



IARIW-Bank of Korea Conference “Beyond GDP: Experiences and Challenges in the Measurement of Economic Well-being,” Seoul, Korea, April 26-28, 2017

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Arnold J. Katz (Bureau of Economic Analysis, United States)

Paper prepared for the IARIW-Bank of Korea Conference

Seoul, Korea, April 26-28, 2017

Session 1: New Perspectives on Measuring Well-being from National Accountants

Time: Wednesday, April 26, 2017 [Morning]

Making Estimates of National Income Better Reflect Economic Well-Being: The U.S. Experience*

Arnold J. Katz†

U.S. Department of Commerce

Bureau of Economic Analysis

National Economic Accounts Research Group

Paper prepared for the IARIW-Bank of Korea Special Conference “Beyond GDP: Experiences and Challenges in the Measurement of Economic Well-being,”

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* The views expressed in this paper are solely those of the author and not necessarily those of the U.S. Department of Commerce or the Bureau of Economic Analysis.

† Arnold J. Katz, Economist, U.S. Department of Commerce, Bureau of Economic Analysis, Washington, DC | 301- 278 – 9641 | arnold.katz@bea.gov.

Abstract

The Bureau of Economic Analysis publishes the U.S. National Income and Product Accounts. Its headline measure of production is gross domestic product (GDP). Recently, the Stiglitz Commission and others have expressed concerns that not enough has been done to make the existing measures reflect economic well-being and suggest that fundamental changes be sought to make this ideal a reality. To understand the difficulties of making progress on this front, it is useful to know: what GDP is, what it is designed to measure, what concepts determine how it is measured, and what efforts have been made to expand the scope of the measures and move beyond GDP. This paper discusses these and other related issues. It concludes with the author's views on the best approaches to take in future work.

1. Introduction

After much debate, the Bureau of Economic Analysis (BEA) devised a conceptual framework for presenting aggregate economic data that remains to the present day. This framework is the U.S. National Income and Product Accounts (NIPAs). Its headline measure of production is gross domestic product (GDP).¹ Today, many economists like Stiglitz, Sen, and Fitoussi (2009) as well as Fleurbaey and Blanchet (2013) have expressed concerns that not enough has been done to make the existing measures reflect economic well-being and suggest that fundamental changes be sought to make this ideal a reality. Similar concerns have been advanced since before the NIPAs were founded. Schanz (1892), Haig (1921), Mitchell et al. (1921), and Simons (1938) advanced proposals to measure income that were even broader and bolder than those advanced today. To understand the difficulties of making progress on this front, it is useful to understand: what GDP is, what it is designed to measure, what concepts determine how it is measured, and what efforts have been made to expand the scope of the measures and move beyond GDP.

This paper is organized as follows. It first describes the early history of GDP and the NIPAs. It then explains what GDP is before moving on to a discussion of the objectives of GDP measurement. Next, it details the early conceptual debates in developing the measure of GDP. Much of the paper is then spent in describing BEA's efforts to move beyond the measures that were put in place when the NIPAs were founded. Efforts at BEA and other parts of the U.S. Commerce Department to measure the size distribution of income are also discussed. The paper concludes with the author's views on the best approaches to take in future work to make aggregate income and product as well as the size distribution of income better reflect economic well-being. In particular, in-kind income, the services of consumer durable goods, and capital gains are viewed as low hanging fruit that can readily make our measures of a household's income and national income better measures of economic well-being.

2. Early history of GDP and the NIPAs

In 1940, BEA began work on GDP and developing the NIPAs.² The first official estimates of the overall level of GDP were published in Gilbert (1942a). During the course of World War II, estimates of GDP's components were introduced piece by piece. A rudimentary design for a system of national income accounts for the U.S. was laid out in Gilbert and Jaszi (1944).³ Particularly important was the authors' adoption of the "bird's-eye viewpoint," which presented the basic aggregates required to give a

¹ Prior to 1991, GNP (gross national product) was BEA's featured measure of output. It differs from GDP in that it includes income receipts from the rest of the world and excludes income payments to the rest of the world. This difference amounts to about 1 percent of GDP. To avoid confusion, this paper treats the two as being synonymous and from this point forward "GNP" is only used in direct quotations.

² Technically, the work on GDP and national income in the Commerce Department was in the Bureau of Foreign and Domestic Commerce until the end of World War II when it was transferred to the newly formed Office of Business Economics (OBE). The latter gradually morphed into BEA. When BEA was formed in 1963 it was only a renaming of the existing OBE.

³ Milton Gilbert was the Chief of the National Income Division. George Jaszi helped lead BEA for more than four decades and was its director from 1963 to 1985.

summary view of the economic system in terms of the analytically important types of transactions, such transactions being shown in their interrelation to each other.

In September 1944 officials of the Commerce Department met with their counterparts from Canada and the United Kingdom and reached agreement on some of the major conceptual issues in national income accounting, see Denison (1947). According to Jaszi (1971; p.185) while the accounts had their origin in BEA's work during World War II, "...their design crystallized in the somewhat more leisurely period that followed the war."

The NIPAs were first published in Office of Business Economics (OBE) (1947). The principal authors were Milton Gilbert, Edward F. Denison, George Jaszi, and Charles F. Schwartz. The most important aggregates in the accounts were shown in six interrelated summary accounts. The system was articulated in the sense that every transaction appearing in the summary accounts appears twice, once as a debit in the account making payment, and once as a credit in the account receiving payment. In addition to the summary accounts, there were numerous tables that provided an extraordinary amount of detail for the aggregates that appeared in the summary accounts.

From 1947 until 1958 there was very little change in the NIPAs. Only four additional statistical tables were added. Two of these were extremely important, however. They reported the major components of GNP and "real", i.e., inflation-adjusted, basis and gave the price indexes used to deflate the nominal totals.

