Blueprint for an Expanded and Integrated Set of Accounts for the United States

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Table of Contents

I. Introduction

The U.S. possesses some of the best-developed sets of economic accounts in the world. These accounts have been regularly updated and have served researchers and policy makers well. Certain components of these sets of accounts, however, were developed independently to meet differing policy and analytical needs. As a result, while the flow of funds and balance sheet accounts produced by the Federal Reserve Board (FRB), the productivity statistics produced by the Bureau of Labor Statistics (BLS), and the rest of the national accounts produced by the Bureau of Economic Analysis (BEA) are among the best in the world, they are not a completely comprehensive or fully integrated set of accounts. The lack of integration and problems of consistency have hampered analysis of such issues as the downtrend in personal saving and the sources of the improvement in growth and productivity in the latter half of the 1990's.

Longer standing issues also raise questions about the scope and structure of the nation's economic accounts. Since their inception, there have been suggestions to expand the scope of the accounts to include non-market activities. Simon Kuznets, one of the primary architects of the U.S. accounts, recognized the limitations of focusing on market activities and excluding household production and a broad range of other non-market activities and assets that have productive value or yield satisfaction. The need to better understand the sources of economic growth in the post-war era led to the development—much of it by academic researchers—of various supplemental series, such as investments in human capital.

More recently, some data users have suggested that the overall architecture of the accounts—which have been regularly updated throughout their history but whose basic structure has remained largely unchanged for over 50 years—needs to be reexamined. Alternative structures, such as ownership-based accounting for international transactions or macro accounts that are linked to micro accounts, are examples.

In this paper, we examine these issues and find that the existing accounts have served the nation well, but they have required continuing incremental updates, supplements, and reconciliation.[1] At this point in time, there is no need for a new paradigm but a comprehensive updating, extension, and integration of the accounts produced by BEA, BLS, and the FRB in coordination with the U.S. Census Bureau, a primary supplier of source data.

In the last section of the paper, we present a framework and set of estimates that build on the work of Jorgenson et al and on BEA's seven account framework and estimates introduced as part of BEA's 2003 benchmark revision of the national income and product accounts (NIPAs).

II. Measuring Economic Activity in the Market Sector

1. Introduction – Overview of Existing Sets of U.S. Accounts

The existing system of U.S. accounts are already interrelated through their use of and sharing of the same data. BEA has responsibility for most of the U.S. economic accounts, including the

[1] "We" is used to describe the cumulative work discussed in Christensen and Jorgenson (1996), Jorgenson and Fraumeni (1996a, 1996b), and Jorgenson, Gollop, and Fraumeni (1987) to build integrated accounts as well as the continuation of that work discussed in this article.

national income, product, and reproducible wealth accounts, the balance of payments and international investment position accounts, the GDP by industry and input-output accounts, the regional accounts, and a number of related accounts. These are estimated using Census, BLS, Internal Revenue Service (IRS), U.S. Treasury, FRB, and other data. FRB uses BEA's estimates of reproducible wealth, international balance of payment flows and positions, in combination with FRB estimates of domestic financial stocks and flows to produce the nation's flow of funds and balance sheets accounts. BLS uses BEA estimates of real output, investment, and capital and labor income as inputs into its aggregate, multifactor, and industry estimates of output and productivity.

BEA's NIPAs record the value and composition of national production as measured by expenditures and the distribution of incomes generated in producing that output. BEA's input-output and industry accounts measure national output by each industry's value-added to production, estimate each industry's gross output and intermediate inputs, trace the flow of goods and services among industries in the production process, and provide a detailed commodity breakdown of national production. BLS productivity estimates measure labor productivity, multifactor productivity, and related measures thereby providing a picture of each industry and labor, capital, and other inputs contributions to productivity growth.

BEA's wealth accounts measure stocks and changes in stocks of reproducible assets, while BEA's international investment position accounts measure international assets and liabilities and changes in these assets and liabilities. The FRB's flow of funds accounts detail the role of financial institutions and financial instruments in intermediating saving and investment and the changes in assets and liabilities across sectors that result. The FRB balance sheets record the distribution of these assets and liabilities at year-end.

BEA's supporting international accounts measure U.S. residents' transactions with the rest of the world and trace those transactions by types of goods and services, incomes, and transfers as well as by type of payment for those transactions. BEA's regional accounts disaggregate the national accounts by geographic area and provide many of the same types of information and serve the same purposes as the national accounts.

Taken together these sets of national accounts paint a comprehensive picture of economic activity. The system provides an interconnected set of accounts that measures the flow of current economic transactions (expenditures, incomes, and production), prices, and stocks of productive assets and wealth. The accounts are double-entry accounts that are linked to one another so as to give users an integrated and comprehensive picture of economic activity for macroeconomic monitoring, analysis, and decision making. In an evaluation conducted by the United Nations (UN) and the International Monetary Fund (IMF) in the late 1990's, the United States and Canada were the only countries to receive a rating of 6 out of 6 in terms of the completeness of their sets of accounts as specified by the internationally recognized System of National Accounts (SNA 1993). The U.S. accounts are also regarded as amongst the most accurate, up-to-date, and timely set of accounts (as measured by GDP revisions, incorporation of new measurement concepts and methods, and release of GDP data).

The three most commonly cited difficulties with the U.S. accounts have been: a) Incomplete integration, consistency, and gaps in the U.S. accounts that can for certain purposes reduce their analytic value; b) Inconsistency with the sectoring, structure, and presentation recommended by the SNA that reduces international comparability and analyses (a real problem when the U.S. economy is the benchmark and numeraire for cross-country comparisons); and c) Lack of expanded—and integrated—measures of economic activity (and welfare). A fourth and more recent complaint is that the U.S. accounts have moved ahead too fast in updating the concepts and methods to measure the U.S. economy, resulting in reduced comparability of the U.S. accounts with other nations that have been slower in updating their accounts.

2. BEA's NIPAs

While there are many summary statistics, accounts, and sub-accounts in the NIPAs and the SNAs, the best known is gross domestic product (GDP). GDP is an unduplicated measure of domestic production and can be measured in three ways: by final expenditures, by incomes earned in production, or by the production approach, which is measured residually by industry value-added (the value of gross output less the value of intermediate input). In concept, all three measures should be the same; in practice, they differ because they rely on incomplete and differing source data.

BEA prepares variants of all three of these measures of output. BEA's final expenditures-based estimate is GDP; the income-based measure are gross domestic income (GDI), nominal GDP by industry, and gross state product (GSP); and the production value-added estimates come from BEA's input-output accounts and real GDP by industry.

