the *Oxford English Dictionary* p. 967 knowledge consists of:

'Facts, information and skills acquired through experience or education.'

However, there seems to be an increasing tendency, or fashion, for the term 'knowledge' to be casually used when what is meant is 'information'.

The processes by which information and knowledge are produced have almost nothing in common with each other. New information is discovered by purposive exploratory investigations or other creative or innovative activities such as R&D, whereas knowledge is created by learning and absorbing already existing information. The production of intangibles such as information counts as economic production because the outputs are economic goods. On the other hand, the learning process by which knowledge is created does not fall within the boundary of economic production because the knowledge gained is not an independent tradable entity. Knowledge is embedded within the mind of the person who has learnt it.

The processes by which a community's stock of information or other intangibles are increased are obviously quite different from those by which its stock of knowledge is augmented. New intangibles are produced by engaging in investigative, experimental or other innovative or creative activities. On the other hand, additional knowledge is acquired by individual members of the community engaging in activities such as studying or learning.

There is no industry that is capable of producing knowledge as its output because knowledge is not an economic good. Of course, education industries exist that fall within the boundary of economic production but their output is not knowledge. They produce services that help their consumers (pupils or students) to acquire knowledge or skills through their own study and practice.

Knowledge fails to satisfy the basic criterion for an economic good, namely exchangeability. Nevertheless, one person can acquire small amounts of information from another person to compensate for the first person's lack of knowledge in a particular area. Consultancy firms exist whose principal function is to draw upon the expert knowledge of their staff to provide selected bits of specialised information designed to meet the specific needs of their custom-

ers or clients. They include management, financial, legal and medical consultants. Their clients are able to benefit from the full range of expertise possessed by the consultants even though their own knowledge may be very limited. It is not altogether clear therefore whether the advice received by the clients should be treated as the consumption of a service or as the acquisition of bits of information (intangible goods). Either way, however, the provision of expert advice is an activity that falls within the SNA production boundary. Consultancy has been a rapidly growing activity that is generally regarded as making a significant contribution to the rapid growth of services but they could be viewed as disseminating intangible goods rather than providing services.

The 2008 SNA reaches similar conclusions about knowledge to those outlined above. Paragraph 1.34 of the 2008 SNA contains the following passage under the heading 'Human capital'.

'The acquisition of knowledge, skills and qualifications increases the productive potential of the individuals concerned and is a source of future economic benefits to them. However, while knowledge, skills and qualifications are clearly assets in a broad sense of the term, they cannot be equated with fixed assets as understood in the SNA. They are acquired through learning, studying and practising, activities that cannot be undertaken by anyone else on behalf of the student and thus the acquisition of knowledge is not a process of production even though the instruction conveyed by education services is. The education services produced by schools, colleges and universities etc. are thus treated as being consumed by students in the process of their acquiring knowledge and skills. This type of education is treated as final consumption.'

In the SNA fixed assets must be produced assets by definition. A fixed asset must therefore be a durable good produced as the output from a process of production that falls within the SNA production boundary. An intangible good (or intellectual property product) such as information therefore falls within the fixed asset boundary of the SNA, whereas knowledge does not. Thus, while the SNA recognises that human capital in the form of the knowledge and skills possessed by the labour force may play a major role in determining the level and rate of growth of productivity, it concludes (see, for

example, paragraphs 2.34 and 3.48) that ‘human capital is not treated by the SNA as an asset.’

Given that knowledge can only be possessed by persons and not by products, it is surprising to find the 2008 SNA (paragraph 6.22) introducing the concept of a ‘knowledge capturing product’. It is generally admitted that finding suitable terminology in this area can be very difficult (this being one of the main points of the present paper), but a ‘knowledge-capturing product’ appears to be a contradiction in terms. The justification for introducing the concept is also strange.

It is pointed out in paragraph 6.12 of the 2008 SNA that some manufacturing firms may provide services such as servicing and maintenance as side products. Paragraph 6.13 then reads as follows:

‘Similarly, some service-producing industries may produce products that have many of the characteristics of goods. For convenience, the products of these industries are described in the SNA as knowledge-capturing products.’

A single large enterprise (as distinct from the individual establishments of which it is composed) is likely to produce a range of different products some of which may be goods and others services. The fact both goods and services may be produced by the same enterprise does not diminish the significance of the distinction between them. The enterprise should be classified as either a goods producer or a services producer on the basis of whether its principal product is a good or a service.

If the principal product of an enterprise is a tangible product such as compact disk or a book, then the enterprise must be classified as a goods producer not a services producer. The only way in which a service producer can have a good as its principal product is if the producer is incorrectly classified. This can happen if the residual definition of services explained earlier in this paper is adopted. Newer industries such as those ‘concerned with the provision, storage, communication and dissemination of information, advice and entertainment’ (Paragraph 6.22 of the 2008 SNA), risk being classified as service industries using the residual definition. If the residual definition of service industries is tacitly employed, as seems to be the case in Paragraph 6.13, it is perfectly possible for service producers to produce goods. There is no need to invent a new category of product, ‘knowledge-capturing prod-

ucts’ to describe products that are quite ordinary tangible goods just because they are produced by industries that have been inappropriately classified as service industries.

Knowledge-capturing products are described as follows in Paragraph 6.22 of the 2008 SNA:

‘Knowledge-capturing products concern the provision, storage, communication and dissemination of information, advice and entertainment in such a way that the consuming unit can access the knowledge repeatedly. The industries that produce the products are those concerned with the provision, storage, communication and dissemination of information, advice and entertainment in the broadest sense of those terms including the production of general or specialized information, news, consultancy reports, computer programs, movies, music, etc. The outputs of these industries, over which ownership rights may be established, are often stored on physical objects (whether on paper or on electronic media) that can be traded like ordinary goods. They have many of the characteristics of goods in that ownership rights over these products can be established and they can be used repeatedly. Whether characterized as goods or services, these products possess the essential common characteristic that they can be produced by one unit and supplied to another...’

No justification or explanation is given in the first sentence for introducing the word ‘knowledge’ to refer to information, advice and entertainment. It is true that the outputs of industries referred to in the second and third sentences can be traded like ordinary goods, but this is because they are not actually concerned with knowledge but with information and other intangibles. Knowledge cannot be ‘produced by one unit and supplied to another’ and it cannot be captured by a product.

The problem is that it has become fashionable to use the term ‘knowledge’ indiscriminately to cover all kinds of intangibles whereas it should be restricted to mean the information and skills that are actually known, or have been acquired by, a specified group of people.

As the concept of a ‘knowledge-capturing product’ seems to be both unsatisfactory and unnecessary it could simply be dispensed with. Dropping the term

would have no effect on the SNA. The products in question are ordinary tangible goods like books and computer disks that fall within the production

boundary of the SNA and do not require any special treatment.

Conclusions

The paper argues that, despite the apparent simplicity of many elementary concepts in the SNA, such as goods, services and products, they still need to be defined with precision and rigour. This is particularly the case when dealing with products and activities that are most affected by substantial changes in technology resulting from the revolution in Information Technology, or IT. The outputs from such activities which may include new information itself, are often described as ‘intangible goods’. However, as explained in the paper, there is also a long and deep rooted tradition in economics of describing services as intangible goods. In practice, intangibles as now understood are assets that have nothing whatsoever in common with services. The terminology available is not adequate to deal with the complexities of the economic phenomena that have to be dealt with.

