



## The Future of the SNA's Asset Boundary

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# The Future of the SNA's Asset Boundary

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**Abstract:** With past updates of the System of National Accounts, the asset boundary has expanded. In this paper, we examine some future directions for possible expansion of the SNA's asset boundary and discuss the rationale for possible expansion, as well as some of the practical impediments that would need to be overcome. In particular, we look at: a) intangible knowledge assets, such as investment in non-scientific research, brand equity, and organizational competencies, b) environmental and natural resource assets, c) consumer durables (we consider different ways that they could be brought within the SNA's asset boundary), and d) human capital.

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## I. Introduction

With each update of the System of National Accounts, the asset boundary has expanded. For example, *System of National Accounts 1993*<sup>1</sup> (*SNA 1993*) extended the asset boundary to include expenditures on mineral exploration, computer software, and entertainment, literary, and artistic originals, and *SNA 2008*<sup>2</sup> recognized research and development (R&D) and military weapon systems, and noted that water resources should be treated as an asset in some cases.

In this paper, we will examine some future directions for possible expansion of the SNA's asset boundary in coming decades. We discuss the rationale for each proposed expansion, as well as some of the practical impediments that would need to be overcome. In particular, we look at: a) intangible knowledge assets, such as investment in non-scientific research, brand equity, and organizational competencies, b) environmental and natural resource assets, c) consumer durables (we consider different ways that they could be brought within the SNA's asset boundary), and d) human capital.

Corrado, Hulten, and Sichel (2009) have argued that a more complete set of intangible assets, including several types that are currently not recognized by the SNA, are more important economically than the traditional tangible assets. They propose that *any* use of resources that reduces current consumption in order to increase it in the future qualifies as an investment. Under that definition, investments in brand equity, such as those acquired through advertising, and in economic competencies, such as those acquired through management and consulting services, qualify as economic assets. There are practical difficulties, however, in that these categories of spending also include expenditures that are short-lived, such as short-term advertisements, and it may be difficult to separate long-lived from short-lived expenditures.

The *SNA 2008* and the *System of Environmental- Economic Accounts 2012*<sup>3</sup> (*SEEA 2012*) have provided a framework for analysis of stocks and flows of natural resources and accounting for ecosystems. We will review and contrast the SNA and SEEA frameworks and make suggestions for how future updates of the SNA's asset boundaries could strengthen the linkages between the two systems.

It is often acknowledged that consumer durables, such as cars and furniture, represent an important component of household wealth, yet in *SNA 2008* they continue to be relegated to the position of a memorandum item, rather than directly appearing in the balance sheet. The reasons for this unusual treatment are somewhat difficult to explain to those without expertise in the national accounts, but they primarily derive from the SNA's decision to exclude household production of services from the production boundary. We propose three ways in which consumer durables might be brought within the SNA's asset boundary.

Of the types of asset that are currently excluded, human capital may be the most important, quantitatively. Furthermore, economists have, for more than 50 years, utilized the concept of human

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<sup>1</sup> Commission of the European Communities, *et al.* (1993).

<sup>2</sup> European Commission, *et al.* (2009).

<sup>3</sup> United Nations, *et al.* (2014)

capital in their models of labor, growth, productivity, and distribution of income. Nevertheless, the concept of human capital leads to significant challenges from the point of view of national accounts, in terms of integrating within the concepts and constraints of the overall system. This section of the paper will discuss the advantages of recognizing at least some types of human capital investment, as well as the challenges that will be faced in explicitly identifying that form of investment.

## II. Knowledge assets

According to *SNA 2008*, fixed assets are produced assets that are used repeatedly or continuously in production processes for more than one year (*paragrph* 10.11). The asset boundary for fixed assets conceptually encompasses all goods and services that meet those criteria, with the exceptions of consumer durables (discussed in the next section) and small tools, which are excluded on pragmatic grounds (*paragrphs* 10.33–35). In practice, however, the asset boundary for intellectual property products encompasses only R&D, mineral exploration and evaluation, computer software and databases, and entertainment, literary and artistic originals, though *SNA 2008* does include an unspecified classification for “other intellectual property products” (*paragrph* 10.117). A growing literature suggests that intangible assets that are not identified as fixed assets by *SNA 2008* contribute significantly to economic growth and should be included.

Corrado, Hulten, and Sichel (2005) link the multifactor sources-of-growth model that allocates the growth rate of measured output to the growth rate of labor and capital inputs and a residual “total factor productivity” factor with a model of intertemporal choice based on the deferred-consumption rule. This rule states that any outlay that is intended to increase future rather than current consumption is treated as a capital investment. They apply this model to business expenditures for intangibles and knowledge inputs and conclude that business spending on intangible capital should be treated no differently than tangible capital. When intangibles are included in productivity growth models, they find that capital plays a larger role in explaining labor productivity than does multifactor productivity (MFP). In other words, the importance of MFP declines when intangibles are added to the measured capital stocks.

Firms choose to spend money on tangible capital such as machines and forego current period profits in exchange for expected greater future profit gains from the productive use of the new piece of equipment. Businesses make these same strategic tradeoffs when they decide to spend money, time, and resources on improving and enhancing knowledge-based assets.

The *SNA 2008* currently recognizes intellectual property products as produced assets. These products are the result of research, development, investigation or innovation leading to knowledge that the developer can market or use to their own benefit in production because use of the knowledge is restricted by legal or other protections. Knowledge remains an asset as long as it is used in production and can create profits or other economic benefits for its owner (*paragrph* 10.98). In addition to those intellectual property products that are recognized as fixed assets, the *SNA* also recognizes goodwill as a non-produced non-financial asset, but only when acquired through merger or acquisition.

### *Asset boundary*

If the SNA were to expand the boundary of produced assets to include additional forms of knowledge capital, it would require criteria for defining and classifying these assets.

Yong (1998) provides suggested criteria for deciding on core components of intangible investment. Most importantly, the outlays need to be long-term and aimed at improving a firm's future performance. Additionally, she presents a list of questions:

- Can they be expressed in a way which is analogous with the production and acquisition of tangible capital?
- How are they treated in the System of National Accounts?
- Are the services concerned specified in the latest UN classifications of industrial activities and products?
- Are there any relevant special statistical methodologies and data sources?
- How are they treated in company accounts and reports?
- How have they been treated in experimental national and international surveys of intangible investment?

Corrado, Hulten, and Sichel (2009) apply the deferred-consumption criterion, which is that any use of resources that reduce current consumption in order to increase it in the future qualifies as investment. They include knowledge assets as capital and classify them into three broad categories: computerized information (mainly software), scientific and creative property, and economic competencies.<sup>4</sup> Their work suggests that in total, these intangibles make up approximately 14 percent of U.S. national income, with economic competencies making up half of that at 7 percent over the period 1995-2003. They define economic competencies as representing the value of brand names and other knowledge embedded in firm-specific human and structural resources.

