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A NEW ARCHITECTURE FOR THE U.S. NATIONAL ACCOUNTS

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The key elements of a new architecture for the U.S. national accounts have been developed in a prototype system constructed by Dale W. Jorgenson and J. Steven Landefeld, Director of the Bureau of Economic Analysis, U.S. Department of Commerce. The focus of the U.S. national accounts is shifting from economic stabilization policy toward enhancing the economy's growth potential. A second motivation for the new architecture is to integrate the different components of the decentralized U.S. statistical system and make them consistent.

INTRODUCTION

This paper describes a new architecture for the U.S. national accounts. In this context "architecture" refers to the conceptual framework for the national accounts. An example is the seven-account system recently introduced by the Bureau of Economic Analysis (BEA).[1] A second example is the United Nations' 1993 System of National Accounts (1993 SNA).[2] Both provide elements of a complete accounting system, including production, income and expenditures, capital formation, and wealth accounts. The purpose of such a framework is to provide a strategy for developing the national accounts.

The first question to be addressed is, why do we need a new architecture? The basic architecture of the U.S. national accounts has not been substantially altered in 50 years. The national accounts were originally constructed to deal with issues arising from the Great Depression of the 1930s, focusing on the current state of the

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[1]The BEA's seven-account system is summarized in Jorgenson and Landefeld (2006).

[2]United Nations, Commission of the European Communities, International Monetary Fund, Organisation for Economic Cooperation and Development, and the World Bank (1993). Implementation of the SNA in Australia, Canada, and the United Kingdom is described in Wilson (2006).

economy.[3] In the meantime, the focus of U.S. monetary and fiscal policies has shifted from economic stabilization to enhancing the economy's growth potential.[4] In addition, the U.S. economy is confronted with new challenges arising from rapid changes in technology and globalization. Meeting these challenges will require a new architecture for the U.S. national accounts.

America's economy is large and diverse. It is not surprising that accounting for the vast range of economic activities requires a decentralized statistical system. The major agencies involved in generating the national accounts include the Bureau of Economic Analysis (BEA) in the Department of Commerce, the Bureau of Labor Statistics (BLS) in the Department of Labor, and the Board of Governors of the Federal Reserve System (FRB). The Census Bureau, also in the Department of Commerce, and the Statistics of Income (SOI) division of the Internal Revenue Service in the Department of the Treasury are major sources of primary data. Many other public agencies and private sector organizations provide data for the national accounts.

Without being exhaustive it is useful to enumerate some of the key assignments of the leading contributors to the U.S. national accounts. BEA has responsibility for the core system of accounts, the National Income and Product Accounts (NIPAs). BLS generates employment statistics, wage and salary data, and productivity statistics, as well as almost all of the underlying price information. FRB produces the Flow of Funds Accounts, including income statements and balance sheets for major financial and non-financial sectors. The Census Bureau collects and reports much of the primary information through its business and population censuses and surveys. SOI generates tax-based data on individual and corporate incomes.[5]

The national income and product accounts, the productivity statistics, and the flow of funds have different origins, reflecting diverse objectives and data sources. However, they are intimately linked. For example, the BLS productivity statistics employ data on output, income, and investment from the NIPAs. The flow of funds incorporates BEA data on investment and stocks of reproducible assets and the U.S. International Investment Position. An important part of the motivation for a new architecture is to integrate the different components and make them consistent.

As an illustration, both BEA and BLS measure industry output.[6] BEA's estimates are used to allocate the gross domestic product to individual industries. BLS's estimates of output are employed in measures of industry-level productivity growth. Unfortunately, the BEA and BLS estimates of industry output do not coincide. An important objective of the new architecture is to integrate the data sources employed by BEA and BLS in order to arrive at a common set of estimates. This is a crucial ingredient in long-term projections of the U.S. economy.

[3]See Landefeld (2000) on the origins of the U.S. national accounts.

[4]See Jorgenson *et al.* (2008) for an application of the new architecture in assessing the potential growth of the U.S. economy.

[5]The extensive documentation available for the U.S. national accounts, much of it online, is described in Jorgenson and Landefeld (2006, pp. 107–9). A recent summary is provided in Landefeld *et al.* (2008).

[6]BEA and BLS measures of industry output have been compared in detail by Fraumeni *et al.* (2006).

These depend on disparate trends in productivity growth in key industries, such as information technology producers and intensive users of information technology.

As a second illustration, FRB generates a measure of national saving from the income statements and balance sheets that comprise the Flow of Funds Accounts. BEA produces an estimate of national saving from the income and product accounts. Although both estimates agree that the saving rate has declined sharply since 2000, they employ different data sources and sometimes arrive at conflicting results. An important goal of the new architecture is to bring the flow of funds and the national income accounts into consistency in order to provide better data for anticipating future financing needs of both public and private sectors.[7] A further step will be to integrate the income and expenditures accounts with sector balance sheets.

A third, and final illustration is the estimates of health expenditures presented in the National Health Expenditures Accounts, compiled and published by the Centers for Medicare and Medicaid Services (CMS).[8] BEA also provides estimates of health expenditures as components of Personal Consumption Expenditures and Government Consumption Expenditures. However, the two systems of accounts are based on different concepts and data sources and give different estimates. An effort to reconcile the two alternative systems of accounts for health expenditures is underway at CMS and BEA.[9] This is essential for long-term projections of health care expenditures and the financial requirements for U.S. government programs such as Medicaid and Medicare.

The foregoing review identifies a clear need to update, integrate, and extend the U.S. system of national accounts. Development of a fully integrated and consistent system of accounts will require close collaboration among BEA, BLS, and FRB, as well as coordination with Census, the most important agency for generating primary source data. The first and most important objective is to make the NIPAs consistent with the accounts for productivity compiled by BLS and the Flow of Funds Accounts constructed by FRB. The boundaries of production, income and expenditures, accumulation, and wealth accounts must be made identical in order to achieve consistency throughout the system.

1. The New Architecture

The key elements of the new architecture are outlined in a "Blueprint for Expanded and Integrated U.S. Accounts," by Jorgenson and Landefeld.[10] They present a prototype system that integrates the national income and product accounts with productivity statistics generated by BLS and balance sheets produced by FRB. The system features gross domestic product (GDP), as does the National Income and Product Accounts; however, GDP and gross domestic income (GDI) are generated along with productivity estimates in an internally

[7]BEA national income and FRB flow of funds data on income and expenditure have been integrated within the framework of the 1993 SNA by Teplin *et al.* (2006).

[8]The National Health Expenditures Accounts are described on the CMS website: www.cms.hhs.gov/NationalHealthExpendData/.

[9]An earlier reconciliation was attempted by Sensenig and Wilcox (2001).

[10]See Jorgenson and Landefeld (2006).

consistent way. The balance sheet covers the U.S. economy as a whole and fills a gap in the existing Flow of Funds Accounts.

Issues in measuring productivity were considered by a Statistical Working Party of the OECD Industry Committee, headed by Edwin Dean, former Associate Commissioner for Productivity and Technology of BLS. The Working Party established international standards for productivity measurement at both aggregate and industry levels. The results are summarized in Paul Schreyer's OECD *Productivity Manual*, published in 2001. Estimates of multifactor productivity in the prototype system developed by Jorgenson and Landefeld conform to the standards presented in Schreyer's *Productivity Manual*.

In integrating the components of the U.S. national accounts, the first question to be addressed is, why not use the 1993 SNA? BEA income and expenditures data and FRB flow of funds data have been integrated within the framework for 1993 SNA by Teplin *et al.* (2006). This initial effort has been followed by an annual update, published in the *Survey of Current Business*, BEA's monthly journal, and available on the BEA website.[11] SNA-USA is not the only effort at BEA to provide the U.S. national accounts in the 1993 SNA format. The U.S. national accounts are reported annually to the OECD in this format and the results are published in the OECD's internationally comparable national accounts.[12]

The 1993 SNA is part of the new architecture, since it embodies the collective experience of the national accounting community and is familiar to many people working on the U.S. national accounts. However, the SNA 1993 does not provide the production and income and expenditure accounts in current and constant prices required by the new architecture.[13] Also, consistency of the boundaries among the various component accounts is an unresolved issue. Wealth, for example, refers to a different set of economic units than income and product.

The prototype system of Jorgenson and Landefeld begins with the NIPAs and generates the production and income and expenditure accounts in current and constant prices. The production accounts provide a unifying methodology for integrating the NIPAs generated by BEA and the productivity statistics constructed by BLS. Adding productivity statistics to the national accounts remedies a critical omission in the NIPAs and the 1993 SNA. Similarly, BEA's accounts for reproducible assets and the U.S. International Investment Position can be extended to encompass a balance sheet for the U.S. economy as a whole, now absent from the NIPAs and the Flow of Funds Accounts.

An important advantage of beginning with the NIPAs is that the impact of globalization on the U.S. economy is reflected in BEA's system of international accounts. This system includes the Foreign Transactions Current Account, which records imports and exports, as well as receipts from the Rest of the World (ROW), payments to the ROW, and the balance on current account. The international accounts also include the Foreign Transactions Capital Account, which registers net lending and borrowing from the United States to the ROW. Finally,

[11]The most recent annual update is presented by Bond *et al.* (2007).

[12]Details on the U.S. national accounts in 1993 SNA format are presented by Mead *et al.* (2004).

[13]A program to update the 1993 SNA is scheduled for completion in 2008 and 2009. A report on the revision is presented by the United Nations Statistical Commission (2007). Proposals for revision of the 1993 SNA are discussed by Moulton (2004).

the U.S. International Position includes U.S. assets abroad and foreign-owned assets in the United States. These accounts are generated by BEA and incorporated into the Flow of Funds Accounts by FRB.[14] BEA's international accounts are undergoing substantial improvements intended to enhance the quality of information available to policy makers dealing with globalization.[15]

Other important advantages of beginning with the NIPAs are that the existing U.S. national accounts can be incorporated without modification and improvements in the NIPAs can be added as they become available. For example, BEA is currently engaged in a major program to improve the existing system of industry accounts and accelerate the production of industry data by 2008.[16] This program will integrate the NIPAs with the Annual Input–Output Accounts and the Benchmark Input–Output Accounts produced every five years. Improvements in the source data are an important component of this program, especially in measuring the output and intermediate inputs of services.[17] The Census Bureau has generated important new source data on intermediate inputs of services and BLS has devoted a major effort to improving the service price data essential for measuring output in constant prices.[18]

The major challenge in implementing a consistent and integrated production account is the construction of a measure of GDI in constant prices. The 1993 SNA and BLS (1993) have provided appropriate measures of the price and quantity of labor services. These can be combined with the price and quantity of capital services introduced by BLS (1983) to generate price and quantity indexes of GDI, as well as multifactor productivity. The primary obstacle to construction of capital service measures is the lack of market rental data for different types of capital. Although rental markets exist for most types of assets, such as commercial and industrial real estate and industrial and transportation equipment, relatively little effort has been made to collect rental prices, except for renter-occupied housing.

An alternative approach for measuring rental prices, employed by BLS, is to impute these prices from market transactions prices for the assets, employing the user cost formula introduced by Jorgenson (1963). This requires estimates of depreciation and the rate of return, as well as asset prices based on market transactions. Measures of asset prices and depreciation, as well as investment and capital stocks, are presented in BEA's (2003) reproducible wealth accounts. BLS has generated estimates of the rate of return by combining property income from the NIPAs with capital stocks derived from BEA's estimates of investment. BLS employs the imputed rental prices as weights for accumulated stocks of assets in generating price and quantity measures of capital services.

The most important innovation in the prototype system of national accounts developed by Jorgenson and Landefeld is to include prices and quantities of capital services for all productive assets in the U.S. economy. The incorporation of the price and quantity of capital services into the revision of the 1993 SNA was

[14]Additional detail on BEA's system of international accounts is provided in the international section of the BEA website: bea.gov/bea/dil.htm.

[15]See Kozlow (2006).

[16]The BEA industry program is described by Lawson *et al.* (2006) and Moyer *et al.* (2006).