One practical way of establishing and clarifying the essential characteristics of an intangible, or intellectual property product, would be to develop, in collaboration with appropriate IT experts, much more detailed up to date product and industry classifications covering the entire range of products currently described as intangibles or IPPs. This could help to demonstrate that intangibles comprise a third major category of product that cannot be subsumed under either tangible goods and services. At the same time it would also be useful to develop more detailed up to date classification of services, given that the classification of services has always tended to be neglected compared with that of tangible goods.

Improving the treatment of intangibles in the SNA was already recognized as a priority during the course the last two revisions. The decision to treat R&D as gross capital formation meant that guide

lines were urgently needed to help countries implement the decision in practice. This led to the creation of the OECD task force on the measurement of R&D and other intangibles (or IPPs) which produced its Handbook on the subject in 2010. This Handbook advanced the subject greatly, but it would still seem to be desirable to continue to keep intangibles high on the research agenda and to ensure that the SNA is appropriately revised to take account of progress already made.

The terminology used in the SNA needs to be carefully re-assessed. For example, it is not clear that the advantages gained by switching from ‘intangible assets’ to ‘intellectual property products’ are sufficient to justify the change. The terms ‘intangibles’ and ‘intangible assets’ show no signs of dropping out of general use and economists continue to refer to intangibles. The use of IPPs in the SNA seems likely to widen the communication gap that already exists between national accountants and economists. However, it is not possible to reverse the change, as this would cause even more confusion. On the other hand, it may be desirable to drop the term ‘knowledge-capturing product’ as it seems to be unnecessary and conceptually suspect.

Finally, one subject that needs to be given more prominence is the treatment of information and knowledge in the accounts. Both concepts are extremely important in their own right and need to be clearly differentiated from each other. They are treated correctly in the SNA but the problem is that, outside of the accounts, the term ‘knowledge’ is increasingly used as a collective term to cover all kinds of intangibles including information.

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The treatment of financial transactions in the SNA: A user cost approach W. Erwin Diewert ⁽¹⁾

The paper considers how to integrate financial transactions into the balance sheet and production accounts of a nonfinancial firm. The paper argues that the choice of a reference interest rate is just as important for nonfinancial firms as it is for financial firms and that the choice of the reference rate is tied to the firm's financing decisions. The choice of the reference rate determines the interest rate that enters into the user cost of capital for the nonfinancial firm. The paper also argues that nonfinancial firms can also generate financial flows that are analogous to FISIM (Financial Services Indirectly Measured) flows. The present System of National Accounts restricts FISIM to financial firms. In order to minimize the role of imputations, the paper considers a firm that raises capital at the beginning of the accounting period, engages in some form of productive activity during the period and then distributes the initial capital and any profits back to the capitalists who financed the firm.

Keywords: User costs, banking services, deposit services, loan services, production accounts, System of National Accounts, FISIM, Financial Intermediation Services Indirectly Measured, accounting theory.

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Introduction

When financial transactions are introduced into a national income accounting framework, several problems are encountered:

- Financial transactions are by definition in nominal currency units and hence there are difficulties in determining appropriate deflators to transform these monetary transactions into real components;
- It is difficult to determine what the appropriate discount rate is for each firm in the economy. We think of the firm's discount rate as a factor that converts transactions at the beginning of the accounting period into comparable units at the end of the accounting period;
- When user costs (and supplier benefits) are introduced into the accounting framework, the resulting user costs do not match up with the corresponding supplier benefit terms on the other side of the market, leading to a lack of additivity in the accounts (unless each firm uses the same discount rate) ⁽²⁾;
- If we try to avoid user cost imputations and just live with actual firm transactions, then we do not obtain the 'right' user costs for 'physical' capital services or the 'right' user costs for demand deposits.

It is evident that the existing national income accounting framework does not provide a satisfactory framework for integrating firm financial transactions into the usual production accounts. In this paper, we will attempt to address some of these difficult accounting problems ⁽³⁾.

Our approach will be to develop an accounting framework that starts out with actual firm transactions and take that approach as far as possible without introducing any extraneous imputations. In order to minimize the role of imputations, we

⁽²⁾ See Diewert, Fixler and Zieschang (2013a) (2013b) on this point.

⁽³⁾ Earlier work on introducing financial transactions into the system of accounts and more generally into the theory of the firm include Hancock (1985) (1991), Barnett (1987), Barnett and Zhou (1994) and Keuning (1999). For criticisms of the System of National Accounts 2008 (see Eurostat, IMF, OECD, UN and the World Bank (2008)) treatment of financial sector outputs and inputs, see Hill (1996) and Sakuma (2013).

think of an accounting period that corresponds to a fifteenth century merchant trading voyage, where at the beginning of the accounting period, the firm raises financial capital and uses the financial capital to purchase a ship and inventories of goods (this corresponds to the firm's beginning of the period 'physical' capital stock). The voyage takes place and various revenues are generated by the sale of the goods at the destination port and various costs are incurred in purchasing intermediate inputs of goods at the destination port as well as the labour inputs associated with the voyage. Further revenues are generated by the sales of the goods purchased abroad at the home port. These sales and purchases of goods and labour payments generate the firm's *cash flow* or more accurately, the firm's *gross operating surplus* ⁽⁴⁾. Finally, at the end of the return voyage, the ship is sold and the net proceeds of the voyage are distributed back to the investors in the voyage. Of course, for real life firms that undertake operations for multiple accounting periods, the accounting is more complex due to the difficulties associated with valuing the firm's capital stocks at the end of each accounting period and so imputations for these valuations must be made. Our focus on voyage or venture accounting eliminates this extra layer of imputations.

A brief outline of the paper is as follows.

Section 2 develops a stylized accounting framework for a non financial firm. The model of firm behavior basically follows that of Edwards and Bell (1961) and Hicks (1961) where the accounting period is decomposed into three parts: (i) the beginning of the period; (ii) the time period between the beginning and the end of the accounting period and (iii) the end of the accounting period. At the beginning of the period, the firm raises financial capital and purchases durable inputs. In the middle of the period, the firm produces outputs and uses intermediate and labour inputs. At the end of the period, the firm sells its (depreciated) durable inputs and returns the borrowed financial capital with interest payments and returns to equity financing.

⁽⁴⁾ Gross operating surplus less net interest payments equals cash flow.

Our attention in this section is focussed on the firm's *gross operating surplus* which is equal to the value of outputs produced less intermediate and labour inputs used during the accounting period. We provide some preliminary decompositions of gross operating surplus into various payments to factors of production in this section. The decompositions obtained in this section are broadly consistent with the current structure of the System of National Accounts. The problem with our decomposition of Gross Operating Surplus (GOS) that is given by equation (4) in this section is that it does not lead to the "correct" user cost for the physical capital used by the nonfinancial firm. In order to get the user cost of capital into our decomposition of GOS, it is necessary to introduce the "correct" reference interest rate for the firm, which will be done in the following section.

In section 3, we introduce the concept of a *reference rate of interest*, which we later specify as the average weighted cost of capital for the firm. Using the reference rate of interest and various accounting identities, we are able to decompose the firm's gross operating surplus into more meaningful analytical terms. Two of these terms are the firm's *user cost of*

nonfinancial (or physical) *capital* and the *user cost of holding demand deposits* (or money) ⁽⁵⁾.

In section 4, we generalize our initial accounting framework in order to deal with the firm's holding of very liquid assets (near money) and the granting of trade credit. We develop a model which turns out to be a version of *Barnett's* (1980) *Divisia monetary assets model*. The problems associated with the deflation of financial aggregates into real components are also addressed in this section.

In section 5, we consider alternative approaches to the choice of the reference rate. The two choices we consider in this section are the *safe interest rate* and the *balancing rate of return* that is often used in productivity studies.