In comparison, Vosselman (1998) classifies intangible investment using six core components: R&D; education and training; software; marketing; mineral exploration; and licenses, brands, copyrights, and patents. Vosselman also identifies five supplemental categories: development of the organization; engineering and design; constructions and use of databases; remuneration for innovative ideas; and other human resource development excluding training.

Mandel (2012) suggests a further expansion of the asset boundary by including data as an economic asset because, when accumulated, it can be stored and analyzed in ways that enhance production. He says that statistical agencies tend to measure access to data rather than the volume of data produced and used.

The inherent difficulty in measuring intangible assets, as well as the requirement that assets must have clearly define ownership rights , has limited the extent to which they are included in the SNA framework. Corrado, Hulten, and Sichel (2009) present arguments for why certain knowledge assets are not currently capitalized and why some believe they should remain outside the asset boundary. They identify four attributes of intangible assets that make them difficult to measure and capitalize: Non-

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<sup>4</sup> For the most part the first two categories are already captured in the SNA.

verifiability (lack of market transactions); lack of visibility (hard to track impact inside firm once acquired); non-rivalness (knowledge can be employed by many users simultaneously without diminishing the available quantity, which suggests the marginal product on the intangibles is zero), and lack of appropriability of the returns (returns from knowledge may not be captured only by the firm making the investment). They conclude that even though intangible assets may possess these characteristics, they do not fundamentally affect the fact that firms invest in these knowledge assets by foregoing current profits for future benefits.

There is also a conceptual debate as to whether brand equity should be included as an asset in national accounts. Some argue that brand equity affects the demand function and not the production function. Whereas other types of intangibles, such as R&D, impact the production function and create better outputs or better processes, brand equity impacts a firm's ability to price its products and build market share and revenue.

#### *Valuing knowledge intangibles*

If the SNA expanded the asset boundary to include all of what Corrado, Hulten, and Sichel refer to as "economic competencies," valuation criteria would be needed. Assets included under this category include: brand equity, firm-specific human capital, and organizational development. By recognizing goodwill as a capital asset, the SNA does look to capture the value of these intangibles to the extent that they impact a company's value in merger or acquisition. Currently the SNA does not record the capital formation of goodwill during any one production period. It assumes that goodwill is a one-time addition or subtraction on the balance sheet, and once lost, cannot be rebuilt.

If the SNA recognized the accumulation of goodwill as an ongoing productive activity, how would that capital formation be valued? A number of studies highlighted by Lev (2003) suggest that the value of the stock of intangibles may be derived by looking at the difference between a firm's market value and book value. He points out that this valuation could be taken to an extreme in a case like Enron, whose market-to-book value was extremely large right before it wasn't. He questions whether the large difference was due to intangibles or to "hype." Another notable challenge of relying on market-to-book value ratios is the different applications of financial accounting rules, specifically as they relate to capitalizing or expensing expenditures. These decisions impact book values and potentially market values. Lev points to studies that suggest intangible intensive companies are systemically undervalued, possibly because of lower earnings due to relatively higher costs on spending on intangible activities like R&D, marketing, and branding. Estimates based on market-to-book value relationships could result in undervaluation of the stock of intangible assets.

Even if a stock of intangible economic competencies could be valued, determining how to measure capital formation during any period of time becomes the next challenge. Nakamura (2001) describes three approaches to measuring intangibles: 1) accounting for the investments in R&D, software, brand equity and other intangibles; 2) use of wages and salaries paid to "creative workers"; and 3) measuring the change in operating margins of firms using the cost of goods sold.

Looking at the second and third approaches first, these approaches cannot easily be used to measure capital formation of separate intangible asset categories. The second looks to use growth in wages and salaries of management and “creative” professionals in industries focused on engineering, architecture, math and science, and arts and culture relative to the growth in wages and salaries of production and clerical works. It suggests that as this ratio increases, the increase is attributable to intangible investment. The third approach suggests that as companies gain intangible assets, spending on the activities that support these assets will result in gains in market power that lead to increased margins and decreased direct operating costs as a share of revenue (Nakamura (2001)). Both of these approaches would capture the value of investment in assets that are already included in the SNA asset boundary and for which capital formation is already measured.

The first approach allows for estimates by type of knowledge asset and is generally in line with the approach that Corrado, Hulten, and Sichel (2009) use. Investment by type of asset is measured by an accounting approach that looks at business’s expenditures on activities that support economic competencies such as expenditures on advertising and marketing to enhance brand equity, employee training, and management consulting. Data on management employment could be used to measure the spending on employer-sponsored human knowledge capital and organizational capital. However, a downside to this approach is that the value of these knowledge assets may be significantly larger than the costs associated with producing them. For example, the outlays associated with re-engineering a company’s inventory management system may be small relative to the impact of the new system on the firm’s productivity as demonstrated through increased margins and earnings.

### *Challenges*

Financial accounting rules make it difficult to accurately measure spending on economic competency intangibles. Marketing and advertising expenses as reported on income statements include spending for short-term sales strategies aimed at moving existing products which is not aimed at building brand equity. In their work, Corrado, Hulten, and Sichel (2009) estimate that approximately 60 percent of marketing expenditures were in support of brand equity and should be considered investment. Furthermore, marketing expenditures do not necessarily include employment costs of the sales forces or other personnel who work to develop long-lived marketing strategies (Nakamura (2001)). These expenditures also do not include the value of the contributions of individual agents in a firm, like the CEO, whose work may substantially increase the firm’s brand equity. For firm-specific human capital, companies generally do not separately report expenditures for employee training and development. Consideration of the employees’ time spent on development and training would also be required, in addition to the direct training expenditures. Time and money spent on strategic planning and organizational and process change are hard to estimate and often embedded in overhead costs.

Not all spending on marketing, advertising, employee training, and organizational change is productive. Firms may spend significant amounts of money on strategic planning or marketing, but fail to return higher sales, profits, or margins after implementation of the results. National accountants face similar issues when measuring R&D assets. The general rule is to count all R&D spending as capital formation, even for those projects that do not prove profitable. In this case, market-to-book value ratios could be

helpful in that the market value of the firms should reflect the expected returns from intangibles. Lower market values may be an indicator of the efficacy (or lack of efficacy) of the intangible investment. However, as pointed out above, some studies suggest that current market values of intangible intensive firms may be undervalued.

Even if financial accounting and stock market data could tell us something about publicly traded corporate investment in intangibles, extending measurement to privately held corporations and non-corporate business presents its own set of challenges. Financial accounting data on these businesses are often not readily available, and tax return data are not granular enough to provide the types of spending categories for these estimates. Either business surveys would need to be developed to capture spending on these activities, or models would need to be created that make assumptions about privately held corporations and non-corporate business activities relative to public corporations for which financial data could be used.