[17]This is the subject of important research by Triplett and Bosworth (2004). An update is presented in Triplett and Bosworth (2006).

[18]See the Panel Remarks by Mesenbourg (2006) and Utgoff (2006).

approved by the United Nations Statistical Commission at its February–March 2007 meeting. A draft of Chapter 20 of the revised SNA, "Capital Services and the National Accounts," is undergoing final revisions and will be published in 2009 (Intersecretariat Working Group on National Accounts, 2009). Paul Schreyer, head of national accounts at the OECD, has prepared an OECD Manual, *Measuring Capital*, published in 2008. This provides detailed recommendations on methods for the construction of prices and quantities of capital services.

In Chapter 20 of the revised 1993 SNA, estimates of capital services are described as follows: "By associating these estimates with the standard breakdown of value added, the contribution of labour and capital to production can be portrayed in a form ready for use in the analysis of productivity in a way entirely consistent with the accounts of the System." The measures of capital and labor inputs in the new architecture for the U.S. national accounts are consistent with the revised SNA and the OECD Manual, *Measuring Capital*. The volume measure of input is a quantity index of capital and labor services, while the volume measure of output is a quantity index of investment and consumption goods. Productivity is the ratio of output to input.

The new architecture has been endorsed by the Advisory Committee on Measuring Innovation in the 21st Century Economy to the U.S. Secretary of Commerce, Carlos Guttierez.[19] The first recommendation of the Advisory Committee is:

> Develop annual, industry-level measures of total factor productivity by restructuring the NIPAs to create a more complete and consistent set of accounts integrated with data from other statistical agencies to allow for the consistent estimation of the contribution of innovation to economic growth.[20]

The Advisory Committee endorses the new architecture in the following words:

> The proposed new "architecture" for the NIPAs would consist of a set of income statements, balance sheets, flow of funds statements, and productivity estimates for the entire economy and by sector that are more accurate and internally consistent. The new architecture will make the NIPAs much more relevant to today's technology-driven and globalizing economy and will facilitate the publication of much more detailed and reliable estimates of innovation's contribution to productivity growth.[21]

In response to the Advisory Committee's recommendations, BEA and BLS will produce a first set of estimates integrating multifactor productivity with the NIPAs in 2008. The results will be reported at a special session on economic statistics at the Annual Meeting of the American Economic Association in San Francisco on January 4, 2009. This is an important step in implementing the new

[19]The Advisory Committee on Measuring Innovation in the 21st Century Economy (2008). The Advisory Committee was established on December 6, 2007, with ten members from the business community, including Carl Schramm, President and CEO of the Kauffman Foundation and Chair of the Committee, Sam Palmisano, Chairman and CEO of IBM, and Steve Ballmer, President of Microsoft. The Committee also had five academic members, including Jorgenson. The Advisory Committee met on February 22 and September 12, 2007, to discuss its recommendations. The final report was released on January 18, 2008.

[20]The Advisory Committee on Measuring Innovation in the 21st Century Economy (2008, p. 7).

[21]The Advisory Committee on Measuring Innovation in the 21st Century Economy (2008, p. 8).

architecture. Estimates of productivity are essential for projecting the potential growth of the U.S. economy, as demonstrated by Jorgenson *et al.* (2008). The omission of productivity statistics from the NIPAs and the 1993 SNA is a serious barrier to application of the national accounts in assessing potential economic growth.

Although it will eventually be desirable to provide a breakdown of the prototype system of U.S. national accounts by industrial sectors, the prototype system constructed by Jorgenson and Landefeld is limited to aggregates for the U.S. economy as a whole. Disaggregating the production account by industrial sector will require a fully integrated system of input–output accounts and accounts for gross product originating by industry, as described by Lawson *et al.* (2006) and Moyer *et al.* (2006). This can be combined with the measures of capital, labor, and intermediate inputs by industry presented by Jorgenson *et al.* (2005), to generate production accounts by sector.[22] The principles for constructing these production accounts are discussed by Fraumeni *et al.* (2006).

The production account has been disaggregated to the level of 85 industries, covering the period 1960–2005 by Jorgenson *et al.* (2007), *Industry Origins of the American Productivity Resurgence*. The methodology follows that of Jorgenson *et al.* (2005), *Information Technology and the American Growth Resurgence*. This methodology conforms to the international standards established the OECD *Productivity Manual* (2001).[23] The EU KLEMS project has recently developed systems of production accounts based on this methodology for the economies of all European Union (EU) member states.[24] For major EU countries this project includes accounts for 72 industries, covering the period 1970–2005.

The next step in integrating the NIPAs with the Flow of Funds Accounts will be to extend the national balance sheet for the U.S. economy generated by Jorgenson and Landefeld to incorporate balance sheets for the individual sectors identified in the Flow of Funds Accounts. The Integrated Macroeconomic Accounts for the U.S. produced by Teplin *et al.*, have focused on the income and expenditures accounts, rather than balance sheets and the wealth accounts. A comprehensive wealth account for the U.S. economy is currently unavailable. Such an account is essential for measuring the accumulation of wealth to meet future financial needs for both public and private sectors, as well as assessing the levels of domestic and national saving and their composition.

As an example, investment in housing involves important long-term policy issues, such as the impact of federally subsidized mortgages, the effect of tax incentives for housing through income tax deductions for mortgage interest and state and local property taxes, and the role of investment in public housing. Balance sheets for the household sector will require the integration of rental values

[22]A system of production accounts for industrial sectors of the U.S. economy is given by Jorgenson *et al.* (1987). This incorporates a consistent time series of input–output tables and provides the basis for the industry-level production accounts presented in Schreyer (2001). The system of production accounts of Jorgenson, Gollop, and Fraumeni has been updated and revised to incorporate information on information technology producing sectors by Jorgenson *et al.* (2005). Chapter 4 (pp. 87–146) provides details on the construction of the time series of input–output tables.

[23]See Schreyer (2001).

[24]The EU KLEMS project was completed on June 30, 2008. For further details see: www.euklems.net/. A summary of the findings is presented in van Ark *et al.* (2008).

for housing, the asset value of the housing stock, and level of investment in residential structures. The value of the housing stock includes the value of residential structures, as well as the value of residential land. The value of land is included in the national wealth, but not in BEA's accounts for reproducible assets. This is a crucial gap in the measurement of U.S. national wealth and is especially critical in assessing the importance of recent asset price inflation in real estate.

Another omission from the existing U.S. balance sheets is a comprehensive system of accounts for pension wealth. The international accounting community has achieved consensus on the desirability of accrual-based accounting for pensions. Under this approach pension assets are credited to individuals as they are accrued, while pension liabilities by public agencies such as the Social Security Administration (SSA) and private financial and non-financial firms are accrued on the same basis. Estimates of the liabilities of the SSA have been prepared on an accrual basis, but are not part of the U.S. system of national accounts.[25] The next step will be to compile similar accounts for other government pension funds and for private components of pension wealth.

An important issue, discussed at length by Fraumeni and Okubo (2001) and Brent Moulton (2004), is the appropriate treatment of consumer durables. Moulton (2004) endorses BEA's current practice of including this investment in the reproducible assets accounts, but excluding the services of these durables from the GDP. Starting from the premise that the boundaries of production, income and expenditures, accumulation, and wealth accounts should be the same, the prototype system of accounts constructed by Jorgenson and Landefeld treats the services of consumers' durables as an output as well as an input in the production account. These services are also a source of income and a form of expenditure in the income and expenditures account.

The proposed treatment of consumer durables has the advantage of accounting for owned and rented assets in the same way, following BEA's treatment of owner-occupied and renter-occupied housing. The principal disadvantage is that the scope of the GDP and the corresponding measure of GDI must be increased. The argument for this change is that BEA already compiles detailed accounts for investment and stocks of consumer durables as part of its accounts for reproducible assets. The only additional step required to make the accounts for housing and consumer durables fully consistent is to introduce imputed rental prices for consumer durables based on asset prices, like those employed in the BLS productivity accounts.

Similar, but distinct, issues arise for intangible forms of investment such as software and research and development. Jorgenson and Landefeld follow the 1993 SNA and the NIPAs in treating software as a form of investment, but extend this treatment by imputing a flow of services from stocks of software in household, government, and business sectors. This requires an extension of the scope of the GDP and the GDI for the output and input of capital services in the household and government sectors. While research and development could be treated in the same way, we follow Fraumeni and Okubo (2005) and Moulton (2004) in

[25]Accrual-basis accounts for the Social Security System are included in Financial Management Services (2007).

recommending that this be treated as part of a satellite accounting system until more satisfactory data are available on the prices of assets generated by research and development activities.

The first step in implementing the prototype accounting system in Section 2 is to develop accounts in current prices for production, income and expenditures, accumulation, and wealth accounts for the U.S. economy for 1948–2006. Section 3 introduces accounts in constant prices with a description of index numbers for prices and quantities. The accounts in constant prices begin with production. The product side includes consumption and investment goods output in constant prices. The income side includes labor and capital inputs in constant prices. Multifactor productivity is the ratio of real product to real input. Section 4 gives income and expenditures, accumulation, and wealth accounts in constant prices for the U.S. domestic economy and the ROW.

Section 5 illustrates the application of the new architecture for the U.S. national accounts by considering the sources and uses of U.S. economic growth. Section 6 concludes.

2. Prototype Accounting System

This section lays out a prototype system of U.S. national accounts that builds directly on the NIPAs. The measurement of income and wealth requires a system of seven accounts. This system must be carefully distinguished from the new system of seven accounts employed in presenting the NIPAs. The Domestic Income and Product Account provides data on the outputs of the U.S. economy, as well as inputs of capital and labor services. Incomes and expenditures are divided between two accounts—the Income and Expenditures Account and the Foreign Transactions Current Account. Capital accumulation is recorded in two accounts—the Domestic Capital Account and the Foreign Transactions Capital Account. Finally, assets and liabilities are given in the Wealth Account and the U.S. International Position.

A schematic representation of the prototype accounting system for the new architecture is given in Figure 1. The complete accounting system includes a production account, incorporating data on output and input, an income and expenditures account, giving data on income, expenditures, and saving, and an accumulation account, allocating saving to various types of capital formation. A national balance sheet contains data on national wealth. Finally, the accumulation accounts are related to the wealth accounts through the accounting identity between period-to-period changes in wealth and the sum of net saving and the revaluation of assets.

The production, income and expenditures, accumulation, and wealth accounts are linked through markets for commodities and factor services. For example, the price of investment goods output in the production account is linked to the price of assets in the wealth account. This price is a component of the price of capital services in the production account. The price of capital services also includes the change in the price of the asset and this also occurs as the price of revaluation in the accumulation account. The price of labor input is the price of labor services in the production account and the price of labor income in the

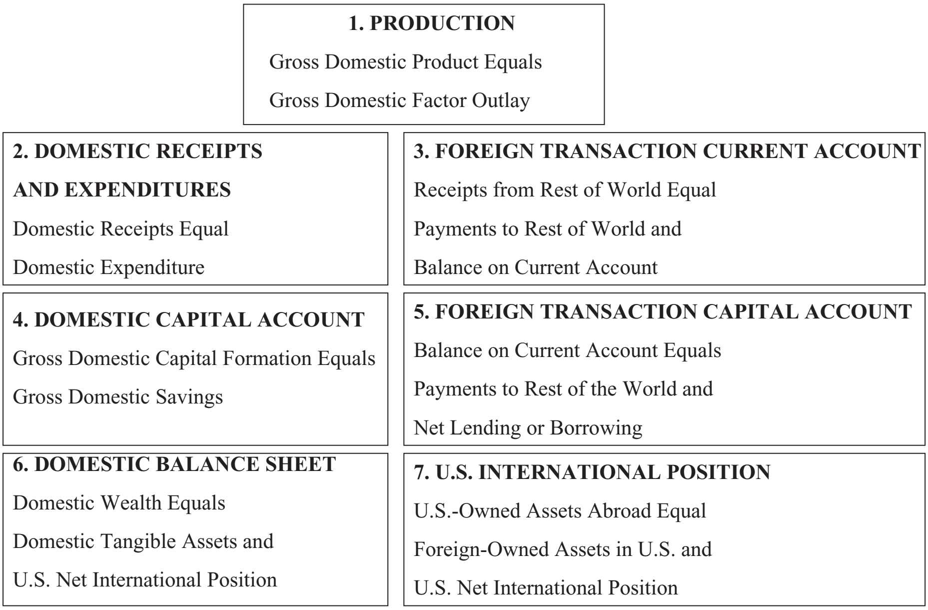

Figure 1. New Architecture for an Expanded and Integrated Set of National Accounts for the United States

income account. Finally, the price of consumption appears as the price of consumption goods output in the production account and the price of consumption expenditures in the income and expenditure account.