Sections 6 and 7 consider the recently developed *multiple reference rate methodologies* that are due to Wang and her coauthors (section 6) and to Zieschang (section 7).

Section 8 concludes with a brief listing of some of the unresolved issues associated with measuring the contribution of financial flows in production theory.

The accounting basics

We first consider the transactions that take place at the beginning of the accounting period. We assume that there are two classes of investor: one class that demands more security for their financial investments in the firm (these are the bond investors) and a second class that is willing to take more risk (these are the equity investors). The bond investors invest the amount V_B^0 at the beginning of the accounting period and expect to earn the rate of return r_B^0 at the end of the accounting period. The equity investors invest the amount V_E^0 and expect to earn the rate of return r_E^0 where $r_E^0 > r_B^0$ ⁽⁶⁾.

Thus there is an inflow of dollars into the bank account of the firm at the beginning of the period equal to $V_B^0 + V_E^0$. How are these dollars allocated? We assume that some of the inflow dollars are held in the firm's deposit account and denote this amount by V_D^0 ⁽⁷⁾. Deposit accounts pay a low rate of interest equal to $r_D^0 < r_B^0 < r_E^0$. Some of the beginning of the period inflow dollars are invested in other securities or direct ventures. Denote the value of these investment dollars by V_I^0 and these investments are expected to earn the rate of return r_I^0 . Finally, the remaining inflow dollars are

⁽⁵⁾ Thus once the 'correct' reference interest rate has been determined for the nonfinancial firm, we end up with FISIM like components for the firm

⁽⁶⁾ The difference in these expected rates of return is regarded as a risk premium. Later, we will note that it is possible to regard r_B^0 and r_E^0 as ex post rates of return rather than expected rates of return.

⁽⁷⁾ For simplicity, we assume that these deposits are held to the end of the accounting period. The analysis needs to be extended to include asset and inventory transactions that take place within the accounting period. The analysis in Diewert (2005a) which dealt with the integration of nonfinancial inventory transactions could be extended to the present framework.

allocated to the purchase of (physical) capital: we suppose that K^0 units of capital are purchased at the price P_K^0 . We will denote the *inflow of dollars less the outflow at the beginning of the accounting period* by π^0 . Under our assumptions, this net inflow of dollars is equal to 0; i.e., we have:⁽⁸⁾

$$(1) \quad \pi^0 = V_B^0 + V_E^0 - P_K^0 K^0 - V_D^0 - V_I^0 = 0.$$

Note that π^0 is also equal to the beginning of the period value of liabilities, $V_B^0 + V_E^0$, less the beginning of the period value of assets, $P_K^0 K^0 + V_D^0 + V_I^0$.

At the end of the accounting period, the firm will have accumulated the *Gross Operating Surplus*, GOS^1 . This is equal to the value of revenues generated by the firm during the accounting period, less the value of intermediate inputs less the value of labour service payments⁽⁹⁾. Since there are no major accounting difficulties with the components of Gross Operating Surplus, we will not provide a detailed breakdown of these components.

We will now consider the inflows and outflows of dollars at the end of the accounting period. GOS^1 is the first component of the inflows. The second component, $P_K^1(1-\delta)K^0$, is the sale of the depreciated capital stock, where P_K^1 is the end of period price of a new unit of the capital stock and δ is the depreciation rate. The third component, $V_D^0(1+r_D^0)$, is the value of the firm's initial stock of deposits, V_D^0 , plus the interest paid by the bank on these deposits, $r_D^0 V_D^0$. The fourth component, $V_I^0(1+r_I^0)$, is the value of the firm's investments in other financial assets, V_I^0 (this term is the repatriation of the capital invested at the beginning of the period) plus the return earned on these investments, $r_I^0 V_I^0$. The fifth component is the repayment of the capital borrowed from bond holders plus the interest earned by these bond investors, $-V_B^0(1+r_B^0)$. This item is a cash outlay

⁽⁸⁾ The student of accounting will recognize that we are essentially taking a double entry bookkeeping approach to the transactions of the firm, except that all of the transactions that take place between the beginning and the end of the accounting period are deferred until the end of the accounting period.

⁽⁹⁾ Note that we are assuming that all of the flow transactions within the accounting period are realized at the end of each period. This is consistent with traditional accounting treatments of assets at the beginning and end of the accounting period and cash flows that occur during the period; see Peasnell (1981; 56).

and so it has a negative sign in front of it.

The sixth component is the return of the capital borrowed from equity providers of funds plus the interest or dividend income earned by these equity investors, $-V_E^0(1+r_E^0)$. This item is also a cash outlay and so it has a negative sign in front of it. Finally, after all the above outflows are subtracted from the above inflows, the firm may earn a pure profit at the end of the period. This *end of period pure profit* π^1 is defined as the above cash inflows less the above cash outflows⁽¹⁰⁾:

$$(2) \quad \pi^1 = GOS^1 + P_K^1(1-\delta)K^0 + V_D^0(1+r_D^0) + V_I^0(1+r_I^0) - V_B^0(1+r_B^0) - V_E^0(1+r_E^0).$$

We will now take an end of period or ex post perspective and assume that we are at the end of the accounting period and GOS^1 , P_K^1 , δ , and of the rates of return which appear in (2) are known⁽¹¹⁾. If π^1 is positive, then the firm makes a profit on its operations for the accounting period and this pure profit will be distributed back to the equity owners as a premium to their expected rate of return r_E^0 . If π^1 is negative, then the equity owners will not make their 'required' ex ante rate of return and the ex post actual rate of return can be obtained by setting π^1 equal to 0 and solving for the resulting r_E^0 ⁽¹²⁾.

In principle, all of the transactions that are listed on the right hand sides of (1) and (2) have counterparts in the rest of the economy and so if we kept track of all financing decisions, interest flows in addition to the usual input and output flows in the production accounts of a system of national accounts, we could construct an expanded set of production accounts that included financial transactions which would add up; i.e., every transaction for a single sector in the expanded accounts would show up as a

⁽¹⁰⁾ All of the assets that appear on the right hand side of (2) could be disaggregated into multiple asset types for each broad category but this generalization is left to the reader. In the context of our voyage accounting model, r_E^0 would be the return to equity capital that just made π^1 equal to zero. In a more general model, r_E^0 would equal the rate of return on equity capital that was anticipated at the beginning of the accounting period and π^1 would represent unanticipated profits or pure profits above and beyond the rate that is required to induce equity holders to provide financial capital to the firm.

⁽¹¹⁾ It will be difficult to determine the required rate of return on equity capital, r_E^0 .

⁽¹²⁾ With very large unanticipated losses, bond holders could also suffer a loss of capital.

transaction in another sector of the accounts. There would be no lack of additivity problem in such a set of expanded accounts⁽¹³⁾. The problem with such a set of accounts is that the transactions on the right hand side of (2) look rather unfamiliar to production economists who are used to working with the user cost of capital as the cost of using physical capital during the period⁽¹⁴⁾. Thus in what follows, we will attempt to transform (2) into a more familiar set of transactions. In particular, we would like the user cost of non-financial capital to show up on the right hand side of (2). Since the beginning of the period value of liabilities equals the corresponding value of assets (recall equation (1) above), we can add the right hand side of (1) to the right hand side of (2) and we obtain the following alternative expression for π^1 :

$$(3) \quad \pi^1 = \text{GOS}^1 - \delta P_K^1 K^0 + (P_K^1 - P_K^0) K^0 + r_D^0 V_D^0 + r_I^0 V_I^0 - r_B^0 V_B^0 - r_E^0 V_E^0.$$

Now equation (3) can be reorganized to give us a decomposition of the firm's gross operating surplus, GOS^1 , in terms of pure profits π^1 and the other terms on the right hand side of (3):

$$(4) \quad \text{GOS}^1 = \pi^1 + [\delta P_K^1 - (P_K^1 - P_K^0)] K^0 - r_D^0 V_D^0 - r_I^0 V_I^0 + r_B^0 V_B^0 + r_E^0 V_E^0.$$

The terms in square brackets on the right hand side of (4) can be recognized as part of the *user cost of capital services* except that the imputed interest rate term is missing; i.e., δP_K^1 is the *depreciation term* and $-(P_K^1 - P_K^0)$ is the *revaluation term* in the usual user cost of capital. However, the remaining terms on the right hand side of (4) look unfamiliar. But it is true that the right hand side of (4) gives us an *explicit decomposition of the gross operating surplus of the firm into explanatory factors* where the financing decisions of the firm figure prominently in this decomposition⁽¹⁵⁾.