In 1957 and 1958 the NIPAs rose to national prominence with the publication of two reports by the National Bureau of Economic Research (NBER). The first was the conference volume for a meeting of the Conference on Research in Income and Wealth (CRIW) held in November 1955 that was exclusively devoted to discussing the NIPAs. The lead paper was Jaszi (1958a), which provides a discussion of the reasoning behind the design of the NIPAs and its various treatments. The second report was by the National Accounts Review Committee (NARC), which was formed by the NBER in November 1956 at the invitation of the Office of Statistical Standards of the Bureau of the Budget. The NARC reviewed, appraised, and made recommendations in a report to the Joint Economic Committee of Congress in 1957, which was also published in NARC (1958).

The NIPAs underwent a major expansion in 1958. The most important aspect of this overhaul was that the number of statistical tables was almost doubled to 95. GDP and its product components were also now shown in constant as well as current dollars. During the next decade, the NIPAs became increasingly integrated with other parts of the U.S. statistical system. In 1964 BEA completed an input-output table for 1958 and integrated it with the NIPAs. In 1965, the NIPAs changed its handling of foreign transactions to align with their treatment in the balance of payments accounts. Also in 1965, the Federal Reserve Board's Flow of Funds Accounts were modified so that they could be integrated conceptually and statistically with the NIPAs.

In the period since then, particularly since 1990, there have been major changes in the NIPAs. Some of the most important conceptual changes have been in a broadening of the concept of investment to include government durables, software, expenditures on research and development, and

entertainment originals. The introduction of accrual accounting for pensions and chained-weighted price and quantity indexes were also highly important. Perhaps the greatest changes were an explicit movement towards greater consistency with the *System of National Accounts (SNA)*, adoption of updates to the international guidelines, and an increased emphasis on international cooperation and harmonization.

3. What is GDP?

The concept of the circular flow of income and product lies at the core of national economic accounting and, indeed, all modern macroeconomic thought. Essentially, the aggregate value of goods produced will equal the aggregate value of all incomes from production. The values of aggregate income and aggregate product are not just conceptually the same. When defined and measured properly, the values of gross national income and gross national product should be statistically the same. Jaszi (1946; p. 38) notes that this equality was mentioned as early as 1648.

The SNA (2009; p. 621) defines the expenditure measure of GDP as “...the sum of expenditure on final consumption plus gross capital formation plus exports less imports.” I prefer an early definition that describes GDP as the summation of the market values of final products. This makes it clear that a central problem is the determination of which products are final and which products are intermediate. It also makes it clear that market values are to be used.

3.1 Which goods are included in the summation?

Although the definition of GDP does not explicitly say so, only economic goods are included. Consequently, pots made as a hobby or for recreation are not included because they are considered to be “non-economic.” Likewise, GDP only includes goods that are produced. Oil reserves that are discovered as a result of exploration are considered to be “non-produced” so that the value of newly discovered reserves is not recorded in GDP.

Produced goods are divided into those that are “final” and those that are “intermediate.” Final goods are goods (and services) that are not used up in the production of other goods (and services). All goods that are not final goods are intermediate goods, i.e., they are used up in the production of other goods and services.

It is important to note that the definition of “production” has always been nebulous. This has led to many debates about what should be included in GDP. For example, the treatments of interest and services of financial intermediaries have always been difficult.

3.2 Market valuation - an ideal not realized in practice

Economists now agree that ideally we would like to value all goods and services in GDP at their market prices.⁴ By “market price” we mean the amount that was actually paid for them. This valuation is useful in theory because it sets a floor on what purchasers are willing to pay for a given good. Actually, most goods in GDP are not valued at market prices. The output of Government and non-profit institutions is valued at its costs of production. The value of many goods, such as the services of owner-occupied housing, is “imputed.” Also, almost all medical care in the U.S. is received through either Government-provided or employer-provided health insurance or directly by Government or non-profit hospitals and is essentially received in kind. None of these goods can be properly regarded as having been purchased at market prices.

4. Objectives of GDP measurement

4.1 Measuring aggregate economic performance

Kuznets (1941; p.4) saw GDP’s primary mission as “an appraisal of the contribution of economic activity to the welfare of the country’s inhabitants, present and future.”⁵ Jaszi (1958a; p. 20) agreed that one of GDP’s two major functions was to serve as an appraisal of economic results, but he differed on how this appraisal was related to economic welfare.

4.1.1 GDP and economic welfare

Kuznets saw a direct connection between GDP and economic welfare, BEA’s early leaders did not. Jaszi (1958a; p. 76) argued that “one cannot draw simple inferences from changes in output to changes in consumer satisfaction if there are concurrent shifts in needs, technological conditions, or institutions....even though (for these and other reasons) output measures cannot provide a quick and simple answer to the very difficult problem of assessing changes in economic welfare, they are absolutely essential for such analysis. Their usefulness in this connection will be promoted by the provision of maximum information on expenditure flows, rather than by the attempt to find an automatic gadget, as it were, in the form of a total comprised of a selection of these flows.”

Denison (1971) argued that GDP is just one component of welfare. It measures the output available to satisfy our needs and wants. To measure welfare, however, we also need to measure changes in needs brought on by population change, the degree of urbanization, climate change, and the prevalence of diseases. We also need an index of the “goodness” of the size distribution of income. We should realize that welfare is affected by people’s perception of reality as well as objective facts as, for example, one’s fear of crime in the streets need not be closely related to actual risks.

⁴ In the 1940’s, most economists, particularly those in the United Kingdom, appear to have been in favor of valuing output at “factor cost,” i.e., the costs of the factors of production. This valuation essentially excludes the value of taxes on production such as sales taxes. Support for it has greatly waned over time.

⁵ Simon Kuznets supervised the Commerce Department’s first official estimates of national income, which were published in 1934. In 1971 he was awarded the Nobel Prize in Economic Sciences for his work on economic growth.