Knowledge assets are extremely heterogeneous and firm specific, which makes it difficult to select appropriate price deflators. Approaches taken with other intangible assets include input costs, wage deflators, and output costs. Corrado, Hulten, and Sichel (2009) use an aggregate deflator based on the nonfarm business output price deflator, which they suggest captures the fact that much of the investment in intangibles is tied to the specific products produced by the firm, which at the aggregate level is represented in the business output price index. Another option is an input price index that accounts for labor, material, and capital costs. BEA uses an input cost approach to derive its R&D prices. In the BEA R&D price, an attempt at quality adjustment is made by applying a productivity adjustment to the input-cost index. In some cases, direct pricing may also be possible, but most knowledge assets are too heterogeneous to allow for direct pricing. For some activities such as management consulting, marketing, and training, producer or consumer prices may be available.

Depreciation of knowledge assets is particularly difficult to measure. Unlike measuring wear and tear on tangible assets, obsolescence is harder to observe and can vary widely depending on the uses of the asset. Most literature suggests that service lives are short and depreciation rates are large for these types of intangibles. However, most of the focus has been related to advertising. Corrado, Hulten, and Sichel (2009) make clear that they assume these service lives are short (maybe less than 3 years). And they make broad assumptions on depreciation rates: brand equity of 60 percent and firm specific resources of 40 percent. Their brand equity rate is based on a review of literature that runs the gambit from articles suggesting short lives (less than 3 year to 7 years) because much of the spending is for maintenance that should be expensed, to those that suggest most spending should be capitalized because it goes toward development of new products. There is little information on rates of firm-specific human and organizational capital, and Corrado, Hulten, and Sichel (2009) assume an average of the rates used for R&D (longer lived) and those for marketing (shorter lived).

### **III. Environmental assets and natural resources**

Environmental assets and natural resources play an important role in determining a country's wealth. They support a country's ability to produce goods and services and generate income. For some



countries, the stocks of their natural resources are their main productive assets underpinning economic growth. For decades, policy makers, economists, and environmentalists have argued that these resources should be fully recognized alongside labor and capital inputs in measuring a country's production, income, and economic growth potential. While *SNA 2008* includes the value of natural resources in the balance sheet, standard economic accounting does not fully capture their use in the production process or the effects of depletion on measures of national income.

For decades economic accountants have struggled with accounting for *natural assets*.<sup>5</sup> To define the scope and measurement techniques for natural assets and related activities requires significant data resources and accounting for complex interrelationships among economic, demographic and environmental actors. Because of the subjectivity and nonmarket nature of these assets, Landefeld and Carson (1994) noted that many questioned whether the inclusion of natural assets in the core economic accounts would impair their usefulness for analyzing market activities. While natural assets are not factors of production in the production and income accounts, national economic accountants do recognize the value natural assets have in measures of a nation's wealth. Recognition of natural assets on the balance sheets has evolved over decades. *SNA 1993* recognized two major types of non-produced, non-financial natural resource assets: land, including surface water, and subsoil assets, including mostly mineral deposits. *SNA 2008* extended the asset boundary and categorized natural resources into five major types: land, mineral and energy reserves that can be recoverable using current technologies, non-cultivated biological resources, water-resources, and other (with the most notable being radio spectra). For all assets, ownership rights must be established and the assets must be capable of bringing economic benefit.

Even with *SNA* guidance and recommendations, in practice the treatment across countries is diverse. Many OECD countries, including the United States, do not include some or all of the recommended natural resources on their balance sheets.

Recording natural assets on a country's balance sheet is not the same as recognizing them as factors of production. In an effort to shed light on the importance of natural assets in the economy, many researchers and statistical agencies have developed satellite account frameworks that track the use of natural assets and their impact on the economy. The *System of Environmental- Economic Accounts 2012*<sup>6</sup> (*SEEA 2012*) provides a framework to do so that is integrated with the *SNA 2008*.

Individual countries have approached environmental satellite accounts with mixed success. For example, the Netherlands introduced an illustrative national accounting matrix including environmental accounts (NAMEA) in 1991 and its first actual NAMEA in 1994. Pilot programs and focused resources have supported continuous expansion of the NAMEA for the past 20 years (Schenau (2009)). On the other hand, the United States introduced its integrated economic and environmental satellite accounts (IEESA)

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<sup>5</sup> In order to discuss the asset boundary, we use the term "natural asset" to allow for the possibility of assets that may not be included in either the *SNA* definition of *natural resources* or the *SEEA* definition of *environmental assets*.

<sup>6</sup> United Nations, *et al.* (2014)

in 1994 (Landefeld and Carson (1994)), but the U.S. Congress directed suspension of further work soon after.

In the remainder of this section, we briefly examine issues about determining the asset boundary for natural assets, the treatment of natural assets in the production and income accounts, and the valuation of capital services.

#### *Asset boundary*

In the SNA 2008, only those natural resources over which ownership rights have been established and enforced are included in the asset boundary. Furthermore, the resources must be capable of bringing economic benefit to their owners given available technology, scientific knowledge and economic infrastructure (*paragraphs* 10.168-10.169). For the most part the asset boundary of the SNA and the SEEA are aligned. The SEEA goes beyond the SNA in defining the “environmental asset boundary” to recognize known mineral deposits without current economic value and remote land and aquatic resources for which ownership rights either do not exist or cannot be enforced. For subsoil mineral and energy resources, the SNA only recognizes proven reserves for which ownership rights are established and that are economically exploitable. Reserves that may be known but are not exploitable are outside of the asset boundary. The SEEA broadens the asset boundary to include all reserves that are known to exist, regardless of whether they are currently used in economic activity. Landefeld and Carson (1994) remind us that “unproven” reserves are bought and sold, so market values potentially exist to value these stocks. The knowledge of their existence affects capital formation decisions, as investors weigh the risks and reward of the investments required to “prove” these subsoil resources. This might be cause to expand the asset boundary to include unproven reserves that have demonstrable market value as economic assets.

Remote undeveloped land, which is often owned by the government, may provide a variety of services, including recreational services, wildlife reserves, etc. The decision on whether remote land should be in the asset boundary is linked to the production boundary. Remote land may provide nonmarket environmental services such as cleaner air, watersheds, or species preservation, but if these services are not included within the production boundary, the remote land asset may not be considered as providing economic value. Because the SNA values nonmarket production based on the inputs of labor and produced capital, services produced solely by land are excluded. Similarly, aquatic resources such as wild marine life, salt, and water itself have the potential for providing environmental services. The SNA currently excludes wild biota living in locations such that no institutional unit is able to exercise effective ownership rights (*paragraph* 10.169). However, companies are researching the use of sea water as energy and as potable water sources, and they are researching the potential discovery of new medicines in the depths of the oceans. These economic activities are possible because of the natural assets available, a potential reason to expand the SNA asset boundary to include them.