The structure of the prototype system is similar to the NIPAs. The NIPAs present current price measures for outputs and inputs, but constant price measures only for outputs. The key innovation in the new architecture and the BLS accounts for multifactor productivity is to present both outputs and inputs in current and constant prices. Constant price measures of inputs and multifactor productivity are essential in accounting for the sources of economic growth. The prototype system provides current and constant price measures of income and expenditures in order to account for the generation of income and its disposition as uses of economic growth. Finally, the system presents current and constant price measures of saving and capital formation to provide the necessary link between current economic activity and the accumulation of wealth.

The Domestic Income and Product Account features gross domestic product (GDP) and gross domestic income (GDI), following the NIPAs. However, both GDP and GDI are presented in current and constant prices. The fundamental accounting identity is that GDP is equal to GDI in current prices. Multifactor productivity, a summary measure of innovation, is defined as the ratio of GDP to GDI in constant prices. The interpretation of output, input, and productivity requires the concept of a production possibility frontier.[26] In each period the inputs

[26]This interpretation is developed by Jorgenson (1966), Jorgenson and Stiroh (2000), and Jorgenson (2001).

of capital and labor services are transformed into outputs of consumption and investment goods. This transformation depends on the level of productivity.

The Domestic Income and Product Account for the U.S. economy includes business, household and government sectors.[27] Imputations for the services of consumer durables and durables used by non-profit institutions, as well as the net rent on government durables and government and institutional real estate, are introduced in order to achieve consistency between investment goods production and property compensation. The services of these assets are included in the output of services, together with the services of owner-occupied dwellings, so that both are included in consumption goods production. Both also appear in property compensation, assuring that the accounting identity between the value of output and the value of input is preserved.

Gross domestic product in the NIPAs is divided among non-durable goods, durable goods, and structures, as well as services. The output of durables includes consumer durables and producer durables used by governments and non-profit institutions, as well as producer durables employed by private businesses. The output of structures includes government structures, private business structures, institutional structures, and new residential housing.

In the NIPAs the rental value of owner-occupied residential real estate, including structures and land, is imputed from market rental prices of renter-occupied residential real estate. The value of these services is allocated among net rent, interest, taxes, and consumption of fixed capital. A similar imputation is made for the services of real estate used by non-profit institutions, but the imputed value excludes net rent. Finally, depreciation on government capital is included, while net rent on this capital is excluded. No property compensation for the services of consumer durables or producer durables used by non-profit institutions is included. By imputing the value of these services and the net rent of government capital and real estate used by non-profit institutions, the treatment of property compensation for these assets is aligned with that for assets used by private businesses.

Taxes charged against revenue, such as excise or sales taxes, must be carefully distinguished from taxes that are part of the outlay on capital services, such as property taxes. In the production account output taxes are excluded from the value of output, reflecting prices from the producers' point of view. However, taxes on input are included, since these taxes are included in the outlay of producers. Taxes on output reduce the proceeds of the sector, while subsidies increase these proceeds; accordingly, the value of output includes production subsidies. To be more specific, excise and sales taxes, business non-tax payments, and customs duties are excluded from the value of output and indirect business taxes plus subsidies are included. This valuation of output corresponds to the value of output at "basic prices" in the 1993 SNA. The Domestic Income and Product Account for 2006 is presented in Table 1.

Gross domestic income includes income originating in private enterprises and private households and institutions, as well as income originating in government.

[27]Our estimates are based on those of Jorgenson (2001), updated through 2006 to incorporate data from the 2003 benchmark revision of the U.S. national accounts.

TABLE 1

Domestic Income and Product Account, 2006

Line	Product	Source	Total
1	GDP (NIPA)	NIPA 1.1.5 line 1	13,194.7
2	+ Services of consumers' durables	our imputation	1,249.8
3	+ Services of household land (net of BEA estimate)	our imputation	−16.0
4	+ Services of durables held by institutions	our imputation	40.1
5	+ Services of durables, structures, land, and inventories held by government	our imputation	424.1
6	+ Private land investment	our imputation	10.2
7	+ Government land and inventory investment	our imputation	61.9
8	− General government consumption of fixed capital	NIPA 3.10.5 line 5	223.6
9	− Government enterprise consumption of fixed capital	NIPA 3.1 line 38–3.10.5 line 5	44.1
10	− Federal taxes on production and imports	NIPA 3.2 line 4	98.6
11	− Federal current transfer receipts from business	NIPA 3.2 line 16	20.0
12	− S&L taxes on production and imports	NIPA 3.3 line 6	868.8
13	− S&L current transfer receipts from business	NIPA 3.3 line 18	40.6
14	+ Capital stock tax	–	0.0
15	+ MV tax	NIPA 3.5 line 28	8.2
16	+ Property taxes	NIPA 3.3 line 8	367.8
17	+ Severance, special assessments, and other taxes	NIPA 3.5 line 29, 30, 31	77.2
18	+ Subsidies	NIPA 3.1 line 25	49.7
19	− Current surplus of government enterprises	NIPA 3.1 line 14	−13.9
20	= Gross domestic product		14,185.8
Line	**Income**	**Source**	**Total**
1	+ Consumption of fixed capital	NIPA 5.1 line 13	1,615.2
2	+ Statistical discrepancy	NIPA 5.1 line 26	−18.1
3	+ Services of consumers' durables	our imputation	1,249.8
4	+ Services of household land (net of BEA estimate)	our imputation	−16.0
5	+ Services of durables held by institutions	our imputation	40.1
6	+ Services of durables, structures, land, and inventories held by government	our imputation	424.1
7	+ National income adjustment for land investment	our imputation	72.1
8	− General government consumption of fixed capital	NIPA 3.10.5 line 5	223.6
9	− Government enterprise consumption of fixed capital	NIPA 3.1 line 38–3.10.5 line 5	44.1
10	+ National income	NIPA 1.7.5 line 16	11,655.6
11	− ROW income	NIPA 1.7.5 line 2–3	58.0
12	− Sales tax	Product Account	574.8
13	+ Subsidies	NIPA 3.1 line 25	49.7
14	− Current surplus of government enterprises	NIPA 3.1 line 14	−13.9
15	= Gross domestic income		14,185.8

The imputed rental value of consumer durables, producer durables utilized by institutions, and the net rent on government durables and real estate and institutional real estate are added, together with indirect taxes included in the value of these inputs. The value of capital inputs also includes consumption of fixed capital and the statistical discrepancy; consumption of fixed capital is a component of the rental value of capital services. The value of gross domestic income for 2006 is presented in Table 1.

Product and income accounts are linked through capital formation and property compensation. To make this link explicit gross domestic product is divided between consumption and investment goods and gross domestic income between

TABLE 2
Domestic Income and Product Account, 1948–2006

Product	1948	1973	1995	2000	2006
Gross domestic product	288.8	1,544.5	7,916.7	10,634.2	14,185.9
Investment goods product	78.7	398.4	1,782.7	2,528.7	3,133.2
Consumption goods product	210.2	1,146.1	6,134.0	8,105.5	11,052.6
Income	**1948**	**1973**	**1995**	**2000**	**2006**
Gross domestic income	288.8	1,544.5	7,916.7	10,634.2	14,185.9
Labor income	172.2	883.2	4,553.3	6,224.5	7,980.3
Capital income	115.9	661.4	3,363.3	4,410.1	6,205.8

labor and property compensation. Investment goods production is equal to the total output of durable goods and structures. Consumption goods production is equal to the output of non-durable goods and services from the NIPAs, together with the imputations for the services of consumer and institutional durables and the net rent on government durables and real estate, as well as institutional real estate.

Property income includes the statistical discrepancy and taxes included in property compensation, such as motor vehicle licenses, property taxes, and other taxes. The imputed value of the services of government, consumer and institutional durables, and the net rent on government and institutional real estate are also included. Labor income includes the compensation of employees of private enterprises, households and non-profit institutions, as well as government. The value of labor input also includes the labor compensation of the self-employed. This compensation is estimated from the incomes received by comparable categories of employees.[28] Gross domestic product, divided between investment and consumption goods output, and gross domestic income, divided between labor and property income, are given for 1948–2006 in Table 2.

An important difference between the prototype system and the NIPAs is the creation of a consolidated Income and Expenditures Account. By consolidating the income and expenditures accounts for household, business, and government sectors presented in the NIPAs, a single account presenting income and its disposition is given in the prototype system. This has the advantage of radically simplifying the accounts by excluding all transactions among the sectors. For example, the taxes paid by private business are expenditures by the business sector and sources of income to the government sector. In the consolidated Income and Expenditures Account, these tax payments cancel out.

For the Income and Expenditures Account the fundamental accounting identity is that income is equal to expenditures in current prices. Income includes labor and property income from the Domestic Income and Product Account, evaluated at market prices, income received from the ROW, net of income payments to the ROW, and net current taxes and transfers to the ROW. Expenditures include personal consumption expenditures, government consumption expenditures, and saving, net of depreciation. Income and expenditures are presented in current and constant prices in order to account for the generation of income and its disposition

[28]Details are provided by Jorgenson *et al.* (2005, pp. 201–90).

through expenditures and saving and uses of economic growth. The interpretation of these magnitudes in constant prices requires the notion of a social welfare function, following Paul Samuelson, William Nordhaus and James Tobin, and Martin Weitzman.[29] Consumption expenditures in constant prices represent the quantity of consumption, while net saving in constant prices corresponds to increments in the current period to future flows of consumption.

Net income is defined as proceeds from the sale of factor services from the Domestic Income and Product Account, plus income receipts from the ROW, less income payments, and net current taxes and transfers to the ROW, less depreciation. Net expenditures are defined as personal and government consumption expenditures from the Domestic Income and Product Account, evaluated at market prices, plus net saving. These expenditures exclude purchases of durable goods, but include the services of accumulated stocks of these durables. The value of net income for the year 2006 is presented in Table 3.

Consumption expenditures include personal and government expenditures on services and non-durable goods, together with the imputation for the services of consumer, institutional, and government durables and the net rent of institutional and government real estate. Purchases of consumer durables, included in personal consumption expenditures in the NIPAs, are excluded from expenditures and included in investment in the Domestic Capital Account described below. The value of personal and government consumption includes taxes and excludes subsidies on output, reflecting prices from the purchasers' point of view. The value of net expenditures for the year 2006 is presented in Table 3.

Income and expenditures accounts are linked through saving and the resulting property income. To make this link explicit, net income is divided between labor and property income, net of depreciation, and net expenditures between net saving and consumption. Net income and expenditures in current prices for 1948–2006 are given in Table 4. Income is divided between labor and property income, net of depreciation, while expenditures are divided between personal and government consumption and net saving.

The Foreign Transactions Current Account in the NIPAs gives receipts from exports and income receipts from the ROW. This is balanced against outlays for imports, income payments, current taxes and transfers to the ROW, and the balance on current account. Receipts, outlays, and the balance on current account are presented for the year 2006 in Table 5. These data are given in current prices for 1948–2006 in Table 6.

The Domestic Capital Account allocates saving to various forms of investment. The fundamental accounting identity is that saving is equal to investment in current prices. Saving and investment in constant prices are taken to be identical as well. Investment in constant prices is an essential link between current economic activity and the accumulation of stocks of capital. As in the Income and Expenditures Account, the Domestic Capital Account is radically simplified by consolidating the capital accounts for household, business, and government sectors. Claims among the sectors cancel out, so that only investment in tangible assets and changes in the U.S. International Position are presented.