4.1.2 GDP and sustainability

Weitzman (1976) showed that the aggregate that policymakers should want to maximize is not GDP but NDP (net domestic product). NDP is equal to GDP less depreciation or consumption of fixed capital, which is a charge for the using up of capital. In fixed dollars, net investment (gross investment less depreciation) measures the increase in the net capital stock. Because NDP includes net investment rather than gross investment, it is a better measure of sustainable product than GDP. Because GDP is now measured in chained dollars and because measuring and interpreting net investment in chained dollars is awkward, NDP has not been discussed as often by policymakers as it was in the past.

From the time that BEA first began estimating GDP, its officials recognized the need for a net measure of product. They acknowledged the need for measures of economic depreciation and depletion. The problem was that methods and data needed to measure these did not yet exist. Instead, BEA used measures from business income tax returns. Beginning with 1942, BEA published estimates of the depletion of timber and minerals. It eliminated these estimates in 1947. Landefeld et al. (1994b; p.51) notes that one of the reasons for this was the lack of a comparable measure for additions to reserves due to the discovery of new ones.

4.2 GDP and economic planning

Economic planning requires that estimates be made of the impact of policy changes on the economy. Such analyses are greatly facilitated by having a measure of aggregate production like GDP. From the 1970s through the 1990s and beyond, large-scale econometric models of the economy were constructed for use in economic forecasting and planning. Such models could not be constructed without the data provided within a system of national accounts like the NIPAs.

The usefulness of the concept of GDP itself was amply demonstrated in its first major use, planning for World War II. Nathan (1994), who was engaged in war planning, states that in the second half of 1940, much of his time was spent in determining what U.S. GDP would be at full employment. Estimates made by his division in the fall of 1940 showed that a major expansion of the iron and steel and aluminum industries was needed in order to mount an all-out defense effort. This led the Government to put economic incentives (essentially subsidies) in place to cause this expansion. As a result, after the attack on Pearl Harbor, the U.S. was able to greatly accelerate arms production. Nathan (1994) notes that the concept of GDP was later used by Kuznets and himself to determine how big a war effort the U.S. economy could support and when there would be enough war material to successfully invade Europe.

4.3 GDP and economic analysis

According to Jaszi (1958a; p. 20) the NIPAs were founded with the view that one of their main objectives was to provide data that would be useful to those who studied economic behavior. This viewpoint helped to guide the selection of what aggregates would be shown. Such analysis is greatly facilitated by having accounts with a common set of definitions and valuations and a structure that shows how the aggregates are related to each other. In short, one of the major objectives of the NIPAs

is to facilitate positive analysis just as another one is to facilitate normative analysis. It was felt that by adopting a healthy amount of compromises in the accounting structure both purposes could be well served.

5. Early conceptual debates

In the early days of national accounting, there was no consensus on the question of what products were final. Likewise, there was no consensus on how one could determine if a given product was final. The principal participants in the initial debates were Simon Kuznets on the one hand and a Commerce Department team composed of the four principal authors of the NIPAs on the other. The main round of the debate occurred in the pages of the *Review of Income and Wealth* in 1948, soon after the NIPAs were first published. The actual debate was ongoing over many years. Because the ideas behind the Commerce team's initial response were best expressed by its conceptual leader, George Jaszi, in other articles, I liberally cite statements that he made in them.

The debate involved a number of closely related issues. The most important were: Was GDP primarily supposed to measure the nation's economic welfare; Was the measurement supposed to be made subjectively or objectively; Should the measurements be made using the "accounting approach;" and Is a large part of government output intermediate? These issues are not just closely related, they are interrelated. We have already examined the first question; we now look at the others.

5.1 Is GDP a subjective concept?

To Kuznets GDP was a subjective concept. Kuznets (1941; p. 3) stated, "The statistician who supposes that he can make a purely objective estimate of national income, not influenced by preconceptions concerning the 'facts', is deluding himself..." His view may have been informed by his belief that GDP should be primarily seen as measure of welfare, which would require a lot of judgment. Jaszi took the opposite point of view. He wanted to make the measurement as objective as possible and limit the role of judgment. Jaszi (1946) explained that various definitions advanced by Kuznets were not suitable for objective operational work because they were vague and unclear.

5.2 What are final products?

Kuznets felt that a large part, if not most, of government product was intermediate. In Kuznets (1948; p. 156) he stated, "At all times a major portion of government activity is devoted not to the provision of services to ultimate consumers (education, health, etc.) but either to services to business (all types of economic legislation, administration, and adjudication) or to the maintenance of internal peace or external security. The latter is not a direct service to consumers: it is rather an antecedent and indispensable cost of maintaining society at large – a *condition* of economic production rather than an activity directly yielding final economic goods." However, Kuznets (1948) never really answered the question of how one could determine which of the goods provided by government were final.

Jaszi (1958a) defended the NIPAs operational rule that treated all expenditures by government and consumers as final. He pointed out that the problem of having seemingly intermediate expenditures included in the BEA's measures of GDP was not confined to government expenditures. It

also occurs in estimates of personal consumption expenditures. For example, expenditures for burglar alarms, watchdogs, and bodyguards appeared to have the same role in private consumption expenditures that defense expenditures played in government services. Some economists would want to remove consumer expenditures on such “regrettable necessities” from measure of final product. The optimal solution to this problem is to construct a clear operational definition of what a final product is. However, Jaszi asserted that it was impossible to construct such a definition. He also asserted that it was impossible to construct a definition of consumption that would clearly explain which items should be imputed and counted in a measure of consumption and which should not.

5.3 The use and usefulness of the accounting approach

Since the NIPAs were first published, official estimates of GDP have been prepared using the so-called accounting approach. This could constrain the estimates in a number of ways. One may well ask whether GDP should be estimated using some other approach.

Exactly what is the “accounting approach” to measuring national income? According to Jaszi (1958a; p. 21) “...the essence of the accounting approach involves, first, the division of the economy into groups of transactors and the depiction of the economic process in terms of their transactions....Finally, it appears to me that in drawing up the picture of the economy we shall find it useful to emphasize the fact that in some sense the incomings and outgoings of each transactor must be equal.”