#### *Production and income accounts*

A key issue in possible future environmental-related extensions of the SNA is determining the boundary of economic activity. Nordhaus and Kokkelenberg (1999) raise the issue of whether such things as clean

air and clean water, other environmental services like watersheds, and public goods like species preservation and carbon sequestration should be included in the production boundary. All of these activities are supported in some way by natural assets. The argument in favor is that expanding the boundary would provide a better estimate of the size, distribution, and growth of economic activity and economic welfare.

The contribution of natural assets to supporting economic production and income is already implicitly included in these measures to the extent that a nation's ability to produce a specific good or service for a specific price is in part due to the available stock of natural assets. The market price for mineral extraction is in part based on the quantity of subsoil reserves. The cost of water transportation is, in part, based on the water resources that allow movement down a river. If too much silt leaves boat unable to navigate the waterway, the result will be higher transportation costs and a shortage of transportation services. Over-fishing of a species will result in supply shortages and increased prices. In these ways, natural assets impact a nation's production capacity and income levels. Taxes, fines, and fees associated with government environmental preservation and protection activities are recorded as general government revenue and may be used to fund government consumption and capital formation. What the core national accounts do not record, however, is the depletion of natural assets as a charge against income. As a result, many researchers believe measures of sustainable growth using the existing national economic accounting framework are incomplete (Repetto *et al.* (1989)).

Much of the literature supporting integration of economic and environmental accounting focuses on measuring the value of depletion of natural assets used in production and its impact on income. Depletion of a natural asset is the result of extraction and harvest of that asset for economic use. The use of these assets in current period production results in a decrease in future potential production if these assets are non-renewable. In the case of renewable natural assets, the potential to replenish or grow the stock of assets would help maintain or increase future production levels (Repetto, *et al.* 1989).<sup>7</sup>

Nordhaus and Kokkelenberg (1999) noted that the SNA could be expanded to include depletion of natural assets as a charge against income, and could recognize additions to the stock of natural resources as capital formation. In this way, net income (or sustainable production) would account for changes in the stock of natural assets, allowing for assessment of the sustainability of GDP and the impact of additions and depletion on wealth. Depletion would be charged against the income of the economic owner of the natural asset. Catastrophic loss of an asset due to a natural disaster would be recorded in the other change in volume of assets account (OCVA) in the same way the SNA treats the loss of equipment or structures due to such disasters. Depletion is different than degradation. According to the SEEA 2012, degradation "considers changes in the capacity of environmental assets to deliver a broad range of contributions know as ecosystem services (*paragraph 5.90*). For example, the value of land resources may be degraded over time due to changes to its chemical composition resulting from

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<sup>7</sup> Landefeld and Carson (1994) noted that when prototypes of the United States national income and product accounts were first introduced prior to 1947, they treated depletion of mineral reserves symmetrically with depreciation, because mineral depletion has long been chargeable against profits in the US tax code.

toxins from pollution entering into the soil. Degradation of one asset may not be separable from degradation of the broader ecosystem and may not be attributable to a single economic unit. Because of these complexities, the SEEA does not include degradation in its centralized framework and instead addresses this issue in its Experimental Ecosystem Account (*paragraph 5.88*).

### *Capital account*

Natural assets are different from other fixed assets such as equipment and structures in that they are mostly non-produced, and many are non-renewable. Non-produced biological assets can regenerate in thus are “renewable”. The SNA capital account records capital formation of produced assets and the acquisition and disposal of non-produced assets. At the total economy level, acquisitions less disposals of non-produced assets equals zero. Changes in the total economy-wide stock of non-produced assets are recorded as other changes in volume rather than in the capital account, and reflect discoveries, depletions, and catastrophic losses.

If the SNA were to recognize the depletion of these natural assets as a charge against income similar to consumption of fixed capital, all else equal, net capital formation would be lower by the value of the depletion of natural assets during the current production period. Net lending or borrowing would not be affected, because the depletion charge would offset the reduction in net disposable saving.

Changes in the volume of natural assets may be the result of activities specifically designed to increase the stock of natural assets or to improve the quality or extend the productive use of renewable assets. For example mineral exploration and scientific R&D activities, already capitalized in the SNA, can result in expansion of the stock of natural assets through discovering new mineral reserves, discovering new biological resources that can be harvested to produce medicines or other products, and developing other potential new economic uses for natural resources. The United States IEESA, described by Landefeld and Carson (1994), recognized the productive activity involved in developing certain natural assets in a category of assets described as “developed natural assets” and included cultivated biological assets, mineral and energy reserves, and developed land. Additions to the stock of these assets that involved mineral exploration or other productive inputs were treated in the same manner as capital formation that adds to the stock of structure and equipment. This approach is different from that used by SEEA. The SEEA classifies mineral and developed land resources as non-produced assets, in line with the SNA, and additions to their stock as other changes in volume of assets. The IEESA treatment was based on the idea that economic resources were required to prove and develop these additions to natural assets. If the SNA were to adopt a similar treatment, capital formation would include the value of discovered mineral reserves, land, and other newly developed natural assets during the period. In the production account, these activities would be recognized in output and gross operating surplus and own-account or purchased resources used for these activities reclassified out of intermediate inputs. National saving would be adjusted accordingly. Recognizing the capital formation of these natural assets would provide symmetry with any decision to recognize the use of such natural assets (depletion) as a charge against income in the production process.

Other activities that support expansion or improve the quality of the stock of natural assets include environmental protection, pollution abatement, and resource management. These activities might be considered comparable to the major repairs, additions and alternations of machinery and structures that are currently recorded as capital formation. For example, activities that protect land, including surface water, can extend the use of those land resources to support economic activities including fishing, water transportation, and recreational services. In the same way that the SNA includes improvements to fixed assets as capital formation, it might recognize that environmental improvement activities add to the stock of the natural assets and record them as capital formation.<sup>8</sup>

### *Challenges*

While the SNA guidelines recommend that nations include natural assets on the balance sheets and recognize the acquisition and disposal of these assets, there exist a variety of reasons why countries have not fully adopted these recommendations. The biggest hindrances involve valuation approaches, source data, and available resources. An expansion of the SNA to include the use of natural assets in production will also bring these same challenges.

Maybe one of the biggest challenges to incorporating natural assets into core economic accounts is determining how to value the assets and how to value changes in the assets resulting from depletion, capital formation, degradation, etc. The SEEA identifies 3 major valuation approaches: observable market prices, written-down replacement costs, and the net present value (NPV) approach. Market prices rarely exist for these assets, or if they do, the volatility is too great to derive meaningful values. Derivatives of market prices could include prices of similar assets or option prices for subsoil mineral resources, but these too are rare and are often too volatile or specific to be used to price entire stocks of assets. The written-down replacement cost is difficult to apply to natural assets that are rarely exchanged. The NPV approach seems most viable and is one of the approaches taken to value other assets when market prices are not available.