[29]See Samuelson (1961), Nordhaus and Tobin (1973) and Weitzman (2003).

TABLE 3

Income and Expenditures Account, 2006

Line	Income	Source	Total
1	+ Gross income	Product Account	14,185.8
2	+ Production taxes	Product Account	574.8
3	– Subsidies	NIPA 3.1 line 25	49.7
4	+ Current surplus of government enterprises	NIPA 3.1 line 14	–13.9
5	= Gross domestic income at market prices		14,697.0
6	+ Income receipts from the rest of the world	NIPA 1.7.5 line 2	691.4
7	– Income payments to the rest of the world	NIPA 1.7.5 line 3	633.4
8	– Current taxes and transfers to the rest of the world (net)	NIPA 4.1 line 25	90.1
9	= Gross income		14,664.9
10	– Depreciation	our imputation	2,385.4
11	= Net income		12,279.5
Line	**Expenditures**	**Source**	**Total**
1	+ Personal consumption expenditures		9,449.4
2	PCE non-durable goods (NIPA)	NIPA 2.3.5 line 6	2,688.0
3	PCE services (NIPA)	NIPA 2.3.5 line 13	5,487.6
4	PCE services less space rental value of inst building and non-farm dwellings	our imputation	4,574.2
5	Services of consumers' durables	our imputation	1,249.8
6	Services of structures and land	our imputation	897.4
7	Services of durables held by institutions	our imputation	40.1
8	+ Government consumption expenditures		2,245.8
9	Government consumption nondurable goods	NIPA 3.10.5 line 8	239.5
10	Government intermediate purchases, durable goods	NIPA 3.10.5 line 7	60.3
11	Government consumption services total		314.3
12	Government consumption services	NIPA 3.10.5 line 9	640.2
13	Less sales to other sectors	NIPA 3.10.5 line 11	325.9
14	Services of durables, structures, land, and inventories held by government	our imputation	424.1
15	Less government enterprise consumption of fixed capital	NIPA 3.1 line 38–3.10.5 line 5	44.1
16	Government compensation of employees exluding force account labor	NIPA 3.10.5 line 4–10	1,251.7
17	+ Gross national saving and statistical discrepancy	Capital Account	2,969.9
	– Depreciation	our imputation	2,385.4
18	= Net domestic expenditures		12,279.7

TABLE 4

Income and Expenditures Account, 1948–2006

Income	1948	1973	1995	2000	2006
Net income	260.5	1,387.6	6,905.6	9,283.1	12,279.5
Labor income	172.3	883.2	4,549.3	6,219.9	7,973.8
Net capital income	88.2	504.4	2,356.3	3,063.2	4,305.7
Expenditure	**1948**	**1973**	**1995**	**2000**	**2006**
Net domestic expenditures	260.5	1,387.6	6,905.6	9,283.1	12,279.5
Personal consumption expenditures	178.5	890.4	5,082.0	6,916.3	9,449.4
Government consumption expenditures	37.9	288.6	1,245.7	1,596.7	2,245.8
Net saving and statistical discrepancy	44.1	208.4	578.0	769.9	584.4

TABLE 5

Foreign Transactions Current Account, 2006

Line	Receipts from the Rest of the World	Source	Total
1	+ Exports of goods and services	NIPA 4.1 line 2	1,467.6
2	+ Income receipts from the rest of the world	NIPA 4.1 line 7	691.4
3	Wage and salary receipts	NIPA 4.1 line 8	2.9
4	Income receipts on assets	NIPA 4.1 line 9	688.6
5	= Current receipts from the rest of the world	NIPA 4.1 line 1	2,159.0
Line	**Payments to the Rest of the World and Balance on Current Account**	**Source**	**Total**
1	+ Imports of goods and services	NIPA 4.1 line 14	2,229.6
2	+ Income payments to the rest of the world	NIPA 4.1 line 19	633.4
3	Wage and salary payments	NIPA 4.1 line 20	9.4
4	Income payments on assets	NIPA 4.1 line 21	624.0
5	+ Current taxes and transfer payments to the rest of the world (net)	NIPA 4.1 line 25	90.1
6	+ Balance on current account	NIPA 4.1 line 29	–794.1
7	= Current payments to the rest of the world and balance on current account		2,159.0

TABLE 6

Foreign Transactions Current Account, 1948–2006

Receipts from the Rest of the World	1948	1973	1995	2000	2006
Exports of goods and services	15.5	95.3	812.2	1,096.3	1,467.6
Income receipts from the ROW	2.0	23.5	233.9	382.7	691.4
Payments to the Rest of the World and Balance on Current Account	**1948**	**1973**	**1995**	**2000**	**2006**
Imports of goods and services	10.1	91.2	903.6	1,475.8	2,229.6
Income payments to ROW	0.6	10.9	198.1	343.7	633.4
Current taxes and transfers to ROW (net)	4.5	7.4	35.4	56.1	90.1
Balance on current account	2.4	9.3	–91.0	–396.6	–794.1

The NIPAs include a Domestic Capital Account that presents investment and saving. In the new architecture this account is implemented by consolidating the accounts of business and government sectors with those of households and institutions. Financial claims on the business sector by households and institutions are liabilities of the business sector; in the consolidated accounts these assets and liabilities cancel out. Similarly, financial claims on the government sector by households and institutions cancel out.

Investment includes gross private domestic investment, government investment, and expenditures on durable goods by households and institutions, all evaluated at market prices, and the balance on current accounts. Net saving includes gross saving, as defined in the NIPAs, less consumption of fixed capital for households, institutions, and governments. Domestic saving and investment are given for 2006 in Table 7, together with the revaluation of fixed assets and the change in wealth. Domestic investment, gross saving, depreciation, net saving, revaluation of assets, and the change in wealth are presented in current prices for 1948–2006 in Table 8.

TABLE 7

Domestic Capital Account, 2006

Line	Investment	Source	Total
1	+ Private fixed investment, non-residential structures	NIPA 5.4.5 line 2	405.1
2	+ Private fixed investment, equipment and software	NIPA 5.5.5 line 1	1,002.2
3	+ Change in private inventories, non-farm	NIPA 5.6.5 line 19	47.8
4	+ Change in private inventories, farm	NIPA 5.6.5 line 2	–1.2
5	+ Private fixed investment, residential structures	NIPA 5.4.5 line 35	755.2
6	+ Personal consumption expenditures, durable goods	NIPA 1.1.5 line 3	1,048.9
7	+ Private land investment	our imputation	10.2
8	= Gross private domestic investment		3,268.2
9	+ Government investment, structures	NIPA 5.8.5 line 6	277.2
10	+ Government investment, equipment and software	NIPA 5.8.5 line 46	156.5
11	+ Government investment, land and inventories	our imputation	61.9
12	= Gross domestic investment		3,763.8
13	+ Net lending or borrowing on rest of world account	NIPA 4.1 line 30	–798.0
14	+ Capital accounts transaction (net)	NIPA 4.1 line 32	3.9
15	= Gross investment		2,969.7
Line	**Saving**	**Source**	**Total**
1	+ Net saving (NIPA)	NIPA 5.1 line 26	251.8
2	Personal saving	NIPA 2.1 line 33	38.8
3	Undistributed corporate profits with IVA and capital consumption adjustments	NIPA 5.1 line 5	400.9
4	Wage accruals less disbursements (private)	NIPA 5.1 line 9	7.5
5	Net government saving	NIPA 5.1 line 27	–195.4
6	+ Consumption of fixed capital	NIPA 1.7.5 line 5	1,615.2
7	= Gross saving (NIPA)	NIPA 5.1 line 1	1,867.0
8	+ Personal consumption expenditures, durable goods	NIPA 1.1.5 line 3	1,048.9
9	+ Private land investment	our imputation	10.2
10	+ Government investment, land and inventories	our imputation	61.9
11	= Gross saving		2,988.0
12	+ Statistical discrepancy	NIPA 5.1 line 26	–18.1
13	= Gross saving and statistical discrepancy		2,969.9
14	– Depreciation	our imputation	2,385.4
15	= Net saving		584.5
16	+ Revaluation	our imputation	4,970.7
17	= Change in wealth		5,555.2

TABLE 8

Domestic Capital Account, 1948–2006

Investment	1948	1973	1995	2000	2006
Gross investment	81.4	431.2	1,911.9	2,513.5	2,969.8
Private investment	71.7	373.3	1,742.5	2,568.9	3,268.2
Government investment	7.3	48.6	260.4	341.2	495.7
Balance on current account	2.4	9.3	–91.0	–396.6	–794.1
Change in Wealth	**1948**	**1973**	**1995**	**2000**	**2006**
Gross saving	81.4	431.2	1,911.9	2,513.5	2,969.8
Depreciation	36.5	222.8	1,334.1	1,743.7	2,385.4
Net saving	44.9	208.4	577.9	769.8	584.4
Revaluation	–	414.9	577.1	1,773.7	4,970.7
Change in wealth	–	623.2	1,154.9	2,543.6	5,555.1

TABLE 9

Foreign Transactions Capital Account, 2006

Line	Balance on Current Account	Source	Total
1	Balance on current account	NIPA 4.1 line 29	–794.1
Line	Capital Account Transactions and Net Lending	Source	Total
1	Capital account transactions (net)	NIPA 4.1 line 32	3.9
2	Net lending or borrowing	NIPA 4.1 line 30	–798.0
3	= Current account transactions and net lending		–794.1

TABLE 10

Foreign Transactions Capital Account, 1948–2006

Balance on Current Account	1948	1973	1995	2000	2006
Balance on current account	2.4	9.3	–91.0	–396.6	–794.1
Capital Accounts Transactions and Net Lending	1948	1973	1995	2000	2006
Current account transactions and net lending	2.4	9.3	–91.0	–396.6	–794.1
Capital account transactions (net)	.....	.....	0.9	0.8	3.9
Net lending or borrowing	2.4	9.3	–91.9	–397.4	–798.0

The estimates of revaluations for net claims on foreigners are based on accounts at market prices included in the U.S. International Position. Revaluations are estimated as the difference between the period-to-period changes in these stocks and the deficit of the rest of world sector. The NIPAs include a Foreign Transactions Capital Account that links net claims on foreigners to the balance on current account from the NIPAs. Data from the Foreign Transactions Account are given for 2006 in Table 9 and for the period 1948–2006 in Table 10.

The Wealth Account completes the domestic side of the prototype system of U.S. national accounts. The Wealth Account is consistent with the balance sheets for financial sectors presented by Teplin *et al.* (2006). These balance sheets also include all tangible wealth of business, government, and household sectors, as well as the U.S. International Position. The principal difference between the prototype system of accounts for capital and wealth and the 1993 SNA is that the SNA's capital and revaluation accounts are combined into a single accumulation account. This account also includes period-to-period changes in wealth. The treatment of consumer durables also differs from the 1993 SNA.[30]

All of the accounts considered up to this point contain data on flows. The wealth accounts contain data on stocks. These accounts are presented in balance sheet form with the value of assets equal to the value of liabilities as an accounting identity. The Wealth Account includes the reproducible and tangible assets of household, business, and government sectors and net claims on the ROW. The U.S. International Investment Position includes foreign holdings of U.S. domestic assets and U.S. holdings of foreign assets. The Wealth Account for 2006 is presented in Table 11, while the U.S. International Position for 2006 is given in

[30]United Nations (1993, p. 208).