Kuznets (1948; p. 152) forcefully stated that he was opposed to the idea of having a system of national accounts, especially the one found in the NIPAs. He stated, “...there is little in the technique of the system of accounts in and of itself to help us to determine the proper scope of national income and the observable flows that represent net yields and those, which from the standpoint of the national economy, represent costs: to decide upon the bases of valuation to be used, and the significant sectors to be distinguished at any level of economic circulation.” He went on to criticize the accounting approach itself in Kuznets (1948; p. 154) when he stated, “The emphasis in all accounting, social or business, on the transactor and the transaction is a dubious addition to the theoretical equipment by aid of which we define the national income and reckon its distribution.”

The basic requirement of the accounting approach is that the two sides of any given T-account must sum to the same total. This does not impose any limitation on how one can define any aggregate. But if income and product are defined so that they are not equal, we are forced to explicitly reconcile how they differ. Moreover, the accounting approach does impose a major limitation that will come up later in our discussion of in-kind income. Items are either in the accounts at their full value (market value or production cost) or they are out of the accounts as if they had a zero value. It is very difficult to devise an acceptable accounting system in which items are valued at a non-zero fraction of their full value.

5.4 The scope of the estimates

One of the earliest disputes in the measurement of national income and product concerned the scope of the estimates. In modern times, this issue is usually discussed in terms of the “boundary of

production.” Mitchell et al. (1921) and Mitchell (1922) used a broader concept of national income and product than Kuznets in the NBER’s first estimates of the national income and its size distribution. They included estimates of the rental value of owner-occupied dwellings as well as the rental value (imputed interest) on consumer durables. Mitchell et al. (1921; p. 57) even published “conjectural” estimates of the value of the services provided by housewives at home although they noted that because they were subject to potentially large errors they should not be included in national totals of income. Kuznets did not include any of these in his 1934 work for the Commerce Department. BEA included the housing imputation and an imputation for financial services received by depositors in the first edition of the NIPAs. Jaszi indicated his support at the theoretical level for a broad concept of product, broader than what is in the 2008 SNA. Jaszi (1958b; p. 302) stated the he had no quarrel with an imputation for the free services consumers received from radio and television programs. On the other hand, he had extremely high standards as to what estimates were accurate enough to be in official statistics.

6. Moving beyond GDP

In discussing BEA’s attempts to “move beyond GDP,” I include all efforts to move beyond what the NIPAs were when they were first published in 1947. This is divided into four parts. The first is the general expansion of BEA’s program both in the national accounts and in other units. The second is the broadening of BEA’s top-line measures of GDP and personal income to make them better measures of economic well-being. In many instances these changes were preceded by research that was initially outside the scope of GDP but which was so successful that the results were adopted into the official measure. The third is work that is currently outside of the NIPAs. Much of it concerns the various satellite accounts that BEA has developed in recent years. The fourth area concerns measurement of the size distribution of income, which is taken up in a separate section.

6.1 The general expansion of BEA’s programs.

The general expansion of the NIPAs and related national programs enhances the study of economic well-being. An evaluation of the nation’s progress in advancing economic welfare requires information on how income and product are distributed. We need to know the functional distribution of income (the distribution by types of income) and the distribution of production across product types. We also need to know how the nation’s product is distributed between defense items like war planes and consumer items like food and clothing as well as how investment is distributed between factories and industrial equipment and structures like schools and hospitals. Over the years, BEA has produced ever more tables that provide greater detail to answer these questions.

Other relevant programs are located in the units of BEA that deal with international transactions accounts, industry accounts, and regional accounts. Roughly 2/3 of BEA’s employees work in these units; this fraction has changed little over the years.

The Commerce Department began compiling statistics on the nation’s balance of payments in 1922, well before work was done on national income. This work shifted to BEA after the end of World War II. Work on international transactions accounts has expanded to include information on the balance of trade, investment income, and both government and private financial flows. These accounts

also measure the value of U.S. international assets and liabilities and direct investment by multinational enterprises.

Much of the work in BEA's industry economic accounts has directly or indirectly fed into the NIPAs. Every five years, an extremely detailed input-output table is produced that is used to benchmark the levels of NIPA data. Today annual input-output tables are produced that are integrated with estimates of GDP by industry and industry-level production accounts are produced that are integrated with BLS data. In addition, satellite accounts are now produced for: travel and tourism, arts and cultural production, innovation, and health care.

The U.S. is so large and geographically diverse that the welfare implications of national data cannot be fully assessed without sub-national breakdowns. This is best illustrated by housing data. Median home values in some of the 50 states are as little as 1/3 of the median value of other states. The data is even more dramatic for smaller areas, such as counties. Some of the more than 3,000 counties have median home values that are only about 10 percent of the median home value of other counties. This implies that the cost of living varies greatly from one part of the country to another, making it difficult to compare differences in well-being from one part of the country to another. Consequently, there has always been a great need for data to be provided on a sub-national basis.

6.2 Broadening top-line aggregates

6.2.1 GDP

One of the most significant developments in the NIPAs ability to capture changes in well-being has been the broadening of the measure of GDP itself by expanding the boundary of production as recommended in the *SNA*. Technological change has brought about the introduction of new types of capital goods that have greatly increased the nation's ability to produce goods and services. To capture the effect of these new goods the NIPAs have broadened the concept of capital by introducing the capitalization of: computer software, research and development, and other intellectual property products. Independently of this, the concept of capital was greatly broadened by the decision to capitalize and depreciate the purchases of fixed assets owned by government. Recently, BEA has begun to treat "artistic originals" as capital. Because much of this broadening occurred after many years of research that was conducted outside of the framework of the NIPAs, these efforts are discussed below in the sections that deal with research outside of the NIPA framework.