There are five key components to measuring the value using the NPV approach, and each requires its own sets of assumptions: 1) measurement of the returns on the natural asset, 2) determination of the expected pattern of resource rents based on expected extraction or harvest profiles and prices, 3) estimation of the life of the natural asset, 4) selection of the rate of return on the produced assets used to derive the economic rents of the natural asset and 5) the selection of the discount rate used in the NPV calculation. (*SEEA 2012 paragraph 5.112*)

In order to derive the NPV for any natural asset one would need to be able to isolate the returns specific to only extracting the natural asset, predict the future pattern of the extraction and its value, predict the migration, reproductive, and environmental variables that impact the natural life of the biological assets, and correctly select the rates of return for the productive assets and a discount rate. (The SEEA

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<sup>8</sup> While the structures, equipment, and intellectual property products used to create these environmental services are already capitalized in the SNA, the activity of improving the stock of natural assets is not.

suggests these two rates can be equal.) The number and magnitude of the assumptions necessary to value the asset itself, let alone to measure depletion and capital formation, are significant. It is understandable that these estimates remain in satellite accounts outside of the core national economic accounts, which are used for setting macroeconomic policy.

Recording natural assets and their use in the economy requires significant amounts of source data. While many government agencies collect information that can be used to construct estimates of natural asset stocks and their associated economic transactions, the scope, definitions, and frequency of the data are varied and are collected for uses other than economic accounting. Often, the data are collected across a number of different government agencies and international organizations and require tedious hours to compile, coordinate, and review. With statistical agencies facing tight budgets, the resources necessary to meet existing SNA guidelines for natural resources, as well as those that might be needed for satellite accounts or expanded core accounts are daunting.

#### **IV. Consumer durables**

Because the SNA does not recognize consumer durable goods as economic assets, their acquisition is not recorded in the capital account or accounted for in measures of saving, nor are they recorded as assets on the main balance sheet (though both *SNA 1993* and *SNA 2008* recommend that they be recorded as memorandum items). It has long been recognized that this leads to seeming anomalies in the accounts—for example, a car purchased by an enterprise is recorded as gross fixed capital formation and appears on the main balance sheet, whereas the same car purchased by a household for its own use is recorded as final consumption expenditure and appears only as a memorandum item. Indeed, if the household sells a used car to an enterprise, it has to be recorded as *negative* household final consumption expenditure and as *positive* gross fixed capital formation to keep the accounts in balance.

More fundamentally, the omission of the consumer durables from the main balance sheet may be surprising to users of the accounts, who may not be aware that balances such as net worth may omit consumer durables, a value that is not insignificant. (For example, for the United States at the end of 2014, consumer durable goods represented 5 percent of household assets and 6 percent of household net worth.<sup>9</sup>) Furthermore, in the context of a system that attempts to be comprehensive, the omission leads to some peculiar anomalies. For example, when consumer durables are purchased, they are often financed by loans that are secured by the durable as collateral. By not recognizing the consumer durable good as an asset, but recording the loan as a liability for the household sector, the balance sheet understates the household sector's net worth and exaggerates the extent to which households are leveraged. Also, households often obtain insurance coverage for their durable goods. The SNA records households purchasing insurance services and settling claims for losses of goods that are not recognized as assets.

These difficulties have long been recognized. For example, the 1968 SNA<sup>10</sup> says:

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<sup>9</sup> See integrated macroeconomic accounts, table S.3.q, [http://www.bea.gov/national/nipaweb/Ni\\_FedBeaSna/Index.asp](http://www.bea.gov/national/nipaweb/Ni_FedBeaSna/Index.asp).

<sup>10</sup> United Nations (1968).

...there is the question of consumers' durable goods, expenditure on which continues to form part of private consumption expenditure although the major durables form separate categories in the classification of household goods and services. The introduction of balance sheets into the new SNA makes this treatment more awkward than it was under the old system since it means that an important element of personal wealth is not recorded although identical objects, such as cars, are recorded as wealth if they are owned by businesses or by the civilian branches of general government. (paragraph 1.95)

According to *SNA 2008*, "consumer durables are not regarded as assets in the SNA because the services they provide are not within the production boundary." (paragraph 3.47) Of course, in some instances the SNA's production boundary, itself, may appear to be arbitrary—for example, the rationale provided for including the services of owner-occupied dwellings within the production boundary might appear to apply also to cars owned and used by households. Furthermore, the SNA's asset boundary is not restricted to economic benefits obtained from production. For example, financial assets or valuables that are held as stores of value are treated as assets by the SNA, regardless of whether their benefits derive directly from production. It can be argued that even if we ignore entirely the services provided by consumer durables, they still provide economic benefits to their owners as a store of value, albeit ones that are subject to economic depreciation due to deterioration and obsolescence. These benefits are realized when the owner chooses to sell the durable on the second-hand market, or when the owner uses the durable as collateral to obtain a loan.

To provide a better picture of household wealth and saving, many researchers have recommended either measuring consumer durables as assets in a satellite account (for a recent example for the Euro area, see Jalava and Kavonius (2009)) or changing the core accounts to treat consumer durables as an asset (see Moulton (2004)). Because there is increasing interest in measuring the distribution of income, consumption, and wealth, we think that the measurement of consumer durables may assume increasing importance, because they may be one of the few assets held by households in the bottom half of the income and wealth distribution who do not own their homes. There is probably broad agreement that including consumer durables as assets on the balance sheet is desirable, and the opposition stems from the potential implications for the production boundary and the rest of the accounts.

#### *Alternative approaches to incorporating consumer durables*

We suggest three options for incorporating consumer durables into the core accounts, and provide examples of how the transactions would be recorded under each option. The three options examined are: 1) full expansion of the SNA production boundary to include household production of services for own final consumption; 2) expansion of the production boundary to include the capital services of consumer durables, without including any of the labor services used in household production of services for own final consumption—a treatment analogous to the SNA's treatment of owner-occupied dwellings; and 3) a "dual" treatment in which household final consumption expenditures are unchanged in the goods and services, supply-use, and use of disposable income accounts, but the net acquisition of consumer durables is treated as an addition to assets in the capital account and on the balance sheet.

Table 1 illustrates the current treatment of consumer durables in *SNA 2008*. We assume that household final consumption expenditure includes 187 for the acquisition of consumer durables. The table also notes that household final consumption expenditure includes 35 in expenditures for maintenance and repair of consumer durables and 138 for goods used in household production of services for own final consumption, which will also need to be re-classified under certain of the alternative treatments. For simplicity, this example will ignore the transactions associated with the production or supply of these goods and services to households.