TABLE 11
Wealth Account, 2006

Line	Wealth	Source	Total
1	+ Private domestic tangible assets	our imputation	49,231.9
2	+ Government tangible assets	our imputation	13,581.9
3	= Domestic tangible assets		62,813.8
4	+ Net international investment position of the United States		–2,199.4
5	= Wealth		60,614.4

TABLE 12
Wealth Account, 1948–2006

Wealth	1948	1973	1995	2000	2006
Wealth	891.3	5,571.9	28,585.9	38,378.8	60,614.4
Private domestic tangible assets	616.4	4,213.2	22,693.0	31,661.3	49,231.9
Government tangible assets	262.0	1,309.3	6,198.7	8,298.4	13,581.9
Net international investment position	12.9	49.3	–305.8	–1,581.0	–2,199.4

TABLE 13
U.S. International Position, 2006

Line	Wealth	Source	Total
1	+ U.S. owned assets abroad		14,039.6
2	– Foreign-owned assets in the United States		16,239.0
3	= Net international investment position of the United States		–2,199.4

TABLE 14
U.S. International Position, 1948–2006

Wealth	1948	1973	1995	2000	2006
Net international investment position of the U.S.	12.9	49.3	–305.8	–1,581.0	–2,199.4
U.S. owned assets abroad	29.4	232.0	3,964.6	7,401.2	14,039.6
Foreign-owned assets in the United States	16.5	182.7	4,270.4	8,982.2	16,239.0

Table 13. Annual data on domestic wealth are presented for the period 1948–2006 in Table 12, while the U.S. International Investment Position for this period is given in Table 14.

The Foreign Transactions Current and Capital Accounts are identical to the NIPAs. Similarly, the U.S. International Position from the NIPAs is incorporated without modification. The income and expenditures, capital, and wealth accounts in the prototype system are limited to national aggregates. This has the advantage that transactions among domestic sectors are not required in accounting for income and expenditures and claims among domestic sectors are not required in accounting for capital formation and wealth. The basic similarities between this approach and current accounting practice can be recognized through the reliance on data from the NIPAs.

3. Production Account

In order to express an accounting magnitude in constant prices the value in current prices must be separated between prices and quantities. Estimates in constant prices are associated with a quantity index, while the price index is an implicit deflator. As an illustration, GDP in current prices in the Domestic Income and Product Account is the product of GDP in constant prices and the implicit price deflator for GDP. Similarly, GDI in current prices is the product of GDI in constant prices and the implicit deflator for GDI.

As a second illustration, income in current prices from the Income and Expenditures Account can be separated between income in constant prices and the implicit deflator for income. Similarly, the value of expenditures can be separated into price and quantity components. Market prices that include production and sales taxes are used in evaluating private and government consumption expenditures, reflecting the purchasers' perspective. The price and quantity decomposition is extended to saving and investment in order to link investment in constant prices to the change in wealth.

The principal innovation in presenting the Domestic Income and Product Account in constant prices is to introduce a user cost formula for imputing the rental price of capital services from market prices for the underlying assets. Systems of national accounts have traditionally relied on market rental prices for making these imputations, but data on market rentals are too limited in scope for an integrated and consistent system of U.S. national accounts. In this section the Domestic Income and Product Account is presented in constant prices.

3.1. *Index Numbers*

To illustrate the construction of price and quantity index numbers for output in the Domestic Income and Product Account, suppose that m components of output are distinguished in the accounts; the value of output, say qY, can be written:

$$qY = q_1 Y_1 + q_2 Y_2 + \cdots + q_m Y_m.$$

The system of index numbers consists of a price index for output q and a quantity index for output Y, defined in terms of the prices (q_i) and quantities (Y_i) of the m components. The base for all price indexes in the prototype system of U.S. national accounts is 1.000 in 2000, following the December 2003 benchmark revision of the NIPAs. The base for the quantity indexes is the corresponding value in 2000.

Landefeld and Parker (1997) have provided a detailed exposition of the chained Fisher ideal price and quantity indexes employed in the NIPAs. Diewert (1976) has defined a superlative index number as an index that exactly replicates a flexible representation of the underlying technology (or preferences). A flexible representation provides a second-order approximation to an arbitrary technology (or preference system). Konus and Byushgens (1926) first showed that the Fisher ideal index employed in the NIPAs is superlative in this sense. Laspeyres and Paasche indexes are not superlative and fail to capture substitutions among products in response to price changes.

In the 1993 SNA superlative systems of index numbers like those employed in the U.S. national accounts are recommended for the output side of the production account and for labor input. As the base period is changed from time to time, chain-linking of the resulting price and quantity indexes is recommended. The index numbers in the prototype system of U.S. national accounts are chain-linked Fisher ideal indexes of components from the NIPAs.

At a number of points data net and gross of taxes are required, reflecting differences between sellers and buyers that result from tax wedges. As one illustration, consumer expenditures on goods and services in the Income and Expenditures Account include sales and excise taxes, reflecting the purchasers' point of view. Sales of the same goods and services in the Domestic Income and Product Account exclude these taxes, reflecting the perspective of producers. The prices net of taxes are denoted "basic prices" in the 1993 SNA. Sales and excise taxes are treated as part of the price paid by consumers, so that the value of transactions can be separated into three components—price, quantity, and tax rate.[31]

3.2. *Output*

The first step in constructing a quantity index for GDP is to allocate the value of output between consumption and investment goods. Investment goods include durable goods and structures. Consumption goods include non-durable goods and services. Data for prices and quantities of consumption and investment goods are presented in the NIPAs. Price and quantity index numbers for the services of consumer, institutional and government durables, as well as institutional and government real estate, are part of the imputation for the value of the capital services.

The value of output from the point of view of the producing sector excludes sales and excise taxes and includes subsidies. These taxes and subsidies are allocated in proportion to the consumption and investment goods output in current prices. The price index for each type of output is implicit in the value and quantity of output included in the GDP. Price and quantity indexes of GDP are constructed by applying chained Fisher ideal index numbers to price and quantity data for consumption and investment goods product. The results are given in Table 15.

TABLE 15

Domestic Product Growth, 1948–2006

Quantities	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Gross domestic product	3.42	3.99	2.79	4.09	2.83
Investment goods product	3.85	4.35	3.03	7.02	2.10
Consumption goods product	3.29	3.87	2.72	3.19	3.05
Prices	**1948–2006**	**1948–1973**	**1973–1995**	**1995–2000**	**2000–2006**
Gross domestic product	3.29	2.72	4.64	1.82	1.98
Investment goods product	2.50	2.14	3.78	−0.03	1.47
Consumption goods product	3.54	2.92	4.90	2.38	2.12

[31]Additional details are given by Jorgenson and Landefeld (2006, pp. 66–8).

TABLE 16
Labor Growth, 1948–2006

Quantities	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Labor income	1.87	1.92	1.95	2.21	1.08
Employment	1.58	1.63	1.73	1.98	0.52
Hours worked	1.28	1.17	1.48	1.89	0.54
Quality	0.59	0.75	0.48	0.32	0.53
Prices	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Labor income	4.75	4.62	5.50	4.05	3.06
Hourly compensation	5.33	5.37	5.98	4.37	3.60

3.3. *Labor Input*

Construction of a quantity index of labor income begins with data on hours worked and labor compensation per hour. Hours worked and labor compensation by sex, age, educational attainment, and employment class are obtained from the Census of Population and the Current Population Survey. These data are based on household surveys. Control totals for hours worked and labor compensation are taken from the NIPAs. These totals are based on establishment surveys and reflect payroll records.[32]

Denoting the labor income quantity index by L and the corresponding price index by p_L, the value of labor input is the sum over all categories of labor input:

$$p_L L = \sum p_{L,j} L_j,$$

where $p_{L,j}$ is the price of the j-th type of labor input and L_j is the number of hours worked by workers of this type. Price and quantity indexes of labor income are constructed from chained Fisher ideal quantity indexes, as recommended in the 1993 SNA.

Price and quantity indexes of labor income for1948–2006 are given in Table 16, along with employment, weekly hours, hourly compensation, and hours worked. Labor quality in Table 16 is defined as the ratio of the quantity index of labor income to hours worked. Labor quality captures changes in the composition of the work force by the characteristics of individual workers, as suggested by BLS (1993). A more detailed description of the sources and methods for these estimates is provided by Jorgenson *et al.* (2005).

3.4. *Capital Input*

Estimates of capital income, property compensation, depreciation, and capital assets in constant prices require data on prices and quantities of capital goods.[33] The starting point for a quantity index of capital income is a perpetual inventory of capital stocks. Under the assumption that efficiency of capital assets declines geometrically with age, the rate of depreciation, say δ, is a constant.

[32]Details are given by Jorgenson *et al.* (2005, pp. 201–90).
[33]Further details are given by Jorgenson *et al.* (2005, pp. 147–200).

TABLE 17

Benchmarks, Depreciation Rates, and Deflators

Line	Asset Class	2006 Benchmark (billions of 2000 dollars)	Depreciation Rate	Deflator
1	Consumer durables	4,806.6	0.201	NIPA
2	Non-residential structures	12,221.3	0.026	NIPA
3	Residential structures	12,181.4	0.016	NIPA
4	Equipment and software	6,488.6	0.145	NIPA
5	Non-farm inventories	1,716.4	–	NIPA
6	Farm inventories	125.7	–	NIPA
7	Land	8,780.1	–	Price by Legal Form from Morris Davis and Eldon Ball

Capital stock at the end of every period can be estimated from investment and capital stock at the beginning of the period:

$$K_t = A_t + (1-\delta)K_{t-1},$$

where K_t is end-of-period capital stock, A_t the quantity of investment and K_{t-1} the capital stock at the beginning of the period. To transform capital stocks into flows of capital services, an assumption about the time required for new investment to begin to contribute to production must be introduced, namely, that the capital service from each asset is proportional to the arithmetic average of current and lagged capital stocks.[34]

The perpetual inventory estimates of capital stocks are based on BEA's fixed assets accounts (2003). These data include investment by asset class for 61 types of non-residential assets from 1901–2006, 48 types of residential assets for the same period, and 13 types of consumers' durables from 1925–2006. Government capital includes 12 types of structures, six types of defense equipment, as well as other equipment and software.

As described by Fraumeni (1997), the reproducible wealth accounts use efficiency functions for most assets that decline geometrically with age. The geometric depreciation rates for these assets are taken from Fraumeni (1997). To simplify the accounts for tangible wealth, the age-efficiency profiles that are not geometric are approximated by Best Geometric Average (BGA) profiles that are geometric, following Hulten and Wykoff (1982).[35] Benchmark estimates of capital stocks in 2006, expressed in constant prices of 2000, rates of depreciation, and the sources of price indexes for each type of capital are presented in Table 17.

The price indexes for reproducible assets are taken from the NIPAs. These prices are measured in "efficiency" units, holding the performance of assets constant over time. For example, the performance of computers and peripheral equipment is held constant, using hedonic price indexes constructed by a BEA–IBM team and introduced into the NIPAs in 1985. Dulberger (1989) presents a detailed

[34]This assumption is employed by Jorgenson and Stiroh (2000), Jorgenson (2001), Jorgenson *et al.* (2005) and Oliner and Sichel (2000). Jorgenson *et al.* (1987) had assumed that capital services were proportional to lagged capital stocks.

[35]BEA efficiency profiles are discussed in Bureau of Economic Analysis (2008).

report on her research on the prices of computer processors for the BEA–IBM project. Speed of processing and main memory played central roles in her model. Triplett (1989, 2005) has provided exhaustive surveys of research on hedonic price indexes for computers. The official price indexes for computers provide the paradigm for economic measurement and capture the steady decline in IT prices.[36]

Both software and hardware are essential for information technology and this is reflected in the large volume of software expenditures. The eleventh comprehensive revision of the national accounts, released by BEA on October 27, 1999, reclassified computer software as investment.[37] Before this important advance, business expenditures on software were treated as current outlays, while personal and government expenditures were treated as purchases of non-durable goods. Software investment is growing rapidly and is now much more important than investment in computer hardware.

The value of wealth from the Flow of Funds accounts includes both reproducible and non-reproducible assets. However, the BEA's fixed assets accounts are limited to reproducible assets. We employ data for the price and quantity of land for households and non-profit institutions, non-farm non-corporate business, and non-farm corporate business prepared by Davis (2008). These data are based on value of real estate from the Flow of Funds Accounts. The value of land is obtained by subtracting the cost of structures from the value of real estate. We employ data on the price and quantity of farm land from the U.S. Department of Agriculture (Economic Research Service, 2008) and data on the price and quantity of government land and inventories from the Office of Management and Budget (2008).[38] Inventory data for the private sector are from the NIPAs.

