

**PRODUCTIVITY MEASUREMENT WITHIN A NEW ARCHITECTURE**

**FOR THE U.S. NATIONAL ACCOUNTS: LESSONS FOR ASIA**

by

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**January 15, 2009**

**APO-Keio Lecture**

**Keio University**

**Tokyo, Japan**

# PRODUCTIVITY MEASUREMENT WITHIN A NEW ARCHITECTURE FOR THE U.S. NATIONAL ACCOUNTS: LESSONS FOR ASIA

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**Abstract.** 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. This paper outlines the measurement of productivity within the new system of U.S. national accounts. (JEL Classification: E01.)

This paper describes the measurement of productivity within a new architecture for the U.S. national accounts.<sup>2</sup> 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).<sup>3</sup> A second example is the United Nations' 1993 System of National Accounts (1993 SNA).<sup>4</sup> 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 fifty 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 economy.<sup>5</sup> In the meantime, the focus of U.S. monetary and fiscal policies has shifted from economic

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<sup>2</sup> I am much indebted to J. Steven Landefeld for his collaboration on an earlier phase of this research. Special thanks are due to Jon Samuels of Johns Hopkins University for excellent research assistance and very helpful comments. Financial support by the Alfred P. Sloan Foundation and the Donald B. Marron Fund for Research at Harvard University is gratefully acknowledged.

<sup>3</sup> The BEA's seven-account system is summarized in Jorgenson and Landefeld (2006).

<sup>4</sup> 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 Karen Wilson (2006).

<sup>5</sup> See Landefeld (2000) on the origins of the U.S. national accounts.

stabilization to enhancing the economy's growth potential.<sup>6</sup> 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.<sup>7</sup>

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.<sup>8</sup> 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. These depend on disparate trends in productivity

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<sup>6</sup> See Jorgenson, Ho, and Stiroh (2008) for an application of the new architecture in assessing the potential growth of the U.S. economy.

<sup>7</sup> The extensive documentation available for the U.S. national accounts, much of it on line, is described in Jorgenson and Landefeld (2006, pp. 107-109). A recent summary is provided in Landefeld, Seskin, and Fraumeni (2008).

<sup>8</sup> BEA and BLS measures of industry output have been compared in detail by Fraumeni, Harper, Powers, and Yuscavage (2006).

growth in key industries, such as information technology producers and intensive users of information technology.

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. This will require a new approach to productivity measurement.

## **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.<sup>9</sup> They present a prototype system that integrates the national income and product accounts with productivity statistics generated by BLS. 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 consistent way.

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 Albert Teplin, *et al.* 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.<sup>10</sup> 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.<sup>11</sup>

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

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<sup>9</sup> See Jorgenson and Landefeld (2006). An updated version is presented by Jorgenson (2009).

<sup>10</sup> The most recent annual update is presented by Bond, Martin, McIntosh, and Mead (2007).

<sup>11</sup> Details on the U.S. national accounts in 1993 SNA format are presented by Mead, Moses, and Moulton (2004).

account in current and constant prices required for productivity measurement within the new architecture.<sup>12</sup> 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 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. 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.<sup>13</sup> 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.<sup>14</sup> 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.<sup>15</sup>

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 constructing 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

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<sup>12</sup> 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).

<sup>13</sup> The BEA industry program is described by Lawson, Moyer, Okubo, and Planting (2006) and Moyer, Reinsdorf, and Yuscavage (2006).

<sup>14</sup> This is the subject of important research by Triplett and Bosworth (2004). An update is presented in Triplett and Bosworth (2006).

<sup>15</sup> See the Panel Remarks by Mesenbourg (2006) and Utgoff (2006).

(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 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. Paul Schreyer, head of national accounts at the OECD, has prepared an OECD Manual, *Measuring Capital*, that will be 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 21<sup>st</sup> Century Economy to the U.S. Secretary of Commerce, Carlos Gutierrez.<sup>16</sup> 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.<sup>17</sup>

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

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<sup>16</sup> The Advisory Committee on Measuring Innovation in the 21<sup>st</sup> 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.

<sup>17</sup> The Advisory Committee on Measuring Innovation in the 21<sup>st</sup> Century Economy (2008, p. 7).

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.<sup>18</sup>

In response to the Advisory Committee’s recommendations, BEA and BLS have produced a first set of estimates integrating multifactor productivity with the NIPAs. The results were 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 architecture.

The production account for the prototype system of accounts presented below is based on the gross domestic product (GDP) and gross domestic income (GDI) in current and constant prices. Multifactor productivity is the ratio of GDP to GDI in constant prices. Estimates of productivity are essential for projecting the potential growth of the U.S. economy, as demonstrated by Jorgenson, Mun Ho, and Kevin Stiroh (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.