6.2.2 Personal income

In 1947, when the NIPAs were first published, the existing series termed "income paid to individuals" was renamed "personal income." That series was first published in October 1938 when a monthly series on income payments to individuals entitled "national income paid out" was conceptually revised to include transfer payments and to exclude contributions to Social Security and Federal Retirement funds to make it a better measure of consumer purchasing power. The revised series was renamed "income paid to individuals." There has been little conceptual change in the definition of personal income over the years. However, its composition has changed greatly in what can be described

as a shift to having benefits provided in kind. While cash wages accounted for over 71 percent of personal income in 1963, they accounted for less than 51 percent of personal income in 2015. This decline is largely offset by corresponding increases in social benefits in kind (primarily health care benefits from the Medicare and Medicaid programs); wage supplements such as employer-paid health insurance; and imputed income. The last category has been expanded due to changes that cause interest and dividends earned on the reserves of life insurance companies and pensions funds to be included in personal income.

6.3 Measuring aspects of economic well-being outside of the NIPAs

Throughout its history, BEA has conducted research on measuring aspects of economic well-being outside of the strict confines of the NIPAs. There have been three main surges in this research activity. The first was between 1972 and 1981 when work was performed on the costs of air pollution and non-market economics. The second was in the early part of the 1990's when work was conducted on environmental and natural resource accounting with the goal of obtaining a measure of a "green GDP." The third has been going on since 2010 with an emphasis on measures related to health care and intangible capital.

6.3.1 Environmental and non-market economics

In 1972 BEA began work on collecting economic data on anti-pollution expenditures by individuals, government, and business and conducting analyses of the new measures. The first estimates of pollution abatement and control expenditures were published in 1975. They would continue to be collected and published until 1995.

In 1978 BEA formed the Environmental and Nonmarket Economics Division. The existing work on pollution and control expenditures was transferred to this division. A new branch began estimates of pollutant emissions per dollar of output for each major pollution industry and of pollutant emissions abated per dollar of abatement expenditures. A Measures of Economic Well-Being (MEW) Branch was also formed. It operated until the end of 1981 when it was abolished as a result of government-wide budget cuts.

Initial versions of most the branch's papers were published as a collection in BEA (1982). Versions of most of them were soon published in the *Review of Income and Wealth*.

The MEW Branch's initial paper was Katz and Peskin (1980). It valued the services of the stock of consumer durables using a methodology similar to that used by Kendrick and by Eisner, see Katz (1983). The methodology was notable for its development of a rate of return that better reflected the opportunity costs faced by consumers than the rates used in 20 or more empirical studies. It discussed how the estimates could be used to present an alternative measure of GDP and was a satellite account in all but name. Katz (1982a) presented alternative estimates of this value obtained with a user-cost formula under alternative assumptions about the relative value of the services of old and new durables and the expected rate of inflation in the prices of the durables. Katz (1983) examined the relative theoretical merits of the various measures of service value that had been found in the literature.

Martin, Landefeld, and Peskin (1984) discussed alternative approaches to the measurement of the service value of government capital and presented alternative estimates for 1948-79. Landefeld and Hines (1985) compared three approaches to valuing the discovery and use (i.e., depletion) of non-renewable resources in the mining industries. It presented alternative estimates for U.S. oil and gas for 1945-79. Murphy (1982) presented estimates of the value of household work performed in 1976 using several valuation methods. The results were found to vary widely by method. Gates (1984) presented a conceptual basis for developing human capital investment in health and preliminary estimates for the U.S. for 1952-78.

6.3.2 Green GDP

Plant (1991) described the Administration's plans for a full blown natural resource accounting project in hearings held before the Joint Economic Committee of the U.S. Congress. Funds were requested in the Administration's 1992 budget for a project that would use satellite accounts. BEA staffed up for the work in 1993 and two papers were published in 1994. The work was co-authored by a team of nine: J.S. Landefeld; Carol S. Carson; Arnold J. Katz; Gerald F. Donahoe; Bruce T. Grimm, Stephanie L. Howell; Gary L. Rutledge; Timothy F. Slaper; and Eric J. Troyer. Landefeld et al. (1994a) presented the analytical and economic accounting background for the work, an overview of the satellite accounting framework, and BEA's long-term plans for this work. It introduced the integrated economic and environmental satellite accounts (IEESA's). These are a supplementary set of accounts structured to show the interactions of the economy and the environment more fully than the existing economic accounts. Landefeld et al. (1994b) discussed the conceptual and methodological issues in mineral resource accounting and presented estimates of the value of mineral stocks, additions to the stocks, and depletion of those stocks for the period 1958-91 using alternative methods of valuation. The work did not address questions related to the measurement of damage due to the degradation of the environment.

Following the publication of these articles, Congress ordered BEA to cease this work pending an external review of its work. Such a review was conducted by a blue ribbon panel set up by the National Academy of Sciences Research Council. Nordhaus and Kokkelenberg (1999) reported that the panel commended BEA on its methodology and endorsed the cautious use of satellite accounts. It recommended that Congress should authorize and fund BEA to recommence its work on IEESA development. However, BEA never received funding or authorization to resume this work.

6.3.3 Capitalizing government durables

In 1995, BEA began to treat the purchase of government durables as investment and included a measure of their services in the NIPAs. The services were measured by depreciation alone; a net return to capital was not included as a cost component. Parker et al. (1995; p. 35) stated that a return to capital was not imputed "...because there is insufficient empirical information with which to select a rate of return." This seems unfortunate given BEA's former research on this topic and the recommendation made in NARC (1958; p. 78) that BEA should impute a return to state and local government capital using

the rate on state and local bonds. On the other hand, the 2008 SNA does not recommend the imputation of a return to government capital.

6.3.4 Capitalizing intangibles

Until 1999 BEA had not treated expenditures on any intangibles as investment. However, two things happened in the 1990's. First, expenditures on computer software became a major part of the economy. Second, the 1993 SNA treated them as investment. Consequently, BEA abandoned its longer standing practice of not capitalizing intangibles.