Given data on market rental prices by class of asset, the implicit rental values paid by owners for the use of their property can be imputed by applying these rental rates as prices. This method is used to estimate the rental value of owner-occupied dwellings in the U.S. national accounts. The main obstacle to broader application of this method is the lack of data on market rental prices. A substantial portion of the capital goods employed in the U.S. economy has an active rental market. Most classes of structures can be rented and a rental market exists for many types of equipment, especially aircraft, trucks, construction equipment, computers, and so on. Unfortunately, very little effort has been devoted to compiling data on rental rates for either structures or equipment.

An alternative approach for imputation of rental prices is to extend the perpetual inventory method to include prices of capital services.[39] For each type of capital perpetual inventory estimates are prepared for asset prices, service prices, depreciation, and revaluation. Under the assumption of geometrically declining relative efficiency of capital goods, the asset prices decline geometrically with vintage. The formula for the value of capital stock,

[36]A survey of hedonic methods in the NIPAs is given by Wasshausen and Moulton (2006). Triplett (2004) discusses the construction and application of hedonic price indexes.

[37]Moulton (2000) describes the 11th comprehensive revision of NIPA and the 1999 update.

[38]Eldon Ball of the USDA generously provided the data on farmland. Richard Anderson of OMB kindly provided the historical data on government land and inventories in electronic form.

[39]Christensen and Jorgenson (1973) present a detailed extension of the perpetual inventory method to rental prices assets. They also provide a prototype accounting system for the private sector of the U.S. economy with prices and quantities of capital services for all assets.

TABLE 18

Relative Proportions of Capital Stock by Asset Class and Sector, 2006

Line	Asset Class	Sector				Total
		Corporate	Non-corporate	Households	Government	
1	Consumer durables	–	–	0.070	–	0.070
2	Non-residential structures	0.107	0.027	0.018	0.118	0.270
3	Equipment and software	0.075	0.010	0.003	0.016	0.104
4	Residential structures	0.002	0.042	0.215	0.005	0.264
5	Non-farm inventories	0.026	0.002	–	0.005	0.033
6	Farm inventories	–	0.003	–	–	0.003
7	Land	0.029	0.054	0.102	0.072	0.257
	Total	0.239	0.137	0.408	0.216	1.000

$$q_{A,t} = \sum q_{A,t}(1-\delta)^{\tau} A_{t-\tau},$$

is the sum of past investments weighted by relative efficiencies and evaluated at the price for acquisition of new capital goods $q_{A,t}$. Second, depreciation $q_{D,t}$ is proportional to the value of beginning of period capital stock:

$$q_{D,t}K_{t-1} = \delta q_{A,t}K_{t-1}.$$

Finally, revaluation $(q_{A,t} - q_{A,t-1})K_{t-1}$ is equal to the change in the acquisition price of new capital goods multiplied by beginning of period capital stock.

Households and institutions and government are not subject to direct taxes. Non-corporate business is subject to personal income taxes, while corporate business is subject to both corporate and personal income taxes. Businesses and households are subject to indirect taxes on the value of property. In order to take these differences in taxation into account each class of assets is allocated among the five sectors of the U.S. domestic economy—corporations, non-corporate business, households, non-profit institutions, and government.[40] The relative proportions of capital stock by asset class for each sector for 2006 are given in Table 18.

For a sector not subject to either direct or indirect taxes, the capital service price $q_{K,t}$ is:

$$q_{K,t} = q_{A,t-1}[r_t - \pi_t + (1+\pi_t)\delta],$$

where r_t is the nominal rate of return and π_t is the rate of inflation in the acquisition price of new capital goods. This formula can be applied to government and non-profit institutions by choosing an appropriate rate of return, as described below.[41] Given the rate of return for government and non-profit institutions, estimates can be constructed for capital service prices for each class of assets held by these sectors—land held by government and institutions, residential and non-residential structures, producer and consumer durables.

[40]A detailed derivation of prices of capital services for all five sectors is given by Jorgenson and Kun-Young Yun (2001).

[41]Alternative methods for imputing the rate of return to capital are reviewed by Schreyer (2008).

Households hold consumer durables and owner-occupied dwellings that are taxed indirectly through property taxes. To incorporate property taxes into the estimates of the price and quantity of capital services taxes are added to the cost of capital, depreciation, and revaluation. The household rate of return is a weighted average of the rate of interest and the nominal rate of return on equity in household assets. The weights depend on the ratio of debt to the value of household capital stock. The nominal rate of return on equity is set equal to the corresponding rate of return for owner-occupied housing after all taxes. Given the rate of return for households, estimates of capital service prices can be constructed for each class of assets held by households—land, residential structures, and consumer durables. Separate effective tax rates are employed for owner-occupied residential property, both land and structures, and for consumer durables.

The main challenge in the measurement of price and quantity of capital services for non-corporate business is to separate the income of unincorporated enterprises between labor and property compensation. Labor compensation of the self-employed is estimated from the incomes received by comparable categories of employees.[42] Property compensation as the sum of income originating in business, other than corporate business and government enterprises and the net rent of owner-occupied dwellings, less the imputed labor compensation of proprietors and unpaid family workers, plus non-corporate consumption of fixed capital, less allowances for owner-occupied dwellings and institutional structures, and plus indirect business taxes allocated to the non-corporate sector. The statistical discrepancy is allocated to non-corporate property compensation.

The personal income tax must be taken into account in order to obtain an estimate of the non-corporate rate of return. The capital service price must be modified to incorporate income tax and indirect business taxes.[43] The non-corporate rate of return is a weighted average of the rate of interest and the nominal rate of return on non-corporate assets with weights that depend on the ratio of debt to the value of non-corporate capital stock. Given data on prices of acquisition, stocks, tax rates, and replacement rates, capital service prices can be estimated for each class of assets held by the non-corporate sector.

Finally, corporate property compensation is the income originating in corporate business, less compensation of employees, plus corporate consumption of fixed capital, plus business transfer payments, plus the indirect business taxes allocated to the corporate sector. The corporate income tax must be taken into account to obtain an estimate of the corporate rate of return.[44] The method for estimating the corporate rate of return is the same as for the non-corporate rate of return. Property compensation in the corporate sector is the sum of the value of services from residential and nonresidential structures, producer durable equipment, inventories, and land held by the sector.

The nominal rate of return is assumed to be the same for all assets within a given sector. For the corporate and non-corporate sectors this rate of return is inferred from the value of property compensation, asset prices based on market

[42]Estimation of the labor compensation of the self-employed is discussed by Jorgenson *et al.* (2005).

[43]Details are given by Jorgenson and Landefeld (2006, pp. 77–8).

[44]Details are given by Jorgenson and Landefeld (2006, pp. 79–83).

TABLE 19

Capital Income Growth, 1948–2006

Quantities	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Capital income	4.05	4.58	3.37	5.08	3.43
Corporate income	4.59	4.80	4.23	6.77	3.22
Non-corporate income	2.29	2.97	1.84	1.98	1.31
Household income	5.08	6.29	3.68	5.45	4.88
Government income	1.73	1.51	1.99	1.36	2.02
Prices	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Capital income	2.82	2.39	4.03	0.34	2.26
Corporate income	2.40	1.65	3.88	–1.23	3.15
Non-corporate income	4.36	3.61	5.34	–0.63	8.09
Household income	2.02	1.35	3.70	1.29	–0.70
Government income	4.14	5.69	3.32	4.99	–0.04

TABLE 20

Domestic Income and Product and Productivty Growth, 1948–2006

Quantities	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Gross domestic product	3.42	3.99	2.79	4.09	2.83
Gross domestic income	2.76	2.99	2.54	3.43	2.09
Prices	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Gross domestic product	3.29	2.72	4.64	1.82	1.98
Gross domestic income	2.76	2.99	2.54	3.43	2.09
	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Multifactor productivity	0.66	0.99	0.25	0.66	0.74

transactions, stocks of capital goods, rates of replacement, and variables describing the tax structure. For households the rate of return is inferred from income from owner-occupied housing. For government, the imputed rate of return is set equal to the average of corporate, non-corporate, and household rates of return after both corporate and personal taxes.

To obtain price and quantity indexes for capital services in the domestic sector, chained Fisher ideal and quantity indexes like those used in the NIPAs are calculated for each of the five sub-sectors—corporations, non-corporate business, households, institutions, and government. Price and quantity indexes of capital income for corporations, non-corporate business, households, institutions, and government, as well as the U.S. domestic economy are given for 1948–2006 in Table 19.

Price and quantity index numbers for GDI are constructed by combining indexes of labor and capital income. The weights for labor and capital are the relative shares of labor and capital income in GDI. Price and quantity indexes of GDI for the U.S. domestic economy are given for 1948–2006 in Table 20. Multifactor productivity, also given in Table 20, is defined as the ratio of GDP in constant prices to GDI in constant prices.[45] Growth in multifactor productivity

[45]This index of multifactor productivity conforms to the international standards presented in Schreyer (2001). For further discussion, see Jorgenson (2001).

can be interpreted as an increase in efficiency of the use of input to produce output or as a decline in the cost of input required to produce a given value of output.

4. Income and Expenditure, Capital, and Wealth Accounts

The previous section gives the Domestic Income and Product Account for the U.S. economy in constant prices. This section presents Income and Expenditure, Capital, and Wealth Accounts in constant prices for the domestic economy. The accounts for the ROW are identical to those generated by BEA.

4.1. *Income and Expenditures*

To construct price and quantity indexes of household and government expenditures for the U.S. domestic economy, data are obtained for consumption expenditures on non-durable goods and services, excluding the services of institutional real estate, from the Domestic Income and Production Account. Consumption expenditures are evaluated at market prices and combined with imputed values of the services of household, institutional, and government durables and the services of institutional and government real estate.

The value of consumption expenditures at market prices includes customs duties, excise and sales taxes, and excludes subsidies. Price and quantity indexes of consumption expenditures are constructed from the price and quantity indexes of non-durables, services, and estimates of capital services by using chained Fisher ideal index numbers. Gross saving and net saving in constant prices are taken from the Domestic Capital Account described below. Price and quantity indexes for personal and government consumption expenditures and net saving are presented in Table 21.

The starting point for estimating price and quantity components of Domestic Capital Income is the price and quantity of capital income in the Domestic Income and Product Account. The most important innovation is the use of thee user cost formula introduced by Jorgenson (1963) to impute the price of capital

TABLE 21
Net Expenditures Growth, 1948–2006

Quantities	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Net expenditures	3.23	3.70	2.77	3.90	2.43
Personal consumption expenditures	3.61	4.10	3.02	4.16	3.21
Government consumption expenditures	2.59	3.53	1.83	1.68	2.27
Net saving	2.27	2.64	3.23	6.13	–6.02
Prices	**1948–2006**	**1948–1973**	**1973–1995**	**1995–2000**	**2000–2006**
Net expenditures	3.40	2.98	4.52	2.02	2.24
Personal consumption expenditures	3.24	2.33	4.89	2.00	1.99
Government consumption expenditures	4.44	4.59	4.81	3.28	3.42
Net saving	2.15	3.50	1.41	–0.40	1.42

TABLE 22

Capital Income Growth, 1948–2006

Quantities	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Capital income	3.98	4.61	3.25	4.86	3.27
ROW capital income	3.30	4.98	2.10	2.46	1.34
Domestic capital income	4.05	4.58	3.37	5.08	3.43
Prices	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Capital income	2.89	2.44	4.13	0.42	2.24
ROW capital income	3.62	3.06	5.19	1.40	2.01
Domestic capital income	2.82	2.39	4.03	0.34	2.26

TABLE 23

Income Growth, 1948–2006

Quantities	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Net income	2.45	2.78	2.19	2.98	1.57
Labor income	1.87	1.92	1.95	2.21	1.07
Net capital income	3.60	4.49	2.68	4.45	2.54
Prices	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Net income	4.19	3.91	5.11	2.94	3.09
Labor income	4.75	4.62	5.50	4.05	3.07
Net capital income	3.10	2.48	4.33	0.80	3.13

services. Price and quantity indexes of capital income are presented in Table 22. Similarly, prices and quantities of the different categories of labor services are combined into price and quantity indexes of labor income using chained Fisher ideal index numbers. Price and quantity indexes of labor, net capital, and net income are presented in Table 23.