BEA's seven summary accounts in the NIPAs feature the GDP and GDI estimates and include quarterly and annual re-estimates in nominal and real terms. The NIPAs are a double-entry sets of accounts in which the use of resources (expenditure) recorded in one account for one sector are also recorded as a source of resources (receipt) in the account of another sector or, if it is an intra-sectoral transaction, in the same sector.

The first account is the domestic income and product account that shows the consolidated (unduplicated) production of all sectors of the economy as the sum of goods and services sold to final users on the right hand side of the account and the income generated by that production on the left side of the account. The other six accounts are consistent with, and map into, account 1 and provide additional detail on the aggregates presented in table 1. Each of these supporting summary accounts map into about 300 detailed supporting tables and sub-accounts.

Accounts 2 through 5 present the receipts and expenditures of the major sectors of the economy. The second account, for example, is the private enterprise income account that provides additional information on the sources of funds (receipts) to private companies and other business enterprises on the right hand side and information on the uses of those funds (payments) on the left hand side. Account 3 is the personal sector account (including households and nonprofit institutions serving households); account 4 is the government sector, and account 5 is the external, or foreign, sector.

Account 6, the domestic capital account, shows the sources of domestic saving and their use in domestic investment and capital transfers. Net borrowing from the foreign sector is the balancing item that fills the shortfall between domestic investment and domestic saving. Account 7 is the external, or foreign, sector capital account.

The United States has a rich set of monthly and quarterly indicators on both the income and expenditure side of the U.S. accounts. As a result, while the U.S. national accounts are benchmarked to the U.S. benchmark input-output accounts every five years, the expenditure and income estimates in the quarterly and annual NIPAs are estimated independently from the annual production (value-added) estimates of GDP by industry and input-output estimates, which are in turn are benchmarked to each other but estimated separately. The result is a set of interrelated accounts that are highly consistent with the current indicators of the economy normally associated with each set of estimates (such as the expenditure estimates and the current data from Census on trade sales, inventories, capital goods shipments, international trade, and corporate profits), which is very important to U.S. financial markets, business analysts, and planners who focus heavily on the most recent data.

Other countries—many with less current period indicators and direct measures—depend heavily on their input-output accounts to develop current period GDP and GDI estimates based on the production or value-added approaches. The result is a highly consistent set of national accounts, but one in which current period estimates are based on fixed proportions of value-added to gross output by industry. This method may often be inconsistent with direct measures of wages and profits or of final expenditures from monthly or quarterly indicators, which are likely to vary from month to month and quarter to quarter. Although lacking direct measures for these variables, it is often impossible to tell. Sometime after the initial estimates—often once-a-year—such countries balance their production accounts with their limited expenditure and income-based estimates.

The NIPAs are constructed in an independent fashion mainly because BEA believes that the quality of the U.S. source data for expenditures and income are, in general, superior to the value-added estimates (mainly due to inadequacies in the data on intermediate inputs). Clearly a better approach would be the joint estimation of the expenditure, income, and production (value-added) estimates using a methodology that weights the relative quality of the source data and methods used in each technique. This would produce a common and, presumabley, more accurate set of estimates that is balanced and consistent.

3. BEA's Other Flow Accounts

BEA international and regional accounts map into the NIPAs, providing further detail on the associated components that appear in the NIPAs. The concepts, source data, and methods used are in general consistent across the accounts, although there are still some differences, and reconciliation tables are available to cross walk differences. The remaining differences largely reflect the differing needs in these areas. These differences have been reduced over time, particularly in the international area, as a result of efforts to harmonize the IMF's balance of payments manual and the SNA.

4. BEA's Capital and Financial Accounts

BEA produces what the SNA describes as capital stocks. These estimates include real, current-cost, and historical-cost estimates of reproducible household, business, and government wealth, including opening and closing net stocks, investment flows, depreciation, average age, and valuation adjustments. The estimates are available by type of asset, by sector, and by industry. They are all consistent with the NIPAs.

BEA also produces capital and financial accounts as part of its international accounts. Within the balance of payments, the current account records flows of goods and services, income, and transfers, while the capital account records transactions related to tangible assets—such as the transfer of the assets of the Panama Canal to Panama. The financial account records changes in U.S. international assets and liabilities, and the international investment position displays the year-end levels for those assets and liabilities.

5. BLS Productivity Estimates

The NIPAs and the associated industry accounts contain many components of a production account, but they, like the SNA, lack a measure of capital services. The BLS multifactor productivity estimates address this gap and include estimates for the value of capital services based on implicit rental prices, as well as measures of labor services that adjust for differences in labor quality and measures of intermediate inputs, all within the structure of a neoclassical production function. The BLS multifactor productivity estimates build on the large body of work by U.S. researchers, notably Denison and later Jorgenson and his colleagues, that extended and reformulated the NIPAs in an attempt to better explain the sources of economic growth.[2] The BLS accounts follow in this tradition, and the estimates build upon and are largely consistent with the NIPAs.

6. FRB Flow of Funds and Balance Sheet Accounts

The NIPAs and BEA's wealth estimates contain stock and flow data on reproducible wealth by sector. BEA's balance of payments accounts contain stock and flow data on international financial assets and liabilities, but neither accounts contain data on domestic financial assets and liabilities. The FRB takes these data and adds estimates on domestic financial assets and liabilities and changes in those balances. The flow of funds and balance sheet accounts are generally consistent with the NIPAs, the balance of payments accounts, and the wealth accounts and cover most of the economy.

7. Overview of the International System of National Accounts

The SNA is a highly articulated integrated accounts structure that is the international guideline for national accounts around the world. The accounts are jointly sponsored by the UN, IMF, the Organization for Economic Cooperation and Development (OECD), and the European Union (EU). As shown in table 2, they present flow and stock information similar to that presented in the U.S. accounts. The structure of the SNA differ from the U.S. accounts mainly

[2] See Denison (1967), Jorgenson (1996b), and Christensen and Jorgenson (1996).

with respect to their focus on the production account, their degree of consolidation, and their sectoring.

Whereas the U.S. accounts feature GDP as measured by the expenditure approach, the SNA structure features value-added measurement as estimated by the production approach. Like the NIPAs, it then details the distribution of the incomes earned in production by sector and details the sources and uses of those funds. The familiar GDP as measured by C+I+G+(X-M) is not presented except in a disaggregated fashion in the auxiliary goods and services transactions accounts. In practice, while most countries (as described above) use the production approach in estimating value-added output and GDP, when reporting national accounts estimates and GDP estimates, countries—and organizations including the UN, OECD, and IMF in their presentations of the national accounts—feature GDP and its expenditure components, which are balanced to their production-based estimates. Also, most countries do not produce the highly detailed information specified by the SNA.