6.3.4.1 Recognizing computer software as investment

In 1999, BEA began to recognize business and government expenditures on computer software as investment. Previously, only software embedded in equipment by the producer of that equipment was counted as investment. Business expenditures for software were classified as inputs to production, and government expenditures for software were classified as government consumption expenditures. In the new estimates three types of software were treated as investment. They are: (1) prepackaged software; (2) custom software; and (3) own-account software. The impact of the changes was large. In 1998, the new definitions resulted in an upward revision in GDP of \$123 billion.

6.3.4.2 R & D satellite account

In 1992, BEA began work aimed to develop a satellite account for expenditures on research and development (R & D) after determining the usefulness and feasibility of such an account. The account was first published in Carson, Grimm, and Moylan (1994). In it expenditures on R & D were treated as fixed investment and depreciated over their assumed service life. The expenditures reflected labor costs, the costs of material and supplies and overhead costs. The latter included a charge for the capital used in producing R&D. The expenditure data, by performer when available, was taken from surveys conducted by the National Science Foundation. However, many practical and conceptual hurdles had to be overcome before the estimates were of sufficient quality that they could be directly incorporated into the main accounts of the NIPAs. This did not happen until 2013.

6.3.4.3 Artistic originals

As part of a broader effort to expand its coverage of intangible assets in keeping with the latest edition of the SNA, BEA started capitalizing expenditures on literary, entertainment, and artistic originals in the NIPAs beginning with the 2013 Comprehensive Revision of the NIPAs. A summary of the new treatment is provided in Smith et al. (2013). Further details of the new treatment for artistic originals are described in Soloveichik (2011). These include theatrical movies, long-lived television programs, books, music, and other miscellaneous entertainment. Their values were estimated as the net present value of expected future royalties or other revenue obtained from these assets, net of any associated sales costs.

6.3.4.4 Arts satellite account

Kern, Wasshausen, and Zemanek (2015) described the first estimates of a new arts and cultural production satellite account. It provides detailed statistics that shed light on the impact of arts and cultural activities on the U.S. economy including its contributions to current-dollar GDP. Essentially, the account rearranges the I-O accounts in order to feature arts and cultural activity and provides more detail than is available in the I-O accounts. The statistics are presented under the two broad headings: (1) core arts and cultural production and (2) supporting arts and cultural production. The core category includes performing arts, museums, design services, and arts education while the supporting category includes event promotion, printing, and broadcasting.

6.3.5 Health care satellite account

Another major effort was the development of a health care satellite account. Between 2007 and 2015 about 25 BEA working papers and a number of papers were written on topics regarding medical care. One of the most useful articles is Aizcorbe et al. (2012), which describes the program in the context of national economic accounting. The research efforts reached a major milestone with the publication of the first BEA Health Care Satellite account in Dunn, Rittmueller, and Whitmire (2015). This account was innovative in that it redefined the commodity provided to patients as the treatment of a specific disease rather than the provision of specific types of medical care, such as doctor's visits or drugs. This redefinition required the development of price indexes that are different from those published in the NIPAs.

6.3.6 Household production

Landefeld and McCulla (2000) illustrated how household production could be accounted for in a satellite account. Their illustrations reflect the household's role as a producer and an investor in durables as well as a consumer by modifying the NIPAs to incorporate the value of nonmarket (unpaid) household work into GDP and by measuring the value of the services of consumer durables and treating their purchase as an investment. An input-output model was used to highlight the household's functions as a producer and investor in great detail. Similar work appears in Landefeld, Fraumeni, and Voitech (2009) and in Bridgman et al. (2012).

6.4 The size distribution of income

Economic statisticians have always recognized that any appraisal of the economic performance of the nation requires data on the distribution of income. To understand the functioning of the economy, economists want to know what is labor and capital's share of the national income. It should, therefore, be little surprise that the first estimates of national income by the NBER in 1921 and the first estimates by the Commerce Department in 1934 included breakdowns of the national income by distributive shares, i.e., the distribution of national income by functional type such as wages, profits, etc. This type of breakdown has always been part of the NIPAs. Economists have always been interested in the size distribution of income and, in the past, BEA was engaged in estimating such distributions.

6.4.1 Work at BEA

As noted above, the founders of the NIPAs recognized that an accurate assessment of the nation's level of economic well-being needed to take into account the size distribution of income. For many decades BEA was a leader in constructing statistics of this distribution before budget cuts forced it to stop. Since then, hope for improvements in official measures of the size distribution lies with the Census Bureau, which provides much of the data that underlies the NIPAs. We now examine the work done by both BEA and the Census Bureau because any attempt to look at the historical development of work in this area would be misleading if it only looked at the work done in one of the bureaus. Furthermore, the work done at the Census Bureau is important to those interested in measuring national economic well-being because it used measures of value that better reflected an individual's well-being.

Shortly after the end of World War II, BEA began work on the general size distribution of income. The first estimates were published in Jaszi and Goldsmith (1953). This report was 86 pages long and contained 21 exhibits (text tables) as well as 29 tables. Because it was controlled to BEA's estimates of personal income, the BEA size distribution was essentially integrated with the NIPAs. It also had the advantage of covering all income, in contrast to the source data, which omitted substantial amounts of cash income as well as income in kind. BEA included the rental income that is imputed to be received from owner-occupied housing. The BEA estimates are unique in incorporating this income. While the control totals came from BEA's work on personal income, data on how components of income were distributed came from federal individual income tax returns and surveys conducted by the Census Bureau and the Bureau of Agricultural Economics.

This work was reprised in Goldsmith et al. (1954). The new article added data for 1935-36 obtained from another agency. It described the changes in the distribution of income that occurred from 1935 through 1950 on both a before and after (income) tax basis.