The quantity index of net expenditures is a measure of social welfare. It combines the quantity of current consumption with net increments to future consumption, as suggested by Weitzman (2003). Similarly, the quantity index of net income is a measure of the labor and property incomes generated by the U.S. economy. The ratio of expenditures to income in constant prices is the level of living, a quantity index of welfare generated from current and future consumption in proportion to the effort required in the form of labor and capital services. This must be carefully distinguished from multifactor productivity, the ratio of GDP to GDI, a measure of productive efficiency. Price and quantity indexes of net expenditures, net income and the level of living index are presented in Table 24.[46]

4.2. *Domestic Capital Account*

The fundamental accounting identity for the Domestic Capital Account is that gross saving from the Income and Expenditures Account is equal to investment. Investment and saving are also equal in constant prices. Investment is a chained Fisher ideal quantity index of private and government investment,

[46]For further discussion, see Hulten (1992).

TABLE 24

Income and Expenditures and Level of Living Growth, 1948–2006

Quantities	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Net expenditures	3.23	3.70	2.77	3.90	2.43
Net income	2.45	2.78	2.19	2.98	1.57
Prices	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Net expenditures	3.40	2.98	4.52	2.02	2.24
Net income	4.19	3.91	5.11	2.94	3.09
	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Level of living	0.79	0.92	0.59	0.92	0.85

TABLE 25

Investment Growth, 1948–2006

Quantities	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Gross investment	3.76	3.70	3.87	5.77	1.90
Private investment	4.24	4.39	3.40	8.58	3.01
Government investment	3.66	4.09	3.56	3.49	2.43
Prices	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Gross investment	2.44	2.97	2.90	–0.30	0.88
Private investment	2.35	2.21	3.60	–0.82	1.01
Government investment	3.61	3.49	4.07	1.92	3.80

evaluated at market prices. The quantities are taken from the Domestic Income and Product Account, while the prices include sales and excise taxes paid by purchasers of investment goods. Price and quantity indexes of gross investment are given for 1948–2006 in Table 25.

Depreciation and the revaluation of assets in constant prices are required to complete the saving side of the Domestic Capital Account in constant prices. If the decline in efficiency of capital goods is geometric the change in wealth from period to period for a single capital good is written:

$$\begin{aligned} W_t - W_{t-1} &= q_{A,t}K_t - q_{A,t-1}K_{t-1} \\ &= q_{A,t}(K_t - K_{t-1}) + (q_{A,t} - q_{A,t-1})K_{t-1} \\ &= q_{A,t}A_t - q_{A,t}\delta K_{t-1} + (q_{A,t} - q_{A,t-1})K_{t-1}. \end{aligned}$$

Gross saving is represented by $q_{A,t}A_t$, which is equal to gross investment and has the same price and quantity components.

Depreciation is represented by $q_{A,t}\delta K_{t-1}$. The price and quantity indexes of depreciation are constructed from the lagged stocks, K_{t-1}, with depreciation prices $q_{D,t}$ as weights. Revaluation is represented by $(q_{At} - q_{A,t-1})K_{t-1}$. Price and quantity indexes of revaluation are constructed from lagged capital stocks with revaluation prices $(q_{A,t} - q_{A,t-1})$ as weights. Chained Fisher ideal price and quantity index numbers of private national saving, depreciation, and revaluation for the period 1948–2006 are presented in Table 26.

TABLE 26
Change in Wealth Growth, 1948–2006

Quantities	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Gross saving	3.76	3.70	3.87	5.77	1.90
Depreciation	4.67	4.87	4.26	5.63	4.59
Net saving	2.27	2.64	3.23	6.13	–6.02
Revaluation	3.76	1.42	3.04	0.11	18.84
Change in wealth	4.36	3.76	2.89	3.11	13.21
Prices	**1948–2006**	**1948–1973**	**1973–1995**	**1995–2000**	**2000–2006**
Gross saving	2.44	2.97	2.90	–0.30	0.88
Depreciation	2.53	2.37	3.88	–0.28	0.63
Net saving	2.15	3.50	1.41	–0.40	1.42
Revaluation	8.96	16.85	–0.67	22.34	–1.66
Change in wealth	4.37	7.86	–0.08	12.68	–0.19

4.3. *Wealth Accounts*

Changes in the value of wealth from period to period can be separated into price and quantity components. The quantity is linked to investment in the accumulation account, while the price is linked to revaluation. Under the assumption of geometric decline in efficiency of capital goods, net investment is the quantity component, while revaluation is the price component. Wealth is the product of the price index $q_{A,t}$ and quantity index K_t:

$$W_t = q_{A,t}K.$$

Asset prices and quantities of capital stocks are combined into price and quantity indexes for wealth, using chained Fisher index numbers.

The Wealth Account for the U.S. economy includes reproducible assets held by businesses, households and institutions, and government and net claims on foreigners. Prices and quantities of assets are estimated for each of the five sectors by applying chained Fisher ideal index numbers to price and quantity data for all classes of assets held by the sector. Price and quantity indexes of private domestic tangible assets, government tangible assets, and wealth for 1948–2006 are given in Table 27. These are obtained by applying Fisher ideal index numbers to price and quantity indexes for the five sectors.

5. The Sources and Uses of Economic Growth

An important application of the prototype system of accounts is the analysis of sources and uses of U.S. economic growth.[47] The sources of growth are essential for assessing the growth potential of the U.S. economy. The uses of growth are vital for evaluating growth in terms of economic welfare. The sources of postwar U.S. economic growth require measures of output, input, and multifactor

[47]The international standards for aggregate growth accounting presented in Schreyer (2001) are discussed in detail by Jorgenson *et al.* (2005, pp. 17–58). The demise of traditional growth accounting is described by Jorgenson *et al.* (2005, pp. 49–58).

TABLE 27
Wealth Growth, 1948–2006

Quantities	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Wealth	2.75	3.74	2.17	2.40	1.04
Private domestic assets	3.33	4.23	2.58	3.18	2.44
Government domestic assets	2.13	2.51	1.79	1.92	2.03
Prices	**1948–2006**	**1948–1973**	**1973–1995**	**1995–2000**	**2000–2006**
Wealth	4.53	3.60	5.26	3.49	6.57
Private domestic assets	4.22	3.46	5.07	3.48	4.92
Government domestic assets	4.67	3.93	5.28	3.91	6.19

productivity from the Domestic Income and Product Account presented in Table 20. The uses of U.S. economic growth necessitate estimates of income, expenditures, and the level of living from the Domestic Income and Expenditures Account given in Table 24. Finally, patterns of investment, saving, and the accumulation of wealth call for data from the Domestic Capital and Wealth Accounts in Tables 25, 26, and 27.

The interpretation of outputs, inputs, and productivity requires the production possibility frontier introduced by Jorgenson (1966):

$$Y(I,C) = A \cdot X(K,L),$$

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

The key feature of the production possibility frontier is the explicit role it provides for changes in the relative prices of investment and consumption outputs. The aggregate production function is a competing methodology and gives a single output as a function of capital and labor inputs. There is no role for separate prices of investment and consumption goods. Under the assumption that product and factor markets are in competitive equilibrium, the share-weighted growth of outputs is the sum of the share-weighted growth of inputs and growth in multifactor productivity:

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

where $\bar{w}$ and $\bar{v}$ denote average shares of the outputs and inputs, respectively, in the value of GDP in current prices.

Table 28 presents accounts for U.S. economic growth during the period 1948–2006 and various sub-periods, following Jorgenson (2001). The earlier sub-periods are divided by the business cycle peak in 1973. The period since 1995, the beginning of a powerful resurgence in U.S. economic growth linked to information technology, is divided in 2000, the start of the dot-com crash. The contribution of each output is its growth rate weighted by the relative value share. Similarly, the

TABLE 28

Contributions to Output and Growth, 1948–2006

Output	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Gross domestic product	3.42	3.99	2.79	4.09	2.83
Contribution of consumption	2.46	2.84	2.07	2.44	2.39
Contribution of investment	0.96	1.15	0.72	1.65	0.44
Growth	**1948–2006**	**1948–1973**	**1973–1995**	**1995–2000**	**2000–2006**
Gross domestic income	2.76	2.99	2.54	3.43	2.09
Contribution of capital services	1.69	1.89	1.41	2.17	1.49
Contribution of labor services	1.08	1.11	1.13	1.26	0.60
Multifactor productivity	0.66	0.99	0.25	0.66	0.74

contribution of each input is its weighted growth rate. Growth in multifactor productivity is the difference between growth rates of output and input.

For the period 1948–2006 the most important source of economic growth was capital services at 49.4 percent, while labor services contributed 31.6 percent. Multifactor productivity growth contributed 19.0 percent of economic growth. After strong output and productivity growth in the 1950s, 1960s and early 1970s, the U.S. economy slowed markedly from 1973 through 1995. Output growth fell from 3.99 to 2.79 percent and multifactor productivity growth declined precipitously from 0.98 to 0.25 percent. The contribution of capital input also slowed from 1.89 percent for 1948–73 to 1.41 percent for 1973–95, while the labor input contribution increased slightly from 1.11 to 1.13 percent.

U.S. economic growth surged to 4.09 percent during the period 1995–2000. Between 1973–95 and 1995–2000 the contribution of capital input jumped by 0.76 percentage points, accounting for more than half the increase in output growth of 1.30 percent. This reflects the investment boom of the late 1990s, as businesses, households, and governments poured resources into plant and equipment, especially computers, software, and communications equipment. The contribution of labor input increased by a relatively modest 0.13 percent, while multifactor productivity growth accelerated by 0.41 percent.

After the dot-com crash beginning in 2000, U.S. economic growth slowed substantially to 2.83 percent per year and the relative importance of investment declined sharply. The contribution of capital services to economic growth dropped by 0.68 percent per year, reverting almost to the level before 1995. The growth of multifactor productivity also declined, but not as sharply, to 0.74 percent per year, while the contribution of labor input sank to 0.60 percent per year.

The results presented above highlight the importance of having an internally consistent set of accounts like those provided by the new architecture. In the absence of an integrated production account, the analysis of sources of economic growth at the aggregate and industry level would have to rely on a mixture of BEA industry accounts estimates and BLS productivity estimates, combined with an analyst's estimates of missing information, such as growth in labor input per hour worked. With inconsistent source data, different analysts could produce inconsistent results during periods of higher or lower growth, such as the post-1973 productivity slowdown and the more recent spurt in productivity growth since 1995.

Economic growth creates opportunities for both present and future consumption. These opportunities are generated by expansion in the supply of capital and labor services, augmented by changes in the level of living:

$$Z(C, S) = B \cdot W(L, N),$$

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

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

$$\bar{w}_C \Delta \ln C + \bar{w}_S \Delta S = \bar{v}_L \Delta \ln L + \bar{v}_N \Delta \ln N + \Delta \ln B$$

where $\bar{w}$ and $\bar{v}$ denote average value shares for expenditures and incomes, respectively.

Table 29 presents a decomposition of the uses of economic growth for the period 1948–2006. The growth rate of expenditures is a weighted average of growth rates of personal consumption expenditures, government consumption expenditures, and net saving. The contribution of each category of expenditures is the growth rate weighted by the relative share. Similarly, the contributions of labor and property incomes are the growth rates weighted by the relative shares. Growth in the level of living is the difference between growth rates of expenditures and incomes.