Uses	Resources
Households	Households
	<i>Production account</i>
	Output
	Intermediate consumption
	<i>Use of disposable income account</i>
	Final consumption expenditure
187	• for consumer durable goods
35	• for maintenance and repair
138	• for supplies used in production of services for own final use
	<i>Capital account</i>
	Gross fixed capital formation
	Consumption of fixed capital

The standard objection to capitalizing consumer durables is that they are used in the provision of services for the household’s own final consumption, which are outside the *SNA*’s production boundary. For example, households combine the use of cars with the unpaid labor provided by a household member who acts as a driver to produce transportation services for the household. *SNA 2008* paragraphs 29.143–29.155 discuss possible satellite accounts for unpaid household services, including consumer durables. Abraham and Mackie (2005), published by the U.S. National Research Council, provides some expert recommendations on household satellite accounts, and Landefeld, Fraumeni, and Vojtech (2009) and Bridgman, *et al.* (2012) provide satellite account estimates of unpaid household production of services for own use for the United States.

In Table 2, we illustrate the changes to the accounts required for the recording household production of services for own final consumption, including the capital services of consumer durable goods. For valuation of output for own final use, *SNA 2008* recommends the basic prices at which the services could be sold if offered for sale in the market. For example, services of owner-occupied dwelling are generally valued at the estimated rental that a tenant would pay for a similar dwelling. Although rental prices may be available for certain consumer durables, they are probably not available for most. If reliable market prices are not available, the *SNA* allows for the valuation of output for own final use as the sum of costs.



As part of the calculation of costs, we must reclassify the consumption of those goods and services that are used in production of services for own final consumption as intermediate consumption. For example, if meals prepared at home are recognized as produced services, then the groceries that are used in preparing those meals would need to be reclassified as intermediate consumption. In the example, I assume that the output of 720 is calculated by the sum of costs with the following costs:

- a) 173 for goods and services reclassified from household final consumption expenditure to intermediate consumption because they are supplies for the production of household services for own final consumption (138), or maintenance and repairs of consumer durables (35);
- b) 351 for the unpaid labor used in the production of household services;
- c) 159 for consumption of fixed capital for consumer durables; and
- d) 37 for a net return to fixed capital.

Value added and GDP are raised by  $720 - 173 = 547$ , and the additional income is recorded as gross mixed income. Household gross saving is increased by the amount of the reclassified gross fixed capital formation for consumer durables (187), and net saving is increased by the value net of consumption of fixed capital (28).

Uses	Resources
Households	Households
	<i>Production account</i>
	Output 720
173	Intermediate consumption
	<i>Use of disposable income account</i>
	Final consumption expenditure
720	• for services produced for own use
	<i>Capital account</i>
187	Gross fixed capital formation
-159	Consumption of fixed capital

While option 1 is conceptually elegant in its consistency with the rest of the SNA, it would raise some important practical challenges:

- In order to ensure consistency in the measurement of household production of services, guidelines would need to be developed for which activities would be treated as production. Paragraph 6.28 of *SNA 2008*, for example, provides a list of some of the common household services that are currently outside the SNA's production boundary.
- Time-use data are generally necessary to develop estimates of unpaid labor expended on these activities. Although time-use data are available for a number of countries, they are not always available at regular, annual frequency and they are not currently available for some countries.

- Guidelines would need to be developed for valuing unpaid labor. Several options have been suggested in the literature. For example, Bridgman, *et al.* (2012) use the wage rate of general-purpose domestic workers.
- In general, the absence of market prices would require a substantial amount of imputation, which national accountants have been reluctant to do.

On the other hand, option 1 would provide benefits, such as providing data on trends that may have led to the substitution of market production for unpaid household production in the provision of many services. It would also provide a more comprehensive overall measure of the services that are available for household final consumption, and would help document the time spent on unpaid productive activities. It would help answer long-standing criticisms of the national accounts that they tend to undervalue the contributions of unpaid household workers, especially women.

For option 2, we consider a measurement approach that is analogous to the *SNA 2008* treatment of owner-occupied dwellings. This option would include the capital services provided by consumer durables within the production boundary, but would not include any imputation for unpaid labor in the production of services for own final consumption. As justification for this approach, we note that the role of consumer durables in production of services may actually be smaller than one might think, because in many countries large appliances, such as refrigerators, stoves, and washing machines, are not consumer durables, but instead are included in the purchase price of homes or in the rental price of tenant-occupied dwellings. It's true that some small appliances, such as irons and vacuum cleaners, are primarily used for unpaid household production. But many consumer durables, such as furniture, are used directly in the provision of decoration and comfort to members of the household, while other durables, such as television or golf clubs, are used directly for leisure or recreational activities rather than for traditional production. It is true that cars require drivers (though work is underway at several enterprises to develop technologies for driverless cars), but even for car transportation, often the driver is the same person being transported and would need to spend the time regardless of whether he or she is actually driving. To the extent that the capital services of consumer durables are largely consumed independently of the unpaid household labor used in production of services for own use, it seems reasonable to incorporate only the capital services within the SNA production boundary.

In option 2, we calculate output of 231 as the sum of costs as follows:

- a) 35 for maintenance and repair purchases reclassified from household final consumption expenditure to intermediate consumption;
- b) 159 for consumption of fixed capital for consumer durables; and
- c) 37 for a net return to fixed capital.

Table 3. Option 2 – Recognize capital services only		
Uses		Resources
Households		Households
	<i>Production account</i>	
	Output	231
35	Intermediate consumption	
	<i>Use of disposable income account</i>	
	Final consumption expenditure	
231	• for services of consumer durables	
138	• for supplies used in production of services for own final use	
	<i>Capital account</i>	
187	Gross fixed capital formation	
-159	Consumption of fixed capital	

Supplies used for the production of services for own final consumption would not be reclassified, but would remain as final consumption expenditures, and no imputation would be made for unpaid labor. This option would raise GDP and gross mixed income by  $231 - 35 = 196$ , and would increase net saving by 28.

In comparison with option 1, this option entails fewer measurement challenges. The consumption of fixed capital would need to be calculated, which requires information on depreciation rates or on service lives. But it may actually be easier to obtain accurate estimates of economic depreciation for consumer durables than for traditional fixed capital because of the widespread use of second-hand markets and the requirements to register cars in use. Compared with option 1, option 2 requires fewer imputations and presumably there is better information available about the values that would need to be imputed.

Option 3, which we've labelled the "dual" approach, represents a hybrid of the SNA's current treatment of consumer durables with an alternative that allows the accumulation of consumer durables to be shown in saving and the net stock to appear on the balance sheet. In particular, we suggest that the SNA's current treatment would be retained in the goods and services account and in the supply-use tables.