The reference rate and analytic decompositions of gross operating surplus

Our goal in the remainder of the paper is to obtain *useful decompositions* of the firm's gross operating surplus into explanatory terms that make sense. In order to make further progress, we now make a somewhat arbitrary assumption. From equation (1), we know that the value of liabilities at the beginning of the accounting period equals the corresponding value of assets. Hence we can multiply the initial stock of liabilities less assets by the *reference interest rate* r_R^0 and obtain the following equation:

$$(5) \quad [V_B^0 + V_E^0 - P_K^0 K^0 - V_D^0 - V_I^0] r_R^0 = 0.$$

The arbitrary element in equation (5) is the choice of the reference interest rate, r_R^0 : at this stage of the analysis, this rate is completely arbitrary and yet, as we will see, it will play a key role in what follows.

⁽¹³⁾ The current System of National Accounts does add up.

⁽¹⁴⁾ Readers who are familiar with the current SNA will have no trouble recognizing the entries in equations (3) and (4) and they will be able to allocate these entries into their proper places in the SNA. It should be noted that the user cost of physical capital plays a large role in the measurement of Total Factor Productivity of the firm; see Jorgenson and Griliches (1967) and Schreyer (2001) (2009).

Now add the left hand side of equation (5) to the right hand side of equation (3) and we obtain the following expression for π^1 :

$$(6) \quad \pi^1 = \text{GOS}^1 - [r_R^0 P_K^0 + \delta P_K^1 - (P_K^1 - P_K^0)] K^0 - (r_R^0 - r_D^0) V_D^0 + (r_I^0 - r_R^0) V_I^0 - (r_B^0 - r_R^0) V_B^0 - (r_E^0 - r_R^0) V_E^0.$$

Equation (6) can be rearranged to give an *alternative exact decomposition of the firm's end of period gross operating surplus* into explanatory terms:

⁽¹⁵⁾ If we simplify the accounts by absorbing the pure profits term into the ex post return on equity (i.e., set $\pi^1 = 0$ and use equation (2) or (3) to solve for the balancing rate of return on equity that makes the equation equal to zero), then all of the terms on the right hand side of (4) will have offsetting entries elsewhere in an expanded set of accounts. When we subtract depreciation from gross operating surplus, we obtain net operating surplus. The placement of the revaluation term is more controversial; if the price of the asset declines over time due to technical progress, then the revaluation term could be regarded as an obsolescence charge and could be added to wear and tear depreciation. However, if the price of the asset increases over time, then the revaluation term typically shows up in the revaluation accounts of the System of National Accounts. But the basic point here is that there is no additivity problem in principle with the expanded system of accounts when we use the decomposition of gross operating surplus given by (4).

$$(7) \text{ GOS}^1 = \pi^1 + [r_R^0 P_K^0 + \delta P_K^1 - (P_K^1 - P_K^0)]K^0 + (r_R^0 - r_D^0)V_D^0 - (r_I^0 - r_R^0)V_I^0 + (r_B^0 - r_R^0)V_B^0 + (r_E^0 - r_R^0)V_E^0.$$

The expression in square brackets on the right hand side of (7) can be recognized as the user cost of capital services⁽¹⁶⁾. Note that the interest rate component of this user cost, $r_R^0 P_K^0$, uses the reference rate r_R^0 to value the *opportunity cost* of tying up the firm's financial capital in holding physical capital. With this observation, the choice of the reference rate is no longer so arbitrary: *the reference rate can be interpreted as the interest rate that represents waiting services in the firm's user cost of capital*⁽¹⁷⁾.

Thus equation (7) provides a decomposition of the firm's gross operating surplus into the sum of the following components:

- the *pure profits* earned by the firm during the accounting period, π^1 ;
- the value of *nonfinancial capital services*, $[r_R^0 P_K^0 + \delta P_K^1 - (P_K^1 - P_K^0)]K^0$;
- the *user cost of holding demand deposits* during the period, $(r_R^0 - r_D^0)V_D^0$;
- (less) the *net margins* earned by the firm on its financial investments, $-(r_I^0 - r_R^0)V_I^0$ (this is the firm counterpart to *loan margins* earned by banks on their loan portfolios) and
- the sum of two terms, $(r_B^0 - r_R^0)V_B^0 + (r_E^0 - r_R^0)V_E^0$, which reflect the costs of raising financial capital via debt and equity capital, $r_B^0 V_B^0 + r_E^0 V_E^0$, relative to raising the same amount of financial capital at the reference rate, $r_R^0 V_B^0 + r_R^0 V_E^0$.

Typically, the reference rate r_R^0 will lie between the debt interest rate r_B^0 and the required equity rate of return r_E^0 . Under these conditions, $(r_B^0 - r_R^0)V_B^0$ will be negative and $(r_E^0 - r_R^0)V_E^0$ will be positive. Thus

⁽¹⁶⁾ For a sampling of material on the user cost of capital concept, the reader is referred to Hall and Jorgenson (1967), Jorgenson and Griliches (1967), Christensen and Jorgenson (1969), Diewert (1974) (1980) (2005a) (2005b), Harper, Berndt and Wood (1989), Jorgenson (1989) (1996a) (1996b), Hulten (1990) (1996), Diewert and Lawrence (2000) and Schreyer (2001) (2009).

⁽¹⁷⁾ Thus $r_R^0 P_K^0$ represents the waiting services term in the user cost of capital; see Rymes (1968) (1983) on the concept of waiting services.

the positive term $(r_E^0 - r_R^0)$ can be interpreted as a *positive equity premium* that is earned by equity capital for taking on more risk and the negative term $(r_B^0 - r_R^0)$ can be interpreted as a *negative debt discount* to reflect the lower risk that is associated with the provision of debt capital. Alternatively, $r_E^0 - r_R^0$ can be interpreted as the *user cost* of raising financial capital via equity financing, relative to the average cost of raising funds and since $r_B^0 - r_R^0 = -(r_R^0 - r_B^0)$, $r_R^0 - r_B^0$ can be interpreted as the *supplier benefit*⁽¹⁸⁾ to the firm of raising financial capital via debt financing.