The growth of net expenditures largely reflects the pattern of output growth with strong growth of expenditures during the period 1948–73, followed by a

TABLE 29

Contributions to Expenditure, 1948–2006

Expenditure	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Income	2.45	2.78	2.19	2.98	1.57
Contribution of labor income	1.22	1.24	1.28	1.44	0.68
Contribution of net property income	1.23	1.54	0.90	1.53	0.89
Level of living	0.79	0.92	0.59	0.92	0.85
Net Expenditure	**1948–2006**	**1948–1973**	**1973–1995**	**1995–2000**	**2000–2006**
Net expenditures	3.24	3.70	2.77	3.90	2.43
Consumption	2.97	3.36	2.47	3.34	2.86
Contribution of personal consumption	2.47	2.71	2.08	3.04	2.44
Contribution of government consumption	0.50	0.65	0.39	0.29	0.41
Net saving	0.27	0.35	0.30	0.56	–0.43

slowdown after 1973, a sharp revival after 1995, and a further slowing after 2000. The growth of expenditures for the post-war period as a whole was 3.24 percent by comparison with output growth of 3.42 percent. The growth of expenditures rebounded by 1.13 percent per year during 1995–2000, while output jumped by 1.30 percent. Expenditures dropped by 1.47 percent after 2000, compared with the decline in output of 1.26 percent.

Net saving added a healthy 0.35 percent to growth of net expenditures during 1948–73, but this contribution eased to 0.30 percent per year during 1973–95, before jumping sharply to 0.56 percent during the investment boom of 1995–2000. The decline in saving after 1973 has attracted considerable attention, for example, in the work of Gale and Sabelhaus (1999) and Reinsdorf (2005). However, the most arresting feature of the uses of economic growth is the precipitous drop in the contribution of net saving to –0.43 percent per year in 2000–06. Net saving remained positive, but declined in magnitude during this period.

Further insight into the relationship between investment and saving is obtained from the Domestic Capital and Wealth Accounts presented in Tables 27, 28, and 29. Gross investment and gross saving are identical in both current and constant prices. Gross saving is reduced by depreciation to yield net saving. This is combined with revaluation to generate the change in wealth. Finally, wealth is comprised of private domestic tangible assets, government tangible assets, and the U.S. International Position.

One link from the Domestic Capital Account to the Domestic Wealth Account is net saving, a measure of change in the quantity of assets. A second link is revaluation, a measure of change in asset prices. The change in wealth is presented in current prices in Table 9 and the average value shares of net saving and revaluation are obtained from this table. The growth rates of the two components are calculated from the constant price estimates in Table 28. Finally, the asset side of the Domestic Wealth Account is provided in current prices in Table 13. The estimates in this table are utilized in generating average value shares of the three components. Growth rates are calculated from the constant price estimates in Table 29.

Table 30 presents decompositions of gross investment and gross saving. The contribution of each component is its growth rate, weighted by the relative value

TABLE 30

Contributions to Investment and Saving, 1948–2006

Investment	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Gross investment	3.76	3.70	3.87	5.77	1.90
Contribution of private investment	3.78	3.63	3.13	8.11	3.20
Contribution of government investment	0.53	0.63	0.48	0.45	0.37
Contribution of ROW investment	–0.56	–0.57	0.26	–2.80	–1.67
Saving	**1948–2006**	**1948–1973**	**1973–1995**	**1995–2000**	**2000–2006**
Saving	3.76	3.70	3.87	5.77	1.90
Contribution of net saving	0.91	1.12	1.10	2.00	–1.62
Contribution of depreciation	2.85	2.58	2.77	3.77	3.52

share. Throughout the post-war period foreigners have been accumulating assets in the U.S. faster that the U.S. has been accumulating assets abroad. In fact, the contribution of ROW investment was negative in all sub-periods, except 1973–95, when it was very slightly positive. The contribution of private investment is almost the same as the growth of gross investment for the period 1948–2006. The contribution of government investment nearly offsets the negative contribution of ROW investment.

The share of private investment has been trending upward throughout the post-war period and exceeded 100 percent of investment after 1995. Government investment peaked in the early 1950s and has been declining gradually. ROW investment was essentially zero until the early 1980s, dipped into negative territory until 1991, when it was positive for a single year, and then plunged deeper and deeper into the negative range through 2006. Net saving has been declining as a share of gross saving in current prices, while depreciation has been rising. This reflects the shift in the composition of investment toward shorter-lived assets, including information technology equipment and software.

Gross investment rose slightly from 3.70 percent in 1948–73 to 3.87 percent in 1973–95 and jumped to 5.77 percent during the investment boom of 1995–2000 before dipping to 1.90 percent during 2000–06. The average from 1995–2006 was slightly higher than during the rest of the post-war period. Dramatic changes in the composition of gross investment took place after 1995. The contribution of private investment soared to 8.11 percent for 1995–2000 and then dropped sharply to 3.20 percent for 2000–06. This reflects the spectacular boom in investment after 1995. However, the rise in private investment was completely offset by a decline in the contribution of ROW investment, which sank from a positive 0.26 percent in 1973–95 to a negative 2.80 percent in 1995–2000 and a negative 1.67 percent in 2000–06.

By definition gross saving perfectly parallels gross investment. The contribution of depreciation has risen steadily throughout the post-war period, jumping sharply after 1995 as the composition of investment shifted toward short-lived assets. A different perspective on net saving is presented in Table 31, where the contributions of net saving and revaluation are combined to generate the change

TABLE 31

Contributions to Change in Wealth, 1948–2006

Change in Wealth	1948–2006	1948–1973	1973–1995	1995–2000	2000–2006
Change in wealth	4.36	3.76	2.89	3.11	13.21
Contribution of net saving	2.51	3.38	2.76	3.02	–2.31
Contribution of revaluation	1.85	0.38	0.12	0.09	15.52
Wealth	**1948–2006**	**1948–1973**	**1973–1995**	**1995–2000**	**2000–2006**
Wealth	2.75	3.74	2.17	2.40	1.04
Contribution of private tangible assets	2.53	3.12	2.00	2.58	2.02
Contribution of government tangible assets	0.50	0.62	0.38	0.42	0.45
Contribution of international position	–0.28	0.00	–0.21	–0.59	–1.42

in wealth. The contribution of revaluation was relatively modest until 2000, when the rapid asset price inflation in real estate led to a stunning leap to an average annual rate of 15.52 percent per year. The magnitude of this asset price inflation did not appear in the NIPAs and went almost unnoticed.[48]

Finally, Table 31 provides a decomposition of the growth of domestic wealth. The growth rate of domestic wealth attained a post-war high of 3.74 percent during 1948–73, before declining to 2.17 percent during 1973–95. Wealth grew at 2.40 percent during 1995–2000, but dipped to 1.04 percent in 2000–06. The contribution of the U.S. International Investment Position was essentially zero from 1948–73 before moving into the negative range, ultimately declining at 1.42 percent in 2000–06. Private tangible assets increased in relative importance throughout the period.

6. Summary and Conclusions

The first major innovation in the new architecture for the U.S. national accounts is the utilization of imputed rental prices for capital assets, based on the user cost formula introduced by Jorgenson (1963), for all productive assets in the U.S. economy. This is the key to integration of the NIPAs generated by BEA with the BLS productivity accounts. The price and quantity of capital services also provide a valuable link between the NIPAs and the revised 1993 SNA that will be released in 2008 and 2009. The second major innovation in the new architecture is the presentation of all accounts in both current and constant prices. This makes it possible to incorporate data on productivity and the level of living into the NIPAs and the revised 1993 SNA.

The new architecture challenges conventional views of the U.S. economy. First, investment is the most important source of U.S. economic growth and growth of labor input is next. Growth in productivity is a relative modest contributor to economic growth. Second, the precipitous drop in net saving after the dot-com crash of 2000 is the cause of genuine concern about the future growth of U.S. living standards. This decline is all but invisible in the U.S. national accounts. The change in wealth continued at a substantial clip, even after the dot-com crash. However, this change has been a consequence of the revaluation of assets, especially asset price inflation in real estate, rather than net saving. Asset revaluation is not presented in the NIPAs, which do not include a national balance sheet.

The implementation of a new architecture for the U.S. national accounts will open new opportunities for development of the U.S. statistical system. The boundaries of the U.S. national accounts are defined by market and near-market activities. An example of a market-based activity is the rental of residential housing, while a near-market activity is the rental equivalent for owner-occupied housing. The new architecture project is not limited to these boundaries. Under the auspices of the National Research Council, the Committee on National Statistics has

[48]Asset price inflation is compared for residential housing and common stocks by Case and Shiller (2003).

outlined a program for development of non-market accounts, covering areas such as health, education, household production, and the environment.[49]

New accounts for health and education could make use of new data sources, such as the American Time Use Survey (ATUS), recently instituted by BLS.[50] This survey provides detailed accounts for time use for the U.S. population. Jorgenson and Fraumeni have provided estimates of investment in human capital, including education.[51] An important part of investment in education is the value of time spent by students enrolled in educational programs. Since this time is not evaluated in the labor market, investment in education is outside the boundary of the national accounts, but could be included in non-market accounts.

The Jorgenson–Fraumeni estimates of education incorporate a detailed system of demographic accounts for the U.S. population.[52] This includes a breakdown of the population by age, sex, education, and labor force status. Employed members of the labor force are included in the labor database that underlies the prototype system of accounts developed by Jorgenson and Landefeld. Time spent in labor market activities is also included in the labor data base. Time spent in non-market activities, such as education, is included in the extended data base employed by Jorgenson and Fraumeni.

The National Health Expenditures Accounts generated by CMS could be extended to encompass non-market benefits of medical care, as proposed by Cutler and his collaborators.[53] The outcomes of medical treatments are evaluated in terms of reduced mortality and additions to quality-adjusted life years (QALYs). The quality of life is assessed through the measurement of symptoms, impairments, and chronic conditions and their relationships to health ratings. Increments to the health of the population could be used as a measure of the output of the medical sector. Since the valuation of reduced mortality and additions to quality-adjusted life years takes place outside the market, this is a very useful complement to the market-based accounts for health expenditures maintained by CMS.

The economic dimension of well-being is captured by the measure of expenditures in constant prices employed by Jorgenson and Landefeld. The availability of data on time use could facilitate the implementation of measures that incorporate social and psychological dimensions of well-being. For example, a System of National Well-Being Accounts has been proposed by Daniel Kahneman and Alan Krueger.[54] This is based on the Day Reconstruction Method in which time use is associated with domain-specific satisfaction. Measures of satisfaction can be compared over time and among groups of individuals to measure levels of well-being and their evolution over time.

BEA has recently extended the NIPAs to include a satellite account for investment in scientific research and development. Investment in software has been included in the core system of accounts since 1999. Corrado *et al.* (2006) have

[49]The NRC report in summarized by Abraham and Mackie (2006). The conceptual framework for non-market accounts is presented by Nordhaus (2006).

[50]See the BLS website for details about ATUS (BLS, 2008).

[51]See Jorgenson (1996) and Fraumeni (2001).

[52]See Land and McMillen (1981) for a system of demographic accounts for the U.S. population.

[53]See Cutler *et al.* (2006) and Jorgenson and Fraumeni (1996a, 1996b).

[54]See Kahneman *et al.* (2004) and Krueger (2008).

proposed a system of accounts for other intangible forms of investment.[55] They propose to include investments in scientific research and development and software, as well as minerals exploration, training of workers, advertising, and non-scientific research and development, such as the development of intellectual capital in the form of movies, music, and the like. Other than software and scientific research and development, none of these intangible investments is now included in the NIPAs or in a satellite system of accounts.

Finally, the EU KLEMS project has generated industry-level production accounts, like those presented by Jorgenson *et al.* (2005) for the U.S., for the economies of 25 EU members and other major U.S. trading partners such as Australia, Canada, Japan, and Korea. These data will greatly facilitate international comparisons and research into the impact of globalization on the major industrialized economies. Efforts are also underway to extend the EU KLEMS framework to important developing and transition economies, such as Brazil, China, India, and Russia. This will open new opportunities for research on the impact of globalization.

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[55]See Corrado *et al.* (2006).

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