- For recording of final expenditures, the acquisition of consumer durables (net of disposals) would be treated as final consumption, the same as in *SNA 2008*.
- In the use of disposable income account, consumer durables would be classified as final consumption expenditure, the same as in *SNA 2008*. A new category would be added to the account, "adjustment for net acquisitions of consumer durables." The value of this adjustment, which would be added as a resource for households, would equal the net acquisitions—that is, the gross acquisitions less disposals recorded in final consumption expenditure, less the "economic depreciation of consumer durables" (we should be careful to avoid the use of "consumption," since we are not treating it as consumption. The counter-entry is net

acquisitions of consumer durables shown as a change in assets in the capital account. This adjustment is in some ways analogous to the “adjustment for the change in pension entitlements” that already appears in this account in *SNA 2008*.

- In the capital account, a new category would be added for “Net acquisitions of consumer durables,” the counter-entry to the adjustment shown in the use of disposable income account. This entry shows the gross acquisitions less disposals of consumer durables that are already recorded as final consumption expenditures, less the economic depreciation of consumer durables. The role of this new category in the account would be analogous to the treatment of “acquisition less disposals of non-produced assets”; that is, the acquisition of consumer durables would *not* be treated as capital formation, but would be incorporated into the balance sheet.

In the example shown in table 4, the value of GDP is exactly the same as in the current treatment in *SNA 2008*, because final consumption expenditure and gross fixed capital formation are the same shown in table 1. The new entries for net acquisitions of consumer durables, however, do allow them to appear in saving and in the balance sheet.

<b>Table 4. Option 3 – “Dual” approach – Both final consumption and wealth</b>		
Uses		Resources
Households		Households
	<i>Production account</i>	
	Output	
	Intermediate consumption	
	<i>Use of disposable income account</i>	
	Final consumption expenditure	
187	• for consumer durable goods	
35	• for maintenance and repair	
138	• for supplies used in production of services for own final use	
	Adjustment for net acquisitions of consumer durables ( <i>new classification</i> )	28
	<i>Capital account</i>	
	Gross fixed capital formation	
	Consumption of fixed capital	
28	Net acquisitions of consumer durables ( <i>new</i> )	
187	Acquisition less disposals of consumer durables ( <i>new</i> )	
-159	Economic depreciation of consumer durables ( <i>new</i> )	

Of course, the “dual” or hybrid treatment of consumer durables would be controversial because it would highlight an internal inconsistency in the system. Some similar internal inconsistencies already appear in the system—for example, the so-called “dual recording” of pensions—pensions are treated as transfers in the secondary distribution of income accounts, but pension entitlements are treated as financial assets of households in the financial account. This leads to an odd mix of accrual and non-

accrual principles in different parts of the accounts and requires the adjustment for the change in pension entitlements to reconcile the two treatments.

Of the three options we have presented, option 2—which would recognize the capital services provided by consumer durables similarly to the services of owner-occupied dwelling—seems like it would allow for recording consumer durables as assets while providing general consistency with existing SNA principles, and would not require the extensive imputations required by option 1. For those who might prefer making minimal revisions to other major balancing items in the system, option 3 may be considered, albeit at the cost of introducing some inconsistencies in treatment in the different accounts of the system.

## **V. Human capital**

While suggestions that the theory of capital might have applicability to individual economic decisions about education and training date back at least to the 18<sup>th</sup> Century, the formalization of that idea, along with the term “human capital,” entered economic literature with the work of Mincer (1958), Schultz (1960), Becker (1975), and Ben-Porath (1967). The essence of human capital theory is that investment in human productive capacity, whether through education, on-the-job training, or health care, can be explained using the same principles of capital theory that are commonly applied to investment in fixed capital. Costly resources from an earlier period are used to enhance productive capacity in subsequent periods, modifying the time structure of production. This theory of human capital has proved to be fruitful in economic research, emerging as part of the theoretical framework economists use to explain the demand for education and for health services, as well as one of the factors that helps explain the size distribution of employee compensation. Literally thousands of published research articles have applied or referenced the concept of human capital.

Notwithstanding the widespread use by economists of human capital theory in research, the concept is not universally accepted. For example, a debate recently took place among economics bloggers about the legitimacy of the term “human capital.” Opposing the term were Krugman (2015), Milanovic (2015), and Bruenig (2015), arguing that it obfuscates the difference between labor and capital and leads to the perception that all individuals are capitalists. Defending the concept and term were Rowe (2015) and Worstall (2015), who point out that the use of costly resources for the development of skills can raise the productivity of labor in subsequent periods. Finally, Smith (2015) attempted to find a middle ground, noting that calling anything capital requires simplification and abstraction, and that human capital has both similarities and differences with other kinds of capital. He also suggested that if one objects to the term “human capital” on the grounds that it objectifies people, another term, such as “skills capital,” could be substituted.

The basic human capital model assumes that individuals make investments in their own general skills when they are young—largely by foregoing opportunities of current earnings while attending school. Society may also provide resources through public or subsidized education. The returns take the form of incremental increases in compensation of employees throughout the remainder of the work life for workers with additional years of schooling. Becker also drew the distinction between *firm-specific*

human capital, in the form of on-the-job training that is useful only to a single employer, and *general* human capital, in the form of education or training that is useful to many employers. The returns to general human capital accrue to the employee in the form of higher compensation, whereas the returns to firm-specific human capital may go entirely to the employer or may be split between employee and the employer. We have included firm-specific human capital in our discussion of knowledge assets in the second section of this paper.

The 1968 SNA acknowledged that education has the character of capital:

...there is the question of expenditure on education which, though segregated, is treated at present as current consumption. In many respects, however, its effects are more like those of capital expenditure in that it results in a more highly qualified population and so alters production possibilities in the future. Similar arguments could be advanced in respect of many forms of expenditure on health. (paragraph 1.95)

Since then, a number of researchers have attempted to develop satellite accounts for human capital formation and stocks. Measuring human capital formation requires an extension of the SNA's production boundary because the resources used are a combination of educational output that is already recognized by the SNA, albeit as final consumption expenditures, from the output of schools, universities, and other educational establishments, along with unpaid household resources in the form of time spent by students, which is not currently recognized within the SNA's production boundary. Because of the non-market dimension, the valuation of human capital formation cannot be based on market prices, but must rely instead either on the costs of production (the *cost* approach) or on the present discounted value of future benefits in the form of additional compensation (the *income* approach). To illustrate how the two approaches can differ, Abraham (2010) considers an example in which an investment costing \$1,000, including any foregone labor earnings, has an expected return of \$100 per year for 40 years. Using a discount rate of 4 percent implies that the social value of the investment, using the income approach, is \$1,979, which is considerably larger than the cost of \$1,000.