After 1954, size distributions of income were reported on a regular basis in the *Survey of Current Business*. During the period 1955-64, distributions were reported each year except 1957 and 1962. The last article reported distributions for 1929 each year from 1947 through 1963. This type of work was temporarily discontinued in 1963 because of lack of funds. The work was taken up again in the 1970's. Budd, Radner, and Hinricks (1973) presented estimates for 1964 and described the methodology in great detail. Radner and Hinricks (1974) was BEA's last published work in this subject area. It presented size distributions for 1964, 1970, and 1971.

Before moving on to the work at the Census Bureau, I would be remiss if I failed to mention that in recent years there has been interest at BEA in determining what the size distribution of income would be if BEA's concepts were used. BEA does not have the resources to compute a size distribution from household data. However, Fixler and Johnson (2014) have presented simple ways in which the Census Bureau's distributions can be adjusted to obtain measures that are close to BEA concepts.

6.4.2 Work at U.S. Census Bureau and Other Agencies

At about the time that BEA was ending its work on the size distribution, work in that area was expanding in other parts of the government, particularly with respect to the valuation of in-kind income.

In 1974, Congress required that a thorough study be conducted of the relative measure of poverty used to distribute educational financial assistance with the hope that a more accurate measure could be developed. An inter-agency task force was formed to research the issue under the auspices of the Department of Health, Education, and Welfare. It contracted with Cooper and Co. to provide guidance on valuing in-kind income. Cooper and Katz (1978) developed a definition of “income” intended to provide a meaningful and internally consistent basis for determining what should or should not be included in income. Building on Simons (1938) notion of “economic rights,” they realized that income results when someone obtains valuable economic rights that others do not have. In-kind income consists of economic rights that are abridged or constrained in some way. The more constraints that are placed on the use of a benefit, the less valuable it would be to the recipient. Thus, giving someone a “company car” that cannot be put to personal use is less valuable than giving them a car that does not have this restriction.

The report made empirical estimates of four major types of in-kind income: Food Stamps, health insurance, Medicaid, and public housing. It emphasized the use of “cash-equivalent “ values (cev’s), which are an extension of Hicks’ compensating variation. The report showed how the exact cev of benefits could be determined given knowledge of the recipients “ordinary” demand curves. Knowledge of some of the recipient’s income-consumption (Engel) curves could be used to establish upper and lower bounds on a good’s cev.⁶ At about the time that this report was written, many other obtained similar results using cost functions and more lately indirect utility functions and money metric utility functions. This demonstrates the validity of the major conclusion, that the cev concept can be empirically implemented from data that is observable.

The Census Bureau has produced size distributions of income using annual data since 1944. It also devotes a large amount of its resources to measuring the official poverty index. In the late 1970’s and 1980’s, government officials were interested in measuring the progress that the government’s new in-kind programs were having in eliminating poverty and producing a more equal distribution of income. Census (1982), a report written by Smeeding, explored the issues, data requirements, and technical feasibility of measuring and valuing in-kind income. It examined several alternative methodologies for valuing of government provided in-kind transfers and for assessing their effect on the size and composition of the official poverty population. Special attention was given to three valuation approaches: market share, cash equivalent value, and poverty budget share value.

The Census Bureau followed up on this report by holding a conference on the measurement of noncash benefits in December 1985. The proceedings are reported in Bureau of the Census (1986). Because this conference recommended against continuing the poverty budget share approach, the Census Bureau dropped the approach from its updates of the empirical valuations initially performed by Smeeding and for a while produced estimates using the cev concept.

⁶ In a follow-up paper, Katz (1982b) showed that as the number of known Engel curves increased, the upper and lower bounds converged to the same value. This demonstrated that precise cash-equivalent values could be determined for any utility function that had concave indifference curves.

Apparently, the Census Bureau was not quite sure what to include in measures of household income. It had always measured money income. However, it was unsure what in-kind benefits to include, whether capital gains should be in the measure, and whether any expenses of earning an income should be in. So, it began to produce statistics for alternative definitions of income. In fact, there was a period whether it was producing estimates for 15 alternative definitions of income. As a result of recommendations made by the National Academy of Sciences, the Census Bureau discontinued its publication of the alternative measures of income series in 2010. Today it only publishes money income and an equivalence-adjusted income that takes into consideration the number of people living in the household and how these people share resources and take advantage of economies of scale.

One notable feature of the Census Bureau's estimates of the value of in-kind benefits is that a different methodology was used for almost every benefit. For example, as noted in Census (1992), Food stamps were valued at their face value. School lunches were valued at their "subsidy cost." Medicare and Medicare benefits were valued at their "fungible value." This is essentially the amount that the recipient would have spent on medical care in the absence of this benefit. Housing subsidies were valued at predicted rent less actual rent. Other benefits were valued using even more concepts.

7. The way forward

The way forward consists of looking to the past and realizing that today we use concepts of household and national income that are less comprehensive than some used in the past. We need to broaden our scope. Despite the large and growing importance of in-kind income, we do not measure much of it and treat the parts of it that we do measure as if they were cash. We have developed the theoretical and empirical tools needed to do otherwise. These areas are low hanging fruit. We have the tools necessary to implement them. Doing so will make our estimates better measures of economic well-being. Then, we can move to less tractable areas.

7.1 Measuring the size distribution of income

In order to understand how income is distributed by size, we need to know exactly what "income" are we talking about. It certainly isn't just income from production. BEA has always seen the need to include income transfers in its measures of personal income to make them a better measure of purchasing power. However, to measure economic well-being, we need to go beyond that.

The Census Bureau attempted to do this by including measures of certain in-kind transfers in its measures of household income and even other items like capital gains. However, its approach of providing 15 alternative measures of income did not have great support. What is needed is a single comprehensive definition of a household's income.

To move forward I look to the distant past. Some of the most useful and broadest definitions of an individual's income were some of the earliest. Wueller (1938; pp.102-103) cites Georg Schanz as stating in 1892 that income is "the net inflow of economic ability." It includes whatever means came within the disposing power of a given person who, during the period in question, neither impaired his capital nor incurred personal debts.