A natural choice for the reference rate is r_C^* , the *average cost of raising financial capital from debt and equity financing*⁽¹⁹⁾; i.e., define r_C^* (the average cost of funds interest rate) as follows:

$$(8) \quad r_C^* = [r_B^0 V_B^0 + r_E^0 V_E^0] / [V_B^0 + V_E^0].$$

Replacing the general reference rate r_R^0 in (7) by r_C^* leads to the following decomposition of gross operating surplus:

$$(9) \quad \text{GOS}^1 = \pi^1 + [r_C^* P_K^0 + \delta P_K^1 - (P_K^1 - P_K^0)]K^0 + (r_C^* - r_D^0)V_D^0 - (r_I^0 - r_C^*)V_I^0.$$

Thus the last two terms on the right hand side of (7) have vanished on the right hand side of (9)⁽²⁰⁾ and so when we set the reference rate equal to the firm's average cost of financial funds, we find that gross operating surplus is equal to pure profits π^1 plus the value of nonfinancial capital services $[r_C^* P_K^0 + \delta P_K^1 - (P_K^1 - P_K^0)]K^0$ plus the cost of deposit services $(r_C^* - r_D^0)V_D^0$ less margins on financial investments and loans $-(r_I^0 - r_C^*)V_I^0$. This seems to be a satisfactory analytical decomposition of gross operating surplus for a non banking firm⁽²¹⁾.

⁽¹⁸⁾ See Diewert, Fixler and Zieschang (2013a) for the introduction of the term 'supplier benefit' as a term for a negative user cost.

⁽¹⁹⁾ Inklaar (2010) used this reference rate in his study of U.S. productivity. His study used a methodology that is similar to ours except he focused on adding various intangible assets to his asset base rather than adding monetary assets to the nonreproducible asset base.

⁽²⁰⁾ Of course, these two missing terms (which sum to zero when the reference rate is defined by (8)) can be brought back onto the right hand side of (9) if this is desired for some analytic purpose but the decomposition given by (9) seems to be very suitable for production function studies of the firm.

⁽²¹⁾ There is a similar decomposition for a banking firm but the cost of deposit services term changes sign into a benefit of creating deposits; see Diewert, Fixler and Zieschang (2012b) for the details.

However, other choices for the reference rate are possible as we shall see in the next two sections.

The question of where to place the last two terms on the right hand side of (9), $(r_C^* - r_D^0)V_D^0 - (r_I^0 - r_C^*)V_I^0$, in a national income accounting framework now arises; i.e., should these terms be moved out of the income side of the accounts into the production accounts (the output and intermediate input part of the accounts)? The first term is the imputed value of deposit services and the second term is the negative of loan and investment margins. Since the provision of deposit services by banks is generally regarded as an output in the SNA, consistency would suggest that the first term be moved out of the income accounts and into the intermediate input part of the accounts. Similarly, since bank loan services are generally regarded as a banking sector output, consistency across sectors would suggest that the last term be moved into the output part of the accounts⁽²²⁾. This is a sensible strategy but it would be useful to distinguish these new rows of the production accounts as

financial outputs and inputs that require special treatment. The special nature of these financial transactions is due to the following factors:

- There are no natural deflators for the entries in these financial rows and so users need to be alerted to the fact that the corresponding real or volume entries will necessarily be somewhat arbitrary.
- We cannot expect these entries for a specific firm or sector to be offset by another entry in the accounts that is equal in magnitude but opposite in sign to the entries in these financial outputs and inputs; i.e., additivity will in general be lost for the rows in the production accounts that correspond to these financial outputs and inputs⁽²³⁾.

In the following section, we will extend the above model by decomposing the value of firm financial investments, V_I^0 , into two components: one component which has a low rate of return associated with it and another which has a higher rate of return.

Barnett's monetary aggregates and the deflation problem

Barnett (1980) worked out a nice theory of monetary aggregation that applied to households. He noted that very liquid assets could serve as a fairly close substitute for deposits and hence broader measures of monetary holdings could be derived by applying modern index number theory and forming broader monetary aggregates. To apply his framework in our present firm context, we need to decompose the firm's holdings of financial investments, V_I^0 , into at least two components⁽²⁴⁾:

- Holdings V_{IL}^0 of a very liquid asset that earns

the *low* interest rate r_{IL}^0 which is less than the reference rate r_R^0 and

- Holdings V_{IH}^0 of a risky asset that earns the *high* interest rate r_{IH}^0 which is greater than the reference rate r_R^0 .

The very liquid assets V_{IL}^0 can be regarded as part of the firm's *working capital*, along with its holdings of demand deposits, V_D^0 .

Using the decomposition of V_I^0 into V_{IL}^0 plus V_{IH}^0 , equations (3), (5) and (7) become the following equations:

$$(10) \pi^1 = \text{GOS}^1 - \delta P_K^1 K^0 + (P_K^1 - P_K^0) K^0 + r_D^0 V_D^0 + r_{IL}^0 V_{IL}^0 + r_{IH}^0 V_{IH}^0 - r_B^0 V_B^0 - r_E^0 V_E^0;$$

$$(11) [V_B^0 + V_E^0 - P_K^0 K^0 - V_D^0 - V_{IL}^0 - V_{IH}^0] r_R^0 = 0;$$

⁽²²⁾ It should be noted that this move to achieve consistency with the treatment of banking sector loans would imply a large change to the present structure of the SNA and is unlikely to be implemented without more study of the implications of the change.

⁽²³⁾ See Diewert, Fixler and Zieschang (2013a) (2013b) for an elaboration of this point. If the reference rate is chosen to be the same across all sectors in the system of accounts, then additivity can be restored.

⁽²⁴⁾ Of course, V_I^0 can be further decomposed into many assets, including accounts receivable (or trade credit).

$$(12) \text{GOS}^1 = \pi^1 + [r_R^0 P_K^0 + \delta P_K^1 - (P_K^1 - P_K^0)] K^0 + \\ (r_R^0 - r_D^0) V_D^0 + (r_R^0 - r_{IL}^0) V_{IL}^0 - (r_{IH}^0 - r_R^0) V_{IH}^0 \\ + (r_B^0 - r_R^0) V_B^0 + (r_E^0 - r_R^0) V_E^0.$$

Equation (12) is the new decomposition of gross operating surplus into analytical components. Under our assumptions on interest rates, the terms $(r_R^0 - r_D^0) V_D^0$ and $(r_R^0 - r_{IL}^0) V_{IL}^0$ will both be positive and it is evident that these terms represent the opportunity costs (relative to the cost of capital r_R^0) of holding the amount V_D^0 in demand deposits and the amount V_{IL}^0 in low yielding, liquid investments throughout the period. The two terms are in nominal dollar units and in order to apply index number theory to these two components of broadly defined monetary services, we need to decompose these two value flows into price and quantity components. Let ρ_D^0 and ρ_{IL}^0 be appropriate deflators for these two value flows. Then the prices and quantities of the two components of monetary services are defined as follows:

$$(13) P_D^0 = (r_R^0 - r_D^0) \rho_D^0; P_{IL}^0 = (r_R^0 - r_{IL}^0) \rho_{IL}^0; Q_D^0 = \\ V_D^0 / \rho_D^0; Q_{IL}^0 = V_{IL}^0 / \rho_{IL}^0.$$

Barnett (1980; 17) used the same true cost of living index (or alternatively, a consumer price index could be used) to deflate all of his household nominal monetary variables into real variables. In our firm context, it is not so clear what the appropriate deflators, ρ_D^0 and ρ_{IL}^0 , should be. We will discuss this choice problem below. Given the prices and quantities of monetary assets defined by (13), we can follow Barnett (1980; 39) and use a superlative index number formula to construct a monetary aggregate for the two assets (25).