The production account has been disaggregated to the level of 85 industries, covering the period 1960-2005 by Jorgenson, Mun Ho, Jon Samuels, and Kevin Stiroh (2007), [Industry Origins of the American Productivity Resurgence](#). The methodology follows that of Jorgenson, Ho and Stiroh (2005), [Information Technology and the American Growth Resurgence](#). This methodology conforms to the international standards established in the OECD *Productivity Manual* (2001).<sup>19</sup> 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.<sup>20</sup> For major EU countries this project includes accounts for 72 industries, covering the period 1970-2005.

A combined production account for Japan and the U.S. for 42 industries, covering the period 1960-2004, has been presented by Jorgenson and Koji Nomura (2007) in their paper, [The Industry Origins of the U.S.-Japan Productivity Gap](#).<sup>21</sup> The Japanese Industrial Productivity Data Base 2008 has been released by the Research Institute on Economy, Trade, and Industry.<sup>22</sup> This provides an industry-level production account for 108 sectors for the period 1970-2005. The JIP Data Base has been used for international

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<sup>18</sup> The Advisory Committee on Measuring Innovation in the 21<sup>st</sup> Century Economy. (2008, p. 8).

<sup>19</sup> See Schreyer (2001).

<sup>20</sup> The EU KLEMS project was completed on June 30, 2008. For further details see: [www.euklems.net/](http://www.euklems.net/). A summary of the findings is presented by Ark, O’Mahoney, and Timmer (2008).

<sup>21</sup> Additional details on the production account for Japan are given by Jorgenson and Nomura (2005), [The Industry Origins of Japanese Economic Growth](#).

<sup>22</sup> See Kyoji Fukao and Tsutomu Miyagawa (2008), JIP Data Base 2008, Tokyo, Research Institute on Economy Trade, and Industry, September.

comparisons as a part of the EU KLEMS project by Fukao and Miyagawa (2007), [Productivity in Japan, the US, and the Major EU Economies: Is Japan Falling Behind?](#)

The first step in implementing the prototype accounting system in Section 2 is to develop the production account in current prices 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 illustrates the application of the new architecture for the U.S. national accounts by considering the sources of U.S. economic growth. Section 5 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 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 Domestic Income and Product Account features gross domestic product (GDP) and gross domestic income (GDI), following the NIPAs. 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.<sup>23</sup> In each period the inputs 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.<sup>24</sup> Imputations for the services of consumer durables and durables used by nonprofit 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 nonprofit 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 nonprofit 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 nonprofit institutions is included. By imputing the value of these services and the net rent of government capital and real estate used by nonprofit 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,

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<sup>23</sup> This interpretation is developed by Jorgenson (1966), Jorgenson and Stiroh (2000), and Jorgenson (2001).

<sup>24</sup> 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.

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. 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 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 nonprofit 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.<sup>25</sup> 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.

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 Ann Lawson, *et al.* (2006), and Brian Moyer, *et al.* (2006). This can be combined with the measures of capital, labor, and intermediate inputs by industry

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<sup>25</sup> Details are provided by Jorgenson, Ho, and Stiroh (2005, pp. 201-290).

presented by Jorgenson, *et al.* (2005), to generate production accounts by sector.<sup>26</sup> The principles for constructing these production accounts are discussed by Fraumeni, *et al.* (2006).

### 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.

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:

$$qY = q_1Y_1 + q_2Y_2 + \cdots + q_mY_m.$$

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 Robert Parker (1997) provide a detailed exposition of the chained Fisher ideal price and quantity indexes employed in the NIPAs. Erwin 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

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<sup>26</sup> A system of production accounts for industrial sectors of the U.S. economy is given by Jorgenson, Gollop, and Fraumeni (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, Ho, and Stiroh (2005). Chapter 4, pp. 87-146, provides details on the construction of the time series of input-output tables.

provides a second-order approximation to an arbitrary technology (or preference system). A.A. Konus and S. S. 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.<sup>27</sup>

### ***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 3.

### ***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,

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<sup>27</sup> Additional details are given by Jorgenson and Landefeld (2006), pp. 66-68.

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.<sup>28</sup>

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 for 1948-2006 are given in table 4, along with employment, weekly hours, hourly compensation, and hours worked. Labor quality in table 4 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, Ho and Stiroh (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.<sup>29</sup> 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  $\delta$ , is a constant. 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<sup>30</sup>.

<sup>28</sup> Details are given by Jorgenson, Ho, and Stiroh (2005, pp. 201-290).

<sup>29</sup> Further details are given by Jorgenson, Ho, and Stiroh (2005, pp. 147-200).

<sup>30</sup> This assumption is employed by Jorgenson and Stiroh (2000), Jorgenson (2001), Jorgenson, Ho, and Stiroh (2005) and Oliner and Sichel (2000). Jorgenson, Gollop and Fraumeni (1987) had assumed that capital services were proportional to lagged capital stocks.

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 Charles Hulten and Frank Wykoff (1982).<sup>31</sup> 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 5.

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. Ellen Dulberger (1989) presents a detailed 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. Jack 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.<sup>32</sup>

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, re-classified computer software as investment<sup>33</sup>. 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 nonprofit institutions, non-farm non-corporate business, and non-farm corporate business prepared by Morris 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 value of farm land from the U.S. Department of Agriculture (2008) and data on government land and inventories

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<sup>31</sup> BEA efficiency profiles are discussed in Bureau of Economic Analysis (2008).