The U.S. accounts differ from the SNA in that they are more consolidated. The SNA, for example, presents households incomes in several separate accounts (generation of income, allocation of primary income, secondary distribution of income, redistribution of income, and use of income accounts). In NIPA account 3, the personal income and outlay account, all sources of personal income are consolidated. For example, wages, salaries, dividends, taxes, and transfer payments are all included in the consolidated personal income and outlay account. There are also counter entries for these transactions in the other sectoral accounts (private enterprise, government, and foreign).

Finally, the U.S. accounts differ from the SNA in sectoring. The SNA, for example, breaks out nonprofit institutions serving households (NPISH) from households. The U.S. accounts are moving in this general direction, in this area, with the introduction of such a separation in the 2003 comprehensive revision. BEA introduced separate estimates of the income and outlays of the households and of the NPISHs. However, in other areas, institutional arrangements in the United States suggest that the U.S. definitions are better suited for the U.S. than the SNA.

8. Evolution of the U.S. National Income and Product Accounts (NIPAs): Responses to Changes in the Economy and Policy Needs

Prior to the development of the NIPAs, policymakers had to guide the economy using limited and fragmentary information—such as stock prices, freight car loadings, and incomplete indexes of industrial production—about the state of the economy. The Great Depression and the growing role of government in managing the economy underlined the problems of incomplete data and led to the development of the national accounts.

In response to the lack of economic data in the 1930's, the Department of Commerce commissioned Nobel laureate Simon Kuznets of the National Bureau of Economic Research (NBER) to develop a set of national economic accounts. Professor Kuznets headed a small group within the Bureau of Foreign and Domestic Commerce's Division of Economic Research. Professor Kuznets coordinated the work of researchers at the NBER in New York and his staff at

Commerce. The original set of accounts was presented in a report to Congress in 1937 and in a research report, *National Income, 1929–35*.

Early in 1942, annual estimates of gross national product were introduced to complement the estimates of national income and to facilitate wartime planning. Wartime planning needs also helped to stimulate the development of input-output accounts. Nobel laureate Wassily Leontief developed the U.S. input-output accounts that subsequently became an integral part of the NIPAs. In commenting on the usefulness of the national accounts, Wesley C. Mitchell, Director, National Bureau of Economic Research, said: "Only those who had a personal share in the economic mobilization for World War I could realize in how many ways and how much estimates of national income covering 20 years and classified in several ways facilitated the World War II effort."

Over time, in response to policy needs and changes in the economy, the accounts have been expanded to provide quarterly estimates of GDP and monthly estimates of personal income and outlays, regional accounts, wealth accounts, industry accounts, and expanded international accounts.

In the 1940's, World War II planning needs were the impetus for the development of product or expenditure estimates (gross national product). By the mid-1940's, the accounts had evolved into a consolidated set of income and product accounts, providing an integrated birds-eye view of the economy. In the late 1950's and early 1960's, interest in stimulating economic growth and in the sources of growth led to the development of official input-output tables, capital stock estimates, and more detailed and timely state and local personal income estimates. In the late 1960's and 1970's, accelerating inflation prompted the development of improved measures of prices and inflation-adjusted output.

In the 1980's, the internationalization of trade in services led to an expansion of the estimates of international trade in services in the NIPAs. In response to rapid technological innovation and the increasing importance in computers—and problems in measuring their prices—BEA did pioneering work with IBM in the development of quality-adjusted price and output measures for computers. In the 1990's, BEA introduced more accurate chain-weighted measures of prices and inflation-adjusted output, developed estimates of investments in computer software, and incorporated updated measures of high-tech products and banking output.

BEA has continued to update its accounts in recent years, developing more accurate measures of changing aspects of the economy ranging from finance and insurance to corporate profits and pensions. BEA has worked to improve the accuracy, expand the scope, and improve the timeliness of BEA's industry (production-based) accounts. Finally, BEA has—as noted above—changed the basic national accounts structure to increase international comparability and to provide expanded information in an easier to use format.

In general, most observers reviewing the history of the accounts have concluded that the basic structure and concepts are sound and that the Department of Commerce and BEA have done a good job of updating the accounts to keep pace with changes in the economy and in

policy needs. As Federal Reserve Board Chairman Alan Greenspan said in reviewing the history of the accounts:

"..the Department of Commerce has treated the national income accounts, and specifically the GDP, as living documents; that is, an endeavor to recognize that the American economy is continuously changing. Its nature is being altered by technology and all sorts of other institutional effects. And as a result, how one measures the notion of what is the market value of goods and services produced, of necessity, has been changing over the years. And I must say that it is really quite impressive the extent to which the Department of Commerce has been able to keep up with the various changes that have evolved."[3]

9. Remaining Challenges

Although over time the accounts have mainly addressed users needs, there have been gaps relating to scope, integration, and non-market goods and services. As economists attempted to chronicle and analyze the sources of economic growth in the post-WWII era, it became clear that important sources of economic growth were omitted from the accounts. Using the national accounts data on income shares, investment, and other information, Denison, Jorgenson and other researchers built a rich set of data and analytical findings on the sources of economic growth. As noted above, the BLS multifactor productivity estimates built upon this important work and developed a comprehensive and consistent official framework and data set for the analysis of productivity growth.

The BEA NIPA and industry account data and the BLS productivity data are widely used to study economic growth, productivity, and structural change. The general picture of economic activity is consistent regardless of which data sources are used, but there are some differences. These differences largely arise from the different purposes for which the data are constructed, which are reflected in agency choices on methodology, coverage, and index number procedures.

For example, within the BEA sets of accounts, the current period NIPAs, as noted above, are—except for benchmarking—estimated independently from the annual production-based input-output accounts and GDP by industry. This independence reflects decisions about the focus of each of the accounts, the quality of the underlying source data, and the need for each set of accounts to be consistent with its own set of methods and current indicators—Census data in the case of the input-output accounts and income data in the case of the GDP by industry accounts. The result is a set of accounts that are less accurate and consistent than they might otherwise be and one that presents differing results to researchers depending on which account's data is used. Examples include uncertainty in budgeting, monetary policy, and business planning or analyses of sources of growth across industries during the latter half of the 1990's when trend growth using the income approach exceeded that derived using the expenditure approach.[4]

The further differences between BEA and BLS data also reflect differences in the focus of each series. BEA strives to provide complete and consistent coverage of the entire economy in

[3] December 7, 1999 press conference in Washington, DC. Full remarks were reprinted in Landefeld (2000).
[4] See for example the Council of Economic Advisers (1997), Office of Management and Budget (1997), and Congressional Budget Office (1997).

the NIPAs, whereas BLS primarily seeks to achieve maximum reliability in its various measures of productivity. These differing goals are not necessarily inconsistent with one another, since both require reliable output and input measures, but they can lead to differences in definition and coverage as well as in methodology. BEA covers all industries, even those for which output measures are sometimes at best tenuous. BLS, on the other hand, can focus on those industries for which measures are quite robust.

Part of the differences, especially at detailed industry levels, also reflects different choices for underlying source data and aggregation techniques. For example, BEA uses a Fisher index-number formula to aggregate components of the NIPAs price and quantity indexes consistently, decomposing the nominal change in GDP. BLS, on the other hand, uses a Tornquist index to aggregate components of its multifactor productivity accounts because it is an exact and superlative index that matches the econometric and statistical properties needed for multifactor productivity analysis. Until the recent NIPA comprehensive revision, moreover, BEA and BLS defined the business sector differently to suit their particular needs.

The differences remaining between the BEA and BLS estimates have led many researchers to construct their own measures, particularly for studying the "new economy" of the late 1990's. Results of these studies have sometimes differed significantly, depending partly on data sources and the level of detail provided, leading to differing interpretations of the sources of productivity growth. For example, Nordhaus (2002) found faster labor productivity growth for the non-farm business sector using BEA's value-added by industry data rather than the official BLS measure. Baily and Lawrence (2001), also using BEA's value-added by industry data, and Stiroh (2002), using BEA's gross output by industry data, concluded that the post-1995 productivity acceleration had spread from information technology (IT) producing industries to IT-using industries. Gordon (2001), however, questioned whether such a spillover actually occurred after finding conflicting evidence from several BEA and BLS output measures. Bosworth and Triplett have documented how productivity estimates may differ significantly for broad sectors (Triplett and Bosworth 2003) and for individual industries (Bosworth 2003a and 2003b) depending upon whether BEA or BLS data are used. These differences can hinder integrated analysis of the sources of productivity growth. Divergences in the data force researchers to either choose one set of estimates over the other, or to develop their own estimates.[5]

Similar issues arise regarding differences between BEA's and the FRB's measures of saving and each agencies' measure of wealth stocks. BEA's and the FRB's measures of saving and wealth stocks are developed in concert, and taken as a whole, they both provide consistent and integrated information on trends in saving and wealth. There are, however, differences between the two series and issues in reconciliation. Similar to the differences between the BEA and BLS, many issues relate to the different purposes for which the data are used. For example, the FRB definition of saving includes saving in the form of purchases of consumer durables. The NIPAs do not, largely because this definition would logically require the treatment of consumer durables as investment and require the estimation of the capital services from these consumer durables, as well as the further step of a full household production account that measures household labor as well as capital services.

[5] Jorgenson, Ho, and Stiroh (2004) use a hybrid of BEA and BLS data to construct estimates of productivity.

These and other statistical and methodological differences between the two agencies data have led economists to estimate their own series to analyze the decline in U.S. saving over the last decade. Gale and Sablehaus (1999), for example, made adjustments to the BEA and FRB data that showed that by their adjusted measures, saving had fallen less than the official measures and the sectoral composition of the decline was different. Their analysis also underlined the importance of an integrated presentation of saving, capital gains, and other changes in household wealth.

In addition to pointing to the need to better harmonize and integrate the nation's accounts, research on the sources of economic growth highlighted the need to expand the scope of the accounts to include important, but difficult to measure sources of economic growth, including human capital (Jorgenson and Fraumeni, 1996a), research and development (Christensen and Jorgenson 1996), and natural resources (Wright 1990).

III. Measuring Economic Activity in the Non-market Sector

1. Economic vs. Welfare Accounts

Since the founding of the U.S. national accounts, there has been an ongoing debate regarding the treatment of natural resources and the environment, as well as the treatment of a whole set of broader welfare-based measures of economic and social progress. One school, exemplified by Kuznets (1946), favored development of a much broader set of welfare-orientated accounts that would focus on sustainability and address the externalities and social costs associated with economic development. Another, exemplified by Jaszi (1971), insisted that the national accounts must be objective and descriptive and thus based on observable market transactions. Jaszi felt that, conceptually, the accounts should be extended to treat the economic discovery, depletion, and stocks of natural resources symmetrically with plant and equipment and other economic resources. The absence of observable market transactions and the subjectivity associated with such estimates led him to conclude, however, that they should not be included in the accounts.

In the 1960's and early 1970's another more environmentally focused move to broaden the accounts arose out of concern about environmental degradation and fears that the world was running out of resources and approaching the "limits to growth."[6] Externalities associated with economic growth also prompted renewed interest in broader social accounting. Work by Nordhaus and Tobin (1973), among others, on adjusting traditional economic accounts for changes in leisure time, disamenities of urbanization, exhaustion of natural resources, population growth, and other aspects of welfare produced indicators of economic well-being. However, the seemingly limitless scope, the range of uncertainty, and the degree of subjectivity involved in such measures of non-market activities limited the usefulness of and interest in these social indicators. It was felt that inclusion of such measures would sharply diminish the usefulness of traditional economic accounts for analyzing market activities. Attention subsequently focused on more readily identifiable and directly relevant market issues, such as the extent to which expenditures that relate to the protection and restoration of the environment (and other so-called defensive expenditures) are identifiable in the economic accounts.

[6] See Meadows et al (1972) which summarizes the running out of resources. In addition, Nordhaus and Tobin (1973) discuss the broader issue of the measurement of economic growth.

2. Satellite Accounting

The development of the UN system of environmental and economic accounting (SEEA) and the use of supplemental, or satellite, accounts went a long way towards resolving the long-standing impasse between those who advocated broader sets of accounts and those concerned with maintaining the usefulness of the existing economic accounts. The supplemental accounts allowed conceptual and empirical research to move forward with estimates that can be linked to the existing accounts without diminishing their usefulness.

The SEEA is a flexible, expandable satellite system. It draws on the materials balance approach to present the full range of interactions between the economy and the environment. The SEEA builds on, and is designed to be used with, the SNA.

3. Integrated Environmental Satellite Accounts (IEESA)

In the 1980's, BEA presented a prototype integrated economic and environmental satellite account (Landefeld, Carson, et al 1994). In constructing this account, BEA built on several key lessons from the social accounting experience of the 1970's and on the framework of the SEEA. First, such accounts should be focused on a specific set of issues. Second, given the kind of uses to which the estimates would be put, the early stage of conceptual development and the statistical uncertainties (even if the estimates are limited to the environment's effects on market activities), such estimates should be developed in a supplemental, or satellite, framework. Third, such accounts should not focus on sustainability or some normative objective but should cover those interactions that can be tied to productive market activities and valued using market values or proxies thereof. Fourth, in keeping with the focus of the existing accounts, the supplemental accounts should be constructed in such a manner as to be consistent with the existing accounts and thus allow analysis of the effects of the interactions between the environment and the economy on production, income, consumption, and wealth. Tables 3 and 4 show the structure of the accounts.

The existing economic accounts do not provide normative data and neither did the integrated economic and environmental account developed by the BEA. The IEESAs were designed to either report market values or proxies for market values. If a problem with property rights leads to the under-evaluation and overexploitation of a resource, a set of integrated economic accounts will not reveal the right price or the correct level of stocks. However, they will provide the data for objective analysis of the problem for items such as the changes in the value of stocks or the share of income to be attributed to a resource.

In accordance with the first criterion, BEA limited the IEESAs to those interactions that directly affected the economy and are thus relevant to the objective of economic accounts. From this standpoint, the environment can be thought of as consisting of a range of natural resource and environmental assets that provide an identifiable and significant flow of goods and services to the economy. The economy's uses of these productive natural assets and the goods and services they provide can be grouped into two general classes. When use of the natural asset permanently or temporarily reduces its quantity, this is viewed as involving a flow of a good or

service, and the quantitative reduction in the asset is called depletion. When use of the natural asset reduces its quality, the qualitative reduction in the asset is called degradation. However, the use of natural assets describes only part of the interaction between the economy and the environment. There are also feedback effects, such as the reduction in the future yield of crops, timber, fisheries etc. from current pollution or overharvesting. Materials balance and energy accounting highlight both the use of the natural assets and the feedback effects from the use; thus, they capture the full interaction between the economy and the environment. In the case of environmental assets, feedback is more complicated, with effects that often fall on other industries and consumers.

Integrated economic and environmental accounting aims to provide a picture of the interactions between the economy and the environment, including uses or resources and feedback effects. However, while this picture has numerous elements and is complex, by definition it does not cover many of the transformations and interactions within the environment itself, for example, the disposal of waste products from wild fish and mammals or the conversion of natural carbon dioxide into oxygen by plant matter on land and in the oceans.

Compliance with the first criterion resulted in prototype accounts that were objective, rather than normative. They would describe activities which bear upon the market in the monetary terms of the market, without implying any conclusions about whether the reflected situation is ”right.”

In accord with the second criterion, the IEESAs had two main structural features. First, natural and environmental resources are treated like productive assets and only the economically productive aspects of the resources are considered. These resources, along with structures and equipment, were treated as part of the nation's wealth, and the flow of goods and services from them is identified and their contribution to production measured. Second, the accounts were designed to provide substantial detail on expenditures and assets relevant to understanding and analyzing the production process. Fully implemented IEESAs would have permitted identification of the economic contribution of natural and environmental resources by industry, by type of income, by product, and ultimately by region.

BEA's decision to treat natural and environmental resources like productive assets in the IEESAs was based on their similarity to man-made capital for labor and materials in that they are devoted to producing fixed assets and then yield a flow of services over time. Inventories, on the other hand, are stocks held pending further processing, sale, delivery, or intermediate use.

The distinction between fixed assets and inventories is not always clear. Proved mineral reserves may seem to be similar to inventories they are a set number of units waiting to be used up in production. Yet, they also fit the classic characteristics of fixed capital expenditures in that materials and labor are needed to produce (“prove”) them, and they yield a stream of product over long periods of time. Further, like a fixed asset such as a machine, the number of units extracted from a new mine or field is uncertain and varies over time and over the service life used up in production. Finally, the treatment of mineral reserves as fixed assets serves equally well as a reminder of the reproducibility of proved reserves.

The valuation basis for the IEESAs was market prices or proxies thereof. While alternative methods such as maintenance cost and contingent valuation have attractive theoretical characteristics, they are not appropriate for BEA 's purpose, and the associated practical difficulties outweigh their pluses. In keeping with the goals and criteria stated above, market pricing was the optimal choice for the IEESAs. First, market pricing maintains objectivity by avoiding the biases that may be inherent in "willingness to pay" surveys. Second, market pricing is consistent with conventional accounts, as well as the SEEA, and facilitates international comparability. Finally, market pricing is consistent with the limits placed on included interactions because it values those interactions from the perspective of the market.

4. Other Supplemental Accounts

In addition to the IEESAs, BEA has developed satellite accounts in a number of other areas including household production (Landefeld and Howell 1997), research and development (Fraumeni and Okubo 2004), tourism (Okubo and Planting 1998), transportation (Fang, Han, Okubo, and Lawson 2000), and ownership based accounts for international transactions (Landefeld, Whichard, and Lowe 1993). These have all been developed in the context of satellite, or supplemental accounts, so as not to reduce the usefulness of the existing accounts. They have also employed the same principles as the IEESAs, including consistency with economic theory and the existing accounts, valuation using market prices or proxies thereof, and limitation of the scope to productive economic activities.

IV. What is Now Required

1. Building on and Extending the Existing Accounts

The foregoing review of the existing accounts suggests that while over the years they have served users well, there is a need to update, integrate, and extend the accounts. This section lays out a possible blueprint for revamping the accounts that builds upon the work of Jorgenson et al, the new seven-account NIPA framework, and estimates presented in the 2003 benchmark revision of the NIPAs. While the prototype framework and estimates that we present below do not explicitly include non-market extensions to the accounts, it can—as outlined in Jorgenson and Fraumeni (1996a, 1996b)—be extended to near market and non-market sectors. Building on the lessons of the past, any such extension to include more determinants of social welfare should be in the form of satellite, or supplementary, accounts. These accounts should then focus on non-market goods and services that contribute to production, that can be valued in market prices, or proxies thereof, and that are consistent with the economic concepts laid out in the existing accounts and the prototype outlined below.

2. Blueprint for a Complete Accounting System

A complete accounting system includes a production account, incorporating data on output and factor input, an income and expenditure account, giving data on factor income, expenditure, and saving, and an accumulation account, allocating saving to various types of capital

formation.[7] In addition, a national balance sheet contains data on national wealth from both asset and liability points of view. Although the separation of changes in accounting magnitudes into price and quantity components is fundamental to the evaluation of economic performance, only the measurement of real product and real assets is well established in accounting practice.

In this section we present an accounting system for the U.S. economy in current and constant prices. Although it would be desirable to provide a breakdown by industrial sectors, our presentation is limited to national aggregates. The basic framework consists of a production account, a consolidated income and expenditure account, an accumulation account, and a balance sheet for the domestic sector. We present a parallel set of income and expenditure, accumulation, and balance sheet accounts for the rest of the world.

The fundamental accounting identity for the production account is that the value of output is equal to the value of input. Changes in these values can be separated into price and quantity components. Productivity, defined as the ratio of real output to real factor input, is a summary measure of performance. The interpretation of real product, real input, and productivity requires the notion of a production possibility frontier.[8] In each period the inputs of factors of production are transformed into outputs.

For the consolidated income and expenditure account the fundamental accounting identity is that receipts are equal to outlays plus saving. Receipts, outlays, and saving can be separated into price and quantity components. The interpretation of real receipts and outlays requires the notion of a social welfare function.[9] An extended description of the determinants of social welfare would include all "goods" and "bads" relevant to social choice. The "goods" would include deliveries to final consumption and the "bads" would include deliveries of labor services. Evaluation involves comparisons of "wealth-like" magnitudes.[10]

The first step in implementing an accounting system is to develop accounts in current prices. In section 3 we present production, income and expenditure, accumulation, and wealth accounts for the U.S. economy for 1948–2002. In section 4, we introduce accounts in constant prices with a description of index numbers for prices and quantities. In section 5, we extend the perpetual inventory method, familiar from national wealth accounting, to prices as well as quantities. Our accounts in constant prices begin with the production account in section 6. The product side includes consumption and investment goods output in constant prices. The factor outlay side includes labor and capital input in constant prices. The ratio of real product to real factor input is total factor productivity.

In section 7, we give income and expenditure, accumulation, and wealth accounts in constant prices for the U.S. domestic economy and the rest of the world. Consolidating the income and expenditure accounts for household, business, and government sectors, we obtain a single account giving income and its disposition. We conclude with possible extensions of the

[7]For a detailed description of a complete accounting system, see United Nations (1993).
[8]This interpretation is developed by Jorgenson and Stiroh (2000) and Jorgenson (2001).
[9]This interpretation is developed by Samuelson (1961), and many others; detailed references to the literature are given in Samuelson (1961, pp. 44–52).
[10]See Samuelson (1961, pp. 53–56).

accounting framework in section 8. The education sector of the economy, largely public rather than private, could be incorporated by compiling data on educational investment, capital and labor inputs used in the education sector, and the stock of human capital.[11] Similarly, research and development, now treated as a current expense, could be capitalized.[12]

Many other extensions of our accounting framework can be suggested. Activities internal to the household and government sectors could be incorporated by making imputations for non-market activities. Accounts for the education sector could serve as a prototype for health accounts. A different range of extensions, not discussed in section 8, would involve accounts in constant prices for industrial sectors. The production account could be disaggregated to provide inter-industry accounts in constant prices.[13] Similarly, accumulation and wealth accounts could be disaggregated to yield flows of funds.

We can contrast our approach with the United Nations System of National Accounts (SNA 1993). Despite the self-imposed limitations of our accounting system, focusing on national aggregates of transactions included in existing systems, our accounts differ from current practice. In comparing our system with the available alternatives we focus on these differences. The basic similarities between our approach and current accounting practice can be recognized through the heavy reliance we have placed on data from the benchmark revision of the U.S. national accounts published in December 2003.

3. Income and Wealth

3.1 Introduction

The measurement of income and wealth requires a system of seven accounts. The Domestic Income and Product Account presents data on the output of the producing sector and the outlay of that sector on factor services. Incomes and expenditures are divided between two accounts – Domestic Receipts and Outlays 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 Domestic Balance Sheet and the U.S. International Position.

The Foreign Transactions Current Account, the Foreign Transactions Capital Account, and the U.S. International Position are provided by the Bureau of Economic Analysis (BEA). The Domestic Income and Product Account and the Domestic Capital Account are similar to the corresponding accounts of the U.S. National Income and Product Accounts (NIPA).The Domestic Receipts and Outlays Account consolidates accounts for domestic household, business, and government sectors in the U.S. national accounts.

Domestic Receipts include income from the Domestic Income and Product Account, income receipts from the rest of the world less income payments to the rest of the world, and net current taxes and transfers to the rest of the world. Domestic Outlays include personal consumption

[11]See, for example, Jorgenson and Fraumeni (1996a, 1996b) and Fraumeni (2001).
[12]See, for example, Fraumeni and Okubo (2004).
[13]A system of production accounts for industrial sectors of the U.S. economy is given by Jorgenson, Ho, and Stiroh (2004).

expenditures, government consumption expenditures, and gross saving from the Domestic Capital Account. Personal and government expenditures exclude purchases of durable goods, but include capital services from the accumulated stocks.

The Domestic Capital Account includes gross domestic investment, capital transfers to the rest of the world, and net lending. Investment includes personal and government purchases of durable goods. This is balanced against gross saving and the statistical discrepancy. The account also contains revaluations of domestic assets and the change in domestic wealth from period to period. The Foreign Transactions Capital Account equates the balance on current account to net lending plus capital transfer payments to the rest of the world. This account also contains revaluations of existing claims on foreigners and the change in these claims from period to period.

Finally, the Domestic Balance Sheet gives tangible assets of household, business, and government sectors, including stocks of personal and government durables, as well as net claims on foreigners. The U.S. International Position provides detail on net claims on foreigners. The Flow of Funds Accounts, produced by the Board of Governors of the Federal Reserve System, include balance sheets for households and nonprofit organizations, non-farm, non-financial corporate business, and non-farm, non-corporate business. The U.S. Department of Agriculture provides a balance sheet of agriculture, including the farm sector.

3.2. Production Account

The Domestic Income and Product Account presents data on the values of output and input. As an accounting identity, these values are equal. The two sides of the production account are linked through production of investment goods and compensation for capital services. Investment goods enter the change in wealth through capital formation. The capital services from this wealth generate property compensation. Investment goods output and property compensation must be defined consistently.

In the U.S. National Income and Product Accounts, the domestic product is divided among services, non-durable goods, durable goods, and structures. The output of services includes the services of owner-occupied dwellings and depreciation on government capital. The output of durables includes consumer durables and producer durables used by governments and nonprofit institutions. The output of structures includes the production of government structures and new residential housing.

In the U.S. national accounts, the value of the services 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 capital consumption allowances. 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 in the national accounts, while net rent on this capital is excluded.

We implement the production account for the U.S. domestic economy, including business, household and government sectors.[14] To preserve consistency between the investment goods production and property compensation we introduce imputations for the services of consumer durables and durables used by nonprofit institutions, as well as the net rent on durables used by government and government and institutional real estate. The services of these assets are included in the output of services, together with the services of owner-occupied dwellings; both appear in property compensation as well. This assures that the accounting identity between the values of output and input is preserved.

We distinguish between taxes charged against revenue, such as excise or sales taxes, and taxes that are part of the outlay on factor services, such as property taxes. We exclude output taxes from the value of output, since these taxes are not included in proceeds to the sector. However, we include taxes on input, since these taxes are included in the outlay of the sector. 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, we exclude excise and sales taxes, business non-tax payments, and customs duties from the value of output and include other indirect business taxes plus subsidies. Our concept of output is intermediate between output at market prices and factor cost, as these terms are conventionally employed. Output at market prices includes all indirect taxes in the value of output; output at factor cost excludes all indirect taxes. The production account for 2002 is given in table 5.

Factor outlay includes income originating in private enterprises and private households and institutions, as well as income originating in government. We add the imputed value of consumer durables, producer durables utilized by institutions, and the net rent on government durables and real estate and institutional real estate, together with indirect taxes included in factor outlay. Factor outlay also includes capital consumption allowances and the statistical discrepancy. Capital consumption allowances are part of the rental value of capital services. The value of gross domestic factor outlay for 2002 is presented in table 5.

Product and income accounts are linked through capital formation and property compensation. To make this link explicit we divide the total product between consumption and investment goods and total factor outlay between labor and property compensation. Investment goods production is equal to the total output of durable goods and structures included in the gross domestic product. Consumption goods production is equal to the output of non-durable goods and services in the domestic product, plus our 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.

The value of outlay on capital services 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. The value of labor input

[14]Our estimates are based on those of Jorgenson (2001), updated through 2002 to incorporate data from the 2003 benchmark revision of the U.S. national accounts.

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. We estimate this compensation from the incomes received by comparable categories of employees. Gross domestic product, divided between investment and consumption goods output, and gross domestic factor outlay, divided between labor and property compensation, are given for 1948-2002 in table 6.

3.3 Income and Expenditure Accounts

The Domestic Receipts and Outlays account consolidates data on receipts and outlays of household, business, and government sectors of the U.S. economy. As an accounting identity income is equal to the sum of outlays on consumption and gross saving. The two sides of the account are linked through receipts of property-type income and the accumulation of capital that results from gross saving. Property income and saving must be defined in a consistent manner.

Domestic receipts include Gross Domestic Income from the production account, plus income receipts from the rest of the world, less income payments to the rest of the world and net current taxes and transfers to the rest of the world. Domestic outlays comprise personal consumption expenditures and government consumption and gross saving. Personal and government consumption exclude purchases of durables, but include the capital services generated by stocks of these durables.

Four income and expenditure accounts appear in the U.S. National Income and Product Accounts. The Private Enterprise Income Account gives national property income, net of consumption of fixed capital. The net operating surplus of private enterprises plus the consumption of fixed capital is equal to private domestic capital input. This is the source of private domestic enterprise income. The uses of this income can be allocated among corporate, non-corporate, and household capital inputs. The Private Enterprise Income account also includes income receipts from foreign assets and income payments to foreign owners of domestic assets.

The U.S. National Income and Product Accounts also include income and expenditure accounts for households, as well as the government and rest of the world sectors. Personal Income excludes undistributed corporate profits, a component of gross saving. Personal Income also excludes corporate taxes, but both labor and property income include the personal taxes that appear as part of Personal Outlay. This could be implemented by incorporating labor income from the production account and reducing property income by the value of corporate taxes and undistributed corporate profits.

The Government Receipts and Expenditures Account from the national accounts excludes government fixed investment and the net rent on government capital. This account includes government receipts, as well as government consumption and net government saving. The account could be augmented by incorporating the services of government capital and government fixed investment. Finally, the national accounts include the Foreign Transactions Current Account presented below. By consolidating receipts and expenditures for domestic and rest of the world sectors we could generate an account for the U.S. national economy.

We implement the Domestic Receipts and Outlays Account for the U.S. domestic economy. We define Domestic Receipts as proceeds from the sale of factor services from the production account, plus income receipts from the result of the world, and less income payments and net current taxes and transfers to the rest of the world. We define Domestic Outlays as personal and government consumption expenditures from the production account plus gross saving. These consumption expenditures exclude purchases of durable goods, but include the services of accumulated stocks of these durables. The value of gross domestic receipts for the year 2002 is presented in table 7.

Consumption includes personal and government consumption expenditures on services and non-durable goods, together with our 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 U.S. national accounts, are treated as part of investment in the Domestic Capital Account. The value of personal and government consumption includes taxes and excludes subsidies on output. The value of gross domestic outlays for the year 2002 is presented in table 7.

Income and expenditure accounts are linked through saving and the resulting property income. To make this link explicit we divide income between labor and property compensation and expenditure between saving and consumption. We have already described the allocation of gross domestic income between capital and labor inputs. Gross private national receipts and outlays in current prices for 1948-2002 are given in table 8. Receipts are divided between labor and property compensation, while outlays are divided between personal and government consumption and gross saving.

The Foreign Transactions Current Account in the U.S. national accounts gives receipts from exports and income receipts from the rest of the world. This is balanced against outlays for imports, income payments and current taxes and transfers to the rest of the world, and the balance on current account. Receipts, outlays, and the balance on current account are presented for the year 2002 in table 9. These accounting data in current prices for 1948-2002 are given in table 10.

3.4 Accumulation Accounts

The accumulation accounts include data on saving, investment, revaluation of existing assets, and the change in wealth from period to period. The Domestic Capital Account consolidates the saving and investment of household, business and government sectors. Gross saving includes the consumption of fixed capital. As an accounting identity, gross saving plus the statistical discrepancy is equal to the value of investment plus capital transfer payments to the rest of the world and net lending to the rest of the world, as defined in the national income and product accounts.

The link between income and expenditure and wealth accounts requires both capital accumulation and asset revaluation. The change in wealth from period to period is equal to saving, net of consumption of fixed capital, plus the revaluation of existing assets. Asset revaluation is a component of the change in wealth that is excluded from income and saving. In

measuring the return from investment in different types of assets, both returns in the form of income and returns from revaluations must be considered.

The U.S. national accounts include a Domestic Capital Account that records capital formation for the domestic economy. We implement this account 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.

The assets of the U.S. domestic economy include the tangible assets of business and government, as well as those of households and institutions. Net claims on the rest of the world are also an asset of the domestic economy. The national accounts also include a Foreign Transactions Capital Account that links these claims to the balance on current account, national income and product accounts. By consolidating capital transactions for domestic and rest of the world sectors we would obtain a capital account for the U.S. national economy.

Capital formation includes gross private domestic investment, government investment, and expenditures on durable goods by households and institutions. Saving includes gross saving, as defined in the U.S. national accounts, plus consumption of fixed capital for households, institutions, and government. Domestic saving and investment are given for 2002 in table11, together with the revaluation of fixed assets and the change in wealth. Corresponding data from the Foreign Transactions Account are given for 2002 in table12.

To estimate the change in wealth from period to period we require estimates of saving net of depreciation and estimates of the revaluation of assets. We have estimated the revaluations of domestic tangible assets as part of the perpetual inventory of capital goods described in section 5 below. Our estimates of revaluations for net claims on foreigners are based on the accounts at market prices included in the U.S. International Position. We estimate revaluations as the difference between the period-to-period changes in these stocks and the deficit of the rest of world sector. Domestic saving and capital formation in current prices for 1948-2002 are given in table 13, while corresponding data from the Foreign Transactions Account are given in table 14.

3.5 Wealth Accounts

All of the accounts we have 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 Domestic Balance Sheet includes the tangible assets of household, business, and government sectors and net claims on the rest of the world. The U.S. International Position includes foreign holdings of U.S. domestic assets and U.S. holdings of foreign assets. The Domestic Balance Sheet for 2002 is presented in table 15, while the U.S. International Position for 2002 is given in table 16. Annual data on domestic wealth for the period 1948-2002 are presented in table 17, while the U.S. International Position for this period is given in table 18. By consolidating these accounts we would obtain a balance sheet for the national economy.

3.6 The Accounting System

Our accounting system is very similar to the U.S. national accounts. The most important difference is the creation of a consolidated income and expenditure account, the Domestic Receipts and Expenditures Account presented in section 3.3. There are important differences in detail, arising from our imputations for capital services. The Foreign Transactions Current and Capital Accounts are identical to those in the U.S. national accounts. Finally, the Domestic Balance Sheet completes the domestic side of the U.S. national accounts by adding an account for wealth. The U.S. national accounts already provide a balance sheet for the rest of the world in the U.S. International Position.

The production and income and expenditure accounts are related through markets for commodities and factor services. Factor outlay by the producing sector is the most important component of income by the household sector. Domestic Receipts also include the value of factor services supplied to the rest of the world. The production of consumption goods includes goods consumed by the government and the rest of the world sectors. Expenditure on consumption goods includes goods supplied by the rest of the world.

The accumulation accounts allocate gross saving among its sources and uses. The uses of saving include capital formation through investment in tangible assets. Expenditure on investment is linked to the production account through the market for investment goods output. The production of investment goods is partly allocated to the government and rest of the world sectors; part of the supply of these goods originates in the rest of the world. Finally, the accumulation accounts are linked to the wealth account through the accounting identity between period-to-period changes in wealth and the sum of saving and revaluation of assets.

The structure of our accounting system can also be compared with the SNA1993. The principal difference between our system and the U.N. system is that we have combined the capital and revaluation accounts of the U.N. system into a single accumulation account, which also includes period-to-period changes in national wealth. Our treatment of consumer durables also differs from the U.N. system.[15]

4. Index Numbers

4.1 Introduction

To express any accounting magnitude in constant prices we separate the change in value into components associated with changes in price and quantity. As an illustration, the change in the value of output entering the production account can be separated into a change in real output and a change in the price deflator. Changes in factor outlay, income, expenditure, and capital formation can be decomposed into price and quantity changes in the same way. As a second illustration, the change in the value of wealth can be separated into a change in real assets and a change in the asset price. We identify the change in quantity with saving and the change in price with revaluation of assets.

[15]United Nations System of National Accounts (1993), 9.40, p. 208.

4.2 Index Numbers

To illustrate the construction of index numbers of prices and quantities we consider the value of output in the production account. Suppose m that components of output are distinguished in the accounts; the value of output, say qY, can be written:

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

Our 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. For the index numbers given below we choose the base for all price indexes as 1.000 in 2000. The base for the quantity indexes is the corresponding value in 2000.

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 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 U.S. national accounts is superlative in this sense. Laspeyres and Paasche indexes are not superlative and fail to capture substitutions among products in response to price changes.

The rate of growth of a superlative quantity index that replicates the translog representation of technology and preferences is:

$$\log Y_t - \log Y_{t-1} = \sum \overline{w}_{it}(\log Y_{it} - \log Y_{i,t-1}).$$

We can define the relative share of the i-th output in the value of total output, say w_i, as:

$$w_i = \frac{q_iY_i}{\sum q_iY_i}.$$

The weights $(\overline{w}_{it})$ are arithmetic averages of the relative shares in the two periods,

$$\overline{w}_{it} = \frac{1}{2}w_{it} + \frac{1}{2}w_{i,t-1}.$$

The corresponding price index is obtained by dividing the value of output by the translog quantity index.[16]

4.3 Taxes

At a number of points in our accounting system transactions data are presented net and gross of taxes. As one illustration, consumer purchases of goods and services in the income and expenditure account include sales and excise taxes. Sales of the same goods and services in the production account exclude these taxes. We treat sales and excise taxes as part of the price paid by consumers. We can separate the change in the value of transactions into three components—

[16]Translog index numbers were originally discussed by Fisher (1922) .

change in price, change in quantity, and change in tax. The tax change is a component of the change in the price paid by the sector making the expenditure; the tax change is excluded from the change in the price received by the sector receiving income.

To illustrate the construction of price, quantity, and tax indexes we consider the value of consumer expenditure as it enters the income and expenditure account. Again, suppose that m components of consumer expenditure are distinguished in the accounts; the value of output, gross of tax, say q^+Y, may be written:

$$q^+Y = q_1^+Y_1 + q_2^+Y_2 + \cdots + q_m^+Y_m.$$

The prices (q_i^+) include sales and excise taxes; the quantities (Y_i) are measured in the same way as in the production accounts. Price and quantity indexes based on these prices and quantities can be defined as before.

To introduce taxes into the system of index numbers we let the market price of output q^+ be equal to the price received by the producer, say q, multiplied by