Kendrick (1976) used an input, or cost approach to measure human capital investment and stocks in the United States. His measure included foregone earnings, costs of rearing children through age 14, and direct costs of education and training, adjusted for depreciation and maintenance. According to Haveman, Bershader, and Schwabish (2003), Kendrick's "estimation procedure reflects several dubious assumptions and procedures, including the reliance on input values to estimate the value of lifetime productive contributions, the inclusion of only a selection of inputs to the production of human capital, and badly flawed empirical estimates of the values of these inputs." Since Kendrick, the cost approach has been less frequently used than the income approach; a recent example is a study by Kokkinen (2008) of Finland.

Graham and Webb (1979) used the income approach to measure human capital formation and stocks for U.S. men. They assumed that all returns to human capital can be measured as market earnings, an assumption that they felt was untenable for women, and used cross-sectional data to measure age-education profiles. Their estimated human capital stock was nearly twice as large as Kendrick's, despite focusing on a smaller population.

Jorgenson and Fraumeni (1989, 1992a, 1992b) produced the most comprehensive and rigorous analysis of aggregate general human capital. They measure its value as the present discounted value of “full” lifetime labor income summed over all individuals in the nation. Full lifetime labor income includes both the discounted sum of future expected labor-market income plus the discounted sum of time spent on household production and leisure activities, valued at a shadow wage equal to the after-tax value of labor compensation. Note that their concept of unpaid household production is much more comprehensive than the unpaid labor discussed in the previous section, because it is defined to include almost all household activities other than sleep; for example, it includes time spent on leisure and recreation. This approach to valuing almost all household time is based on the model of household production developed by Becker (1965).

Due to the length of human lives that are being capitalized and the large valuation given to unpaid household labor, the Jorgenson-Fraumeni approach produces extremely large values for the expanded concept of GDP and for the human capital stock. For example, in their 1989 article they estimate that in 1975, 84 percent of “full labor income” is accounted for by unpaid household labor, and their estimated values of human capital are 15 to 17 times as large as the cost-based values calculated by Kendrick (1976).

#### *Extensions and criticisms*

Since the publication of Jorgenson and Fraumeni’s initial research, the income-based approach has been applied in a number of countries. Christian (2011), in addition to providing updated estimates for the United States, provides a summary of studies that have used that approach to create human capital measures for Australia, Canada, China, New Zealand, Norway, Sweden, the United Kingdom, and for a human capital project at OECD. I note that several countries limited their focus to market labor and restricted the measure of unpaid household labor to that used directly either for education or for production that is currently within the production boundary.

Since their initial publication, Jorgenson and Fraumeni’s estimates have been critiqued by, among others, Rosen (1989), Aulin-Ahmavaara (2004), Abraham (2010), and McGrattan (2010). Many of the criticisms have focused on the assumptions required for estimating the contribution of unpaid household labor. Rosen pointed out that the use of the after-tax market wage as the shadow price of unpaid household time might be inappropriate if workers were constrained in the number of hours that they could work at that wage. In fact, most workers are restricted in the number of hours they can work for their primary employer, and surveys indicate that a majority of workers would prefer to work either more or fewer hours than they actually work. A similar concern is that Jorgenson and Fraumeni, like most researchers who have applied Becker’s model of the allocation of time, assumed a single shadow wage for all nonmarket hours, even though that wage may be appropriate only at the margin. Indeed, Becker’s original paper suggested that there should be several shadow wages—for example, a different shadow wage for weekends than for weekdays. Consequently, the Jorgenson-Fraumeni valuation of unpaid labor is quite sensitive to their assumptions about the maximum number of hours that might be worked, which they assume to be 14 hours a day, 7 days a week. Finally, Rosen noted that more direct

studies of household valuation of unpaid time, such as studies of commuting time, suggest a lower valuation.

Abraham (2010) observed that although increases in education may raise the shadow price of time, there is little evidence that increased education directly enhances utility or directly improves productivity in unpaid production. Most university classes focus on developing marketable skills rather than on skills that would enhance unpaid labor.

Another point that Rosen and others have made is that Jorgenson and Fraumeni use a “gross” concept in their net present value calculations, in that they do not reclassify expenditures for maintenance of human capital as intermediate consumption, as might be appropriate under a capitalization model. Other researchers have netted these costs against the income stream, arguing that maintenance is necessary for the investments to be realized. The idea of treating these costs as maintenance of human capital has been controversial, however, since except in the case of slavery, the individuals who possess human capital are also part of the household consuming unit and share in the utility from the household’s consumption expenditures.

McGrattan (2010) examines economic research that uses human capital models and found that they rarely made use of stock valuations. She suggests that perhaps the national accounting-based literature is placing too much emphasis on wealth stocks, and suggested that efforts in measuring human capital could be redirected toward topics of more value to researchers. Unlike the financial and nonfinancial assets currently shown on the SNA balance sheet, human capital cannot be sold (at least in societies that do not practice slavery), and consequently human capital generally can’t be used as security or collateral with respect to loans or other liabilities. Consequently, even if human capital were recognized as an asset in a balance sheet, its interpretation would need to be different from traditional balance-sheet assets.

Abraham (2010) suggests that an education satellite account might focus on confronting the costs of educational investment with the social rate of return, which is often quite high. This approach would require reconciling the cost approach with the income approach and better understanding the discrepancies between these two measures. If the account were constructed at a sufficient level of detail, it might help guide educational policy makers to allocate resources to the types of educational investments that have the highest social rate of return.

## **VI. Conclusions**

The objective of this paper was to provide an overview of various suggestions for extending the SNA asset boundary so that priorities could be identified for future major updates to the guidelines. All four areas that we have examined certainly have merit, at least for recommending continued work on satellite accounts or other supplemental analysis of the issues within a national accounting framework.

In our opinion, the two areas with the highest prospect for being able to move the assets into the core accounts by the next major update to the SNA (which we assume will come within the next decade) are knowledge assets and consumer durables. In the case of knowledge assets, we may not be able to



successfully measure all of the types of economic competencies identified by Corrado, Hulten, and Sichel, but we think it should be possible to identify some of them for which data can be identified and for which there is a reasonable expectation that reliable estimates could be produced. The experience that the national accounting community has developed in measuring software and databases, research and development, and entertainment, literary, and artistic originals might be applied to organizational competencies such as worker training and management consulting. For consumer durables, we think that either of the second or third options that we presented (recognizing capital services only or the “dual” approach) would allow for recognition of consumer durables as assets without adding a large burden of additional imputations to the system.

For natural resource assets, we are not currently recommending an extension of the SNA’s asset boundary. We think the statistical community’s efforts should be focused on implementing the recommendations that are already in place in SNA and SEEA. We think a future SNA update should once again consider accounting for depletion as a cost in the calculation of net income, similar to how consumption of fixed capital is recorded. But any significant extensions to the asset boundary should take place as part of a satellite account. For human capital, we also think that a satellite account is the proper venue for measuring the value of these investments. We also concur with McGrattan that work on human capital should move away from simple emphasis on stock-flow relationships and should emphasize analysis that is more likely to be important to users of the estimates.

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