<sup>32</sup> 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.

<sup>33</sup> Moulton (2000) describes the 11<sup>th</sup> comprehensive revision of NIPA and the 1999 update.

from the Office of Management and Budget (2008).<sup>34</sup> 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.<sup>35</sup> 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,

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

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, nonprofit institutions, and government.<sup>36</sup> The relative proportions of capital stock by asset class for each sector for 2006 are given in table 6.

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<sup>34</sup> Eldon Ball of the USDA generously provided the data on farm land. Richard Anderson of OMB kindly provided the historical data on government land and inventories in electronic form.

<sup>35</sup> 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.

<sup>36</sup> A detailed derivation of prices of capital services for all five sectors is given by Jorgenson and Kun-Young Yun (2001).

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  $\pi_t$  is the rate of inflation in the acquisition price of new capital goods. This formula can be applied to government and nonprofit institutions by choosing an appropriate rate of return, as described below.<sup>37</sup> Given the rate of return for government and nonprofit 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 nonresidential structures, producer and consumer durables.

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.<sup>38</sup> 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.<sup>39</sup> The non-corporate rate of return is a weighted average of the rate of interest and the nominal rate of return on non-corporate

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<sup>37</sup> Alternative methods for imputing the rate of return to capital are reviewed by Schreyer (2008).

<sup>38</sup> Estimation of the labor compensation of the self-employed is discussed by Jorgenson, Ho, and Stiroh (2005).

<sup>39</sup> Details are given by Jorgenson and Landefeld, pp. 77-78.

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.<sup>40</sup> 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 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 7.

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 8. Multifactor productivity, also given in table 8, is defined as the ratio of GDP in constant prices to GDI in constant prices.<sup>41</sup> Growth in multifactor productivity 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.

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<sup>40</sup> Details are given by Jorgenson and Landefeld, pp. 79-83.

<sup>41</sup> This index of multifactor productivity conforms to the international standards presented in Schreyer (2001). For further discussion, see Jorgenson (2001).

#### 4. The Sources of Economic Growth.

An important application of the prototype system of accounts is the analysis of sources of U.S. economic growth.<sup>42</sup> The sources of growth are essential for assessing the growth potential of the U.S. economy. The sources of post-war U.S. economic growth require measures of output, input, and multifactor productivity from the Domestic Income and Product Account presented in table 8.

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 9 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 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

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<sup>42</sup> The international standards for aggregate growth accounting presented in Schreyer (2001) are discussed in detail by Jorgenson, Ho, and Stiroh (2005, pp. 17-58). The demise of traditional growth accounting is described by Jorgenson, Ho, and Stiroh (2005, pp. 49-58).

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 1973-1995 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.

## **5. 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 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, growth of labor input is next, and productivity is a relative modest contributor.

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 outlined a program for development of non-market accounts, covering areas such as health, education, household production, and the environment.<sup>43</sup>

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, Hulten, and Sichel (2006) have proposed a system of accounts for other intangible forms of investment.<sup>44</sup> 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 described above for the U.S., for the economies of 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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<sup>43</sup> The NRC report is summarized by Abraham and Mackie (2006). The conceptual framework for non-market accounts is presented by Nordhaus (2006).

<sup>44</sup> See Corrado, Hulten, and Sichel (2006).

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

## 1. PRODUCTION

Gross Domestic Product Equals

Gross Domestic Factor Outlay

## 2. DOMESTIC RECEIPTS

### AND EXPENDITURES

Domestic Receipts Equal

Domestic Expenditure

## 3. FOREIGN TRANSACTION CURRENT ACCOUNT

Receipts from Rest of World Equal

Payments to Rest of World and

Balance on Current Account

## 4. DOMESTIC CAPITAL ACCOUNT

Gross Domestic Capital Formation Equals

Gross Domestic Savings

## 5. FOREIGN TRANSACTION CAPITAL ACCOUNT

Balance on Current Account Equals

Payments to Rest of the World and

Net Lending or Borrowing

## 6. DOMESTIC BALANCE SHEET

Domestic Wealth Equals

Domestic Tangible Assets and

U.S. Net International Position

## 7. U.S. INTERNATIONAL POSITION

U.S.-Owned Assets Abroad Equal

Foreign-Owned Assets in U.S. and

U.S. Net International Position

# 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

## 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

# Table 3: 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

# Table 4: 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

## Table 5: 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	Nonresidential 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	Nonfarm 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

Table 6: Relative Proportions of Capital Stock by Asset Class and Sector, 2006

Line	Asset Class	Sector				Total
		Corporate	Noncorporate	Households	Government	
1	Consumer durables	-	-	0.070	-	0.070
2	Nonresidential 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	Nonfarm 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

## Table 7: 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
Noncorporate 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
Noncorporate 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 8: Domestic Income and Product and Productivity 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

## Table 9: 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