How should the asset deflators ρ_D^0 and ρ_{IL}^0 be chosen? There is no unambiguous answer to this question. If average stocks of monetary balances are being held in order to make payments to variable inputs and to fund purchases of inventory stocks and other capital input purchases, then a price index ρ_X^0 for the value of input purchases during the period would be an appropriate deflator for the

firm's holdings of deposits and other near monetary stocks. What deflator should be used to deflate the firm's high yielding investments, V_{IH}^0 ? One could argue that the real cost of making these investments is the fact that money spent on risky investments cannot be spent on input purchases and hence the same input price index ρ_X^0 could be used as a deflator for these risky investments. Another alternative would be to deflate all financial nominal amounts by a suitable consumer price index ρ_C^0 . The justification for this alternative would be to measure the real value of a monetary unit in terms of a representative consumption bundle or more generally, in terms of a cost of living index for a reference population.

Obviously, the above paragraph on deflation of monetary flows is very incomplete. Basu (2009) summed up the unsatisfactory treatment of financial variables in economic theory as follows:

'No method of measuring financial sector prices (and hence real output) has yet commanded a consensus. In fact, there is even disagreement about how to measure nominal output in one of the most important financial sectors, namely banking. Thus, it is not surprising that I shall propose different answers than Fixler to the questions that he raises. But more important than the specifics of any particular issue is a general contention: in economics, when a conceptual disagreement has lasted a long time with no resolution in sight, it is usually a sign that economic theory has not been applied sufficiently rigorously. The only way to make progress in this area is to start from detailed models of what financial institutions actually do, and the market environment in which they operate. Once that is done, the measurement implications are usually obvious in principle, although the implied measures may be exceedingly difficult to implement in practice.' Susanto Basu (2009; 267).

We conclude this section with a further cautionary note: we have not modeled the riskiness of alternative financial investments in a completely

(25) See Diewert (1976) for the definition of a superlative index. Barnett (1980; 39) for his household example used the Fisher and Törnqvist superlative indexes and found that the two formula gave identical results to three decimals and commented that 'the choice between these two indices is of no importance'.

rigorous way ⁽²⁶⁾. However, until the theory of firm behaviour under uncertainty with explicit modeling of the firm's financing decisions has been developed to the extent that there is an accepted consensus on how to proceed, we will have to make do with incomplete modeling. Since there is an urgent need to develop an adequate accounting framework for measuring financial outputs and inputs in a national income accounting framework, we hope that the approaches explored in this paper will be

useful in forming a consensus on how to proceed at a practical level.

In the following sections of this paper, we revert back to the more aggregated model of firm behavior that was described in sections 2 and 3 above. The subsequent discussion will focus on alternative choices for the reference rate and on generalizations of the model in section 3 to include multiple reference rates.

Alternative choices for the reference rate

There are advantages in assuming that there is only a single reference rate r_R^0 for the firm, since this assumption leads to a useful interpretation for the firm's end of the period profits. Using definitions (1) and (2) (which define the cash transactions of the firm at the beginning and end of the period) and the assumption (5) of a single reference rate, it be seen that the firm's end of period profits can be written as follows:

$$(14) \text{ End of period profits} = \pi^0(1 + r_R^0) + \pi^1.$$

Thus if the firm chooses inputs and outputs to maximize the right hand side of (14), this will be equivalent to the maximization of discounted cash flows; i.e., (14) is equivalent to the maximization of $\pi^0 + (1 + r_R^0)^{-1}\pi^1$. The maximization of discounted cash flows is the traditional approach to intertemporal production theory ⁽²⁷⁾.

In section 3, we considered the implications of choosing the reference rate equal to the average cost of raising debt and equity financial capital. Another possible choice is the *safe interest rate*, r_s^* . This rate would correspond to the yield on triple A rated assets or on bond rates for short term government securities (for a country with a suitably high debt rating). Inserting this choice of reference rate into (7) leads to the following decomposition of the

firm's gross operating surplus:

$$(15) \text{ GOS}^1 = \pi^1 + [r_s^* P_K^0 + \delta P_K^1 - (P_K^1 - P_K^0)]K^0 + \\ (r_s^* - r_D^0)V_D^0 - (r_I^0 - r_s^*)V_I^0 + (r_B^0 - r_s^*)V_B^0 + \\ (r_E^0 - r_s^*)V_E^0.$$

Comparing the decomposition given by (15) with our earlier decomposition (9) which used the cost of funds reference rate r_C^* , it can be seen that we now have an extra two terms, namely $(r_B^0 - r_s^*)V_B^0$ and $(r_E^0 - r_s^*)V_E^0$. Both of these terms will generally be positive since the safe rate of return will generally be below the bond and equity interest rates. The question is: what should we do with these two terms? Should they be left in the income part of the accounts or should they be shifted into the production accounts where they would appear as sectoral intermediate input costs. The latter treatment seems to be a logical one if we have shifted loan and investment margins into the production accounts since the last two terms in (15) are similar in nature (but of course, they will generally have the opposite sign to loan margins). The major advantage of choosing the reference rate to be the safe interest rate is that the various margins and user costs on the right hand side of (15) will have offsetting entries in other parts of the system of national accounts so that additivity of the system can be preserved. However, a possible disadvantage of the choice of the safe rate as the reference rate is that as compared with the choice of the cost of funds rate r_C^* as the reference rate, the value of capital services and of deposit services will be dramatically reduced and the value of loan

⁽²⁶⁾ See Wang (2003), Barnett and Wu (2005) and Wang, Basu and Fernald (2009) for rigorous approaches to the treatment of uncertainty in a user cost context. However, a consensus on the 'right' approach to the treatment of uncertainty in a national income accounting framework has not yet emerged.

⁽²⁷⁾ See Hicks (1939). See Edwards and Bell (1961), Hicks (1961), Diewert (1980) (2010; pp. 760-762) and Diewert, Fixler and Zieschang (2013b) for the specialization of this theory to the case of a single period.

and investment margin services, $(r_I^0 - r_S^*)V_I^0$, will be dramatically increased. Finally, the user costs of raising funds via debt and equity relative to raising funds at the safe interest rate, $(r_B^0 - r_S^*)V_B^0$ and $(r_E^0 - r_S^*)V_E^0$ respectively, will both become large and positive. These last two margins become large and positive at the cost of the capital services term becoming smaller and this is the difficulty with the use of the safe interest rate as the reference rate. Essentially, these last two terms can be interpreted as extra profits that the firm has to earn in order to cover its costs of raising financial capital. Thus we have shifted costs out of the user cost of capital and into these margin terms which seems to be a dubious strategy.

Another alternative strategy that is frequently used in order to determine the reference rate for a nonfinancial firm is to use the *balancing rate of return reference rate* r_{BR}^* , which is defined by assuming that $\pi^1 = 0$ and to solve the following equation which sets the user cost of capital times K^0 equal to the gross operating surplus:

$$(16) \text{GOS}^1 = [r_{BR}^* P_K^0 + \delta P_K^1 - (P_K^1 - P_K^0)] K^0 \text{ or}$$

$$(17) r_{BR}^* = \{\text{GOS}^1 - [\delta P_K^1 - (P_K^1 - P_K^0)] K^0\} / P_K^0 K^0.$$

Thus all of the financial transactions of the firm are suppressed in the decomposition of gross operating surplus that is given by (16). Now we want to compare the balancing rate of return r_{BR}^* with the cost of funds rate of return r_C^* defined by (8). When we set $\pi^1 = 0$, the cost of funds decomposition of gross operating surplus defined by (9) can be rewritten as follows:

$$(18) \text{GOS}^1 - [\delta P_K^1 - (P_K^1 - P_K^0)] K^0 = (r_C^* - r_D^0) V_D^0 + (r_C^* - r_I^0) V_I^0.$$

Using (17) and (18), it can be seen that we have the

following relationship between r_{BR}^* and r_C^* :

$$(19) r_{BR}^* = [(r_C^* - r_D^0) V_D^0 + (r_C^* - r_I^0) V_I^0] / P_K^0 K^0.$$

Usually, a nonfinancial firm will hold demand deposits and since the deposit rate r_D^0 will almost always be well below the firm's average cost of capital r_C^* , it can be seen that the first term on the right hand side of (18) will generally be positive. A nonfinancial firm will typically not have substantial financial investments and if it does, usually the rate of return earned on these financial investments r_I^0 will be close to the firm's cost of capital r_C^* . Thus typically, the right hand side of (18) will be positive and so the balancing rate of return will generally exceed the firm's cost of raising financial capital; i.e., typically

$$(20) r_{BR}^* > r_C^*.$$

Thus relative to the more accurate decomposition of gross operating surplus that is given by (9), the less accurate decomposition given by the usual balancing rate of return methodology (17) will have the following characteristics:

- The value of nonfinancial capital services will generally be overstated;
- The value of deposit services will be dramatically understated (since it will be set equal to zero) and
- The role of investment or loan margins will be missing.

The fact that deposit services are missing in traditional production function studies of the economy that use the balancing rate of return methodology is potentially large source of bias in these studies, since presently, many firms in developed economies are holding very large deposit balances.

Multiple Reference Rate Methodologies: The Wang Group Approach

Rather than assuming a single reference rate, it is possible to preserve the structure of firm cash flows by replacing assumption (5) by the following

assumption which has multiple reference rates:

$$(21) V_B^0 r_B^* + V_E^0 r_E^* - P_K^0 K^0 r_K^* - V_D^0 r_D^* - V_I^0 r_I^* = 0.$$

Thus there are now five reference rates: r_B^* , r_E^* , r_K^* , r_D^* and r_I^* so that there is one reference rate for each type of asset and liability. Four of these rates can be chosen arbitrarily but the fifth rate must be chosen to satisfy equation (21) ⁽²⁸⁾.

Now add the left hand side of equation (21) to the right hand side of equation (3) and we obtain the resulting expression for π^1 :

$$(22) \pi^1 = GOS^1 - [r_K^* P_K^0 + \delta P_K^1 - (P_K^1 - P_K^0)] K^0 - (r_D^* - r_D^0) V_D^0 + (r_I^0 - r_I^*) V_I^0 - (r_B^0 - r_B^*) V_B^0 - (r_E^0 - r_E^*) V_E^0.$$

Equation (22) can be rearranged to give an *alternative exact decomposition of the firm's end of period gross operating surplus*:

$$(23) GOS^1 = \pi^1 + [r_K^* P_K^0 + \delta P_K^1 - (P_K^1 - P_K^0)] K^0 + (r_D^* - r_D^0) V_D^0 - (r_I^0 - r_I^*) V_I^0 + (r_B^0 - r_B^*) V_B^0 + (r_E^0 - r_E^*) V_E^0.$$

Of course, the practical problem with the multiple reference rate methodology is: how exactly are the various reference rates to be determined? What principles are to be used in justifying a particular selection of rates?

The Wang Group want to avoid putting risk premiums into the outputs of the banking sector ⁽²⁹⁾ so they choose reference rates for deposits and loans to be very close to the corresponding actual rates by choosing reference debt rates to match the various financial assets on the bank's balance sheet, where the reference rates have similar maturity and risk characteristics. Thus a bank's service outputs for the deposits it creates and the bank loans it makes should reflect the costs of servicing the various

accounts ⁽³⁰⁾. The Wang Group worked out their methodology for a bank and it is not completely clear exactly how their methodology would apply to a nonfinancial firm. Applying their methodology to the right hand side of (23) might lead to the choice of a reference deposit rate r_D^* which is close to the actual deposit rate r_D^0 and to a reference investment (or loan) rate r_I^* which is slightly above the actual net loan rate (after loan losses) r_I^0 . Typically they would choose the reference rates for bonds and equity, r_B^* and r_E^* , to be equal to the corresponding actual rates r_B^0 and r_E^0 and so the final reference rate for nonfinancial capital, r_K^* , would be determined by solving equation (21) for r_K^* ⁽³¹⁾.

Suppose we accept the above assumptions so that we set $r_B^* = r_B^0$ and $r_E^* = r_E^0$ and we choose reference rates for deposits and other financial investments, r_D^* and r_I^* , that are close to the observed rates, r_D^0 and r_I^0 respectively. Define the *average reference rate of return on financial assets*, r_{FA}^* , as follows:

$$(24) r_{FA}^* = [r_D^* V_D^0 + r_I^* V_I^0] / [V_D^0 + V_I^0].$$

Define the firm's beginning of the period *ratio of financial assets to nonfinancial assets* (physical capital), $\rho_{FA/K}$, as follows:

$$(25) \rho_{FA/K} = [V_D^0 + V_I^0] / P_K^0 K^0.$$

Now substitute our assumptions on reference rates into equation (21) and solve for the *nonfinancial firm counterpart to the Wang Group reference rate for nonfinancial capital*, r_W^* :

$$(26) r_W^* = [V_B^0 r_B^* + V_E^0 r_E^* - V_D^0 r_D^* - V_I^0 r_I^*] / P_K^0 K^0 = r_C^* + [r_C^* - r_{FA}^*] \rho_{FA/K}$$

where r_C^* is the average cost of raising financial capital from debt and equity financing defined earlier by (8) and we have used (1) and definitions (24) and (25) in order to derive the second equation in (26). A 'typical' nonfinancial firm will not have extensive investments, so usually, the average reference rate on financial assets r_{FA}^* will be close to the reference deposit rate r_D^* which in turn will

⁽²⁸⁾ This multiple reference rate methodology was introduced by Wang (2003). Papers which develop this methodology are Wang, Basu and Fernald (2009), Basu, Inklaar and Wang (2011), Colangelo and Inklaar (2012) and Inklaar and Wang (2012a) (2012b) and Wang and Basu (2012) (the Wang Group). These papers use the multiple reference rate methodology with the reference rate for nonfinancial capital being determined residually using a variant of equation (21). We need equation (21) to hold because when we add terms to the firm's actual cash flows, these additional terms must sum to zero so that the firm's cash flows remain unaffected.

⁽²⁹⁾ This is reasonable: waiting services and risk assumption services can be regarded as primary inputs and hence the remuneration for the provision of these services belongs in the income accounts.

⁽³⁰⁾ Zieschang (2012) refers to these components of bank output as the 'account servicing' components of bank output.

⁽³¹⁾ Since the Wang Group has not explicitly addressed what reference rates they would choose for a non banking firm, we are engaging in a certain amount of guesswork on how they would choose their reference rates for a nonfinancial business.

be close to the reference deposit rate r_D^* which will be much lower than the average cost of capital r_C^* defined by (8). Thus the interest rate which will be imputed to physical capital using the Wang Group methodology, r_W^* , will typically be *larger* than the average cost of capital, r_C^* , since the ratio of financial assets to physical assets, $\rho_{FA/K}$, will always be positive.

Now substitute our Wang Group assumptions about reference rates into (23) and we obtain the following *exact decomposition* of the firm's end of period gross operating surplus⁽³²⁾:

$$(27) \text{ GOS}^1 = \pi^1 + [r_W^* P_K^0 + \delta P_K^1 - (P_K^1 - P_K^0)] K^0 \\ + (r_D^* - r_D^0) V_D^0 - (r_I^0 - r_I^*) V_I^0.$$

The above decomposition of gross operating surplus is very similar to our earlier decomposition (9) which used a single reference rate, r_C^* , which was the average cost of raising financial capital via debt and equity financing. For easy reference, we repeat (9) as (28):

$$(28) \text{ GOS}^1 = \pi^1 + [r_C^* P_K^0 + \delta P_K^1 - (P_K^1 - P_K^0)] K^0 \\ + (r_C^* - r_D^0) V_D^0 - (r_I^0 - r_C^*) V_I^0.$$

Comparing the decompositions (27) and (28), under the assumption that r_W^* is less than r_C^* , it can be seen that the user cost of capital in (28) will be

smaller than the corresponding user cost in (27). If the reference rates r_D^* and r_I^* in (27) are close to the observed rates, r_D^0 and r_I^0 , then the last two terms on the right hand side of (27) will be close to zero whereas the last two terms on the right hand side of (28) will usually be much larger in magnitude. If we assume V_I^0 is equal to zero, then we can be more definite about the differences between the two decompositions: the cost of capital decomposition (28) will have a smaller contribution to gross operating surplus from the user cost of capital and a larger contribution to the firm's holdings of monetary assets.

A problem with the Wang Group methodology is that the assumptions about financial reference interest rates lead directly to an interest rate term that is applied to nonfinancial capital and this interest rate may be quite different from the usual interest rate that we insert into the user cost of capital, which is typically related to the cost of raising financial capital⁽³³⁾. We now turn to an even more general multiple reference rate methodology that has the flexibility of the Wang Group with respect to pricing financial services but, at the same time, can insert the 'right' interest rate for the user cost of physical capital.

Multiple reference rate methodologies: the Zieschang approach

The methodology that will be described in this section is due to Zieschang (2013). Our derivation of his methodology is a bit different but it is completely equivalent, except we are considering nonfinancial firms whereas he considered only financial firms⁽³⁴⁾.

Recall the single reference rate methodology that

⁽³²⁾ The Wang Group decomposition of gross operating surplus given by (27) can be compared to our earlier decomposition of GOS using a balancing rate of return given by (16). If $\pi^1 = 0$, $r_D^* = r_D^0$ and $r_I^* = r_I^0$, then r_W^* will equal the balancing rate of return r_{BR}^* and the Wang Group decomposition (27) will collapse down to the balancing rate of return decomposition (16). Thus with profits equal to zero and the reference rates close to the actual rates, we would expect the Wang Group decomposition of GOS to be close to the balancing rate of return decomposition

was described in section 3 above. Our starting point will be the decomposition of gross operating surplus that was given by equation (7). The basic insight of Zieschang was to decompose the various financial sector user costs and supplier benefit terms on the right hand side of (7) into two components:

⁽³³⁾ A related problem is that the Wang Group imputation for deposit services will be much smaller than our preferred imputation $(r_C^* - r_D^0) V_D^0$ that we obtained in (9) for the (opportunity) cost of the firm's deposit services. Our preferred approach seems to be more consistent with Barnett's (1980) approach to the determination of the user cost for monetary services.

⁽³⁴⁾ This distinction is not important: nonfinancial firms are just like financial firms except that financial firms (banks) have the power to raise financial capital via the creation of demand deposits. Thus financial firms will have an extra liability term in the decomposition of their operating surplus.

- A component that represents the pure services aspect of the transactions associated with each user cost or supplier benefit which Zieschang interpreted as ‘account servicing components’ of bank.
- Another component that represents some kind of financial intermediation services.

The account servicing components of Zieschang’s user costs and supplier benefits are entirely similar to the Wang Group’s notions of bank service outputs and inputs. Thus assume that we have determined *suitable reference rates* r_B^* , r_E^* , r_D^* and r_I^* that are close to the observed rates r_B^0 , r_E^0 , r_D^0 and r_I^0 and we also have determined a suitable overall reference rate r_R^* that we want to apply to the physical capital of the firm. Then applying the single reference rate r_R^* in the manner explained in section 3 above, the counterpart to (7), the decomposition of gross operating surplus at the end of the accounting period, is as follows:

$$\begin{aligned}
 (29) \text{ GOS}^1 &= \pi^1 + [r_R^* P_K^0 + \delta P_K^1 - (P_K^1 - P_K^0)] K^0 \\
 &+ (r_R^* - r_D^0) V_D^0 - (r_I^0 - r_R^*) V_I^0 + (r_B^0 - r_R^*) V_B^0 \\
 &+ (r_E^0 - r_R^*) V_E^0 \\
 &= \pi^1 + [r_R^* P_K^0 + \delta P_K^1 - (P_K^1 - P_K^0)] K^0 + (r_R^* - r_D^* \\
 &+ r_D^* - r_D^0) V_D^0 - (r_I^0 - r_I^* + r_I^* - r_R^*) V_I^0 + (r_B^0 - r_B^* \\
 &+ r_B^* - r_R^*) V_B^0 + (r_E^0 - r_E^* + r_E^* - r_R^*) V_E^0 \\
 &= \pi^1 + [r_R^* P_K^0 + \delta P_K^1 - (P_K^1 - P_K^0)] K^0 + (r_R^* - r_D^*) \\
 &V_D^0 + (r_D^* - r_D^0) V_D^0 - (r_I^0 - r_I^*) V_I^0 + (r_I^* - r_R^*) V_I^0 \\
 &+ (r_B^0 - r_B^*) V_B^0 + (r_B^* - r_R^*) V_B^0 + (r_E^0 - r_E^*) V_E^0 + \\
 &(r_E^* - r_R^*) V_E^0
 \end{aligned}$$

Conclusion

We have tried to integrate financial transactions into the traditional theory of the firm with the hope that such an integration would be helpful in developing a consistent system of national accounts. In particular, we showed that bringing financial transactions into the traditional theory of the firm (which deals with inputs and outputs which have definite physical units of measurement as opposed

where the second equation in (29) follows by adding and subtracting terms. The third equation

in (29) gives the Zieschang decomposition of the firm’s end of period gross operating surplus into explanatory terms. His decomposition does succeed in associating an appropriate reference interest rate r_R^* (which can be chosen to be the average cost of financial capital r_C^* defined earlier) but now we have a large number of account servicing terms on the right hand side of (29) plus the financial intermediation terms to interpret and allocate to the income accounts or the production accounts⁽³⁵⁾.

Our conclusion at this point is that the Zieschang decomposition has a great deal of flexibility associated with it but at the same time, it is somewhat complex and not that easy to interpret. Choosing an appropriate constellation of reference rates also is problematic.

to nominal financial values) can be viewed as the problem of decomposing gross operating surplus into analytically meaningful terms.

⁽³⁵⁾ The account servicing terms involve differences between observed interest rates and reference rates and the financial intermediation terms involve differences in reference interest rates. The financial intermediation terms are approximately equal to our user cost, supplier benefit and differential risk assumption terms that appeared on the right hand side of (7).

A large number of alternative decompositions of GOS were presented in the paper. At our present state of knowledge, the author feels that the decomposition given by equation (9) is the most suitable one. This decomposition involves the choice of a single reference rate, r_c^* , which is the firm's average cost of raising financial capital from debt and equity financing. The decomposition (9) is consistent with standard intertemporal production theory and requires fewer imputations than the multiple reference rate approaches due to the Wang Group and Zieschang.

Many problems associated with the integration of the firm's financial decisions with its 'real' decisions remain unresolved. Some of these unresolved problems are the following ones:

- Which terms in the decomposition of gross operating surplus should be transferred from the income accounts to the gross output and intermediate input accounts?
- How exactly should the reference rates be chosen?
- How exactly should the financial flows be deflated into meaningful real flows?
- What does a firm's production possibilities set look like when we take into account financing decisions?
- How exactly can asset transactions that take place within the accounting period be integrated into the analysis?

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