Haig (1921; p. 7) stated, "Income is the money value of the net accretion to one's economic power between two points of time." He explicitly made a distinction between "the power to attain satisfactions" and the exercise of that power, insisting that income be measured by the former rather than the latter.

Simons (1938; p. 50) defined personal income as "the algebraic sum of (1) the market value of rights exercised in consumption and (2) the change in the value of the store of property rights between the beginning and end of the period in question."

All three writers interpreted income very broadly and all three included capital gains in income. According to Wueller (1938), in 1892 Schanz stated that income included "the monetary equivalent of advantages derived from the direct use of capital goods, houses, gardens, etc." It also included "the monetary equivalent of income in kind, lottery winnings, capital appreciation, inheritances, etc." He even included "such good as flows from the enjoyment of one's leisure." Haig (1921) declared that appreciations in property values constitute income. Simons (1938) definition of income included: realized capital gains, gifts received, inheritances, and income from the ownership of durable consumer goods.

These writers advanced definitions that were so bold and broad that one would think that they were writing about measuring economic welfare. Actually, all three were writing on how income should be defined for purposes of taxation. It is difficult to find modern economists using concepts that are as broad as these. This begs the question of why we are so timid in comparison.

It seems to me that at the very least we should consider including more in-kind income and, perhaps, capital gains in income. A major problem in measuring in-kind income is defining it. As mentioned above, Cooper and Katz (1978) felt that the key to defining in-kind income lies in Simons' notion of economic "rights." With this concept one can see that an employer's contribution to an employee's pension fund and the income earned on the pension reserves are in-kind income to the employee. These benefits cannot be spent, they cannot be used as collateral for a loan, and they cannot be passed on to the employee's heirs.

I now move on to the question of how in-kind income should be valued. Using a different type of measure for every benefit is not very satisfying. If we had to use a single measure, there seems to be general agreement that the Hicksian measures of cash-equivalent value are the best for comparing the economic welfare of individuals.⁷ It is not clear why has there been so little empirical implementation of the concept. It does take a lot of effort to make the estimates and they are far from precise. In theory, the results also depend on the individual's preferences and their income. You can give a poor person a "Cadillac" health insurance policy, but if you give them cash instead they are going to use some of that cash to purchase a more modest form of health insurance and spend the remainder on other goods.

⁷ These measures are the logical extensions of Hicks' compensating and equivalent variations and are often described as the amount an individual is willing to pay for a benefit not possessed or the amount he is willing to receive in compensation for voluntarily giving up a benefit that he possesses. The two differ by an income effect that is generally very small.

These facts are problems only to the extent that we adhere to the idea that the estimates need to be precise. There are many estimates made in the NIPAs that are far from precise and no one seems to have a problem with them. In short, good approximations are more than sufficient.

7.2 Measuring aggregate economic welfare

My recommendations on the way forward for measuring aggregate economic welfare are similar. We need to broaden our concepts of income and first work in the areas of in-kind income, services of consumer durable goods, and capital gains.

We need to recognize that the difficulties at the aggregate level are greater than at the individual level. Ideally, we would like to construct aggregate measures of income or economic welfare using the same measures that were used to construct size distributions. In the past, this was done by BEA with its concept of personal income. If we are convinced that we need to employ the cash-equivalent value concept in constructing size distributions of income, then we would need to use this concept in constructing aggregate measures as well.

One might think that it would be possible to stop short of explicitly valuing in-kind benefits using cash-equivalent values or similar measures by segregating in-kind benefits from other ones. That seems to be the intent of a number of tables in the *SNA*. However, as noted above there are many benefits that are not generally thought of as being in kind but upon further reflection actually are in kind. Consequently, I am not confident that we can develop good operational rules to determine which benefits should be segregated from the ones received in cash transactions.

Given these difficulties the way forward starts with the realization that there are some things that we can immediately put in the main accounts and that there are others that need to be developed in satellite accounts.

In the main accounts we can make better efforts to collect data on “executive compensation” and similar perquisites obtained by workers. We can put capital gains in as an addenda item so that people who want to use them have the data available. However, one of the most important things that we can do is to treat consumer durables as capital.

In the accounts we make an imputation so that GDP is not affected by whether households own or lease their homes. There is no reason why we should let the contribution of cars to GDP depend on whether they are owned or leased. Some have said that these services of consumer durables are not due to production. Fisher (1896) demolished that argument when he stated that this could only be done by twisting and distorting the definition of production. It appears that there are some international differences on this subject. There has always been great support in the U.S. for capitalizing them. In fact, in the run-up to the 1993 *SNA*, a workshop sponsored by the NBER’s CRIW recommended without dissent that the 1993 *SNA* should implement this capitalization. Dozens of articles have made estimates of the service value of consumer durables and serious thought has been made as to what kinds of rates of return are theoretically and empirically superior. It is clear that the errors involved in

making an imputation for them are less than the errors of many things that are currently in the accounts.

In-kind income presents greater problems. The use of concepts like the cash-equivalent value results in recipient values that are less than the cost of the goods that are received so that the two sides of some accounts do not balance. Here the best way forward is through the use of satellite accounts. In such accounts we might, for example, follow some of the insights shown in Smolensky et al. (1977). They asked the following questions: why do donors (i.e., taxpayers) prefer to give someone in-kind benefits that cost, say, \$8,000 when the recipient would prefer to receive \$6,000. The donors must be receiving some benefits (utility) from ensuring that the funds are used by the recipients for the targeted goods. They, consequently, imputed such benefits to taxpayers and got the accounts to balance.

Dealing with the reality of in-kind income is a necessity if we are to better measure economic well-being. We have always had difficulty in comparing the incomes of households that own their own homes with those of households that rent. Today we have more difficult areas that need attention. We have difficulty comparing the incomes of those individuals who have good pension plans with those of individuals who do not; and the incomes of those households that have good health insurance plans with those that do not. I think that great progress can be made in these areas and we should concentrate our efforts on them before we move on to less tractable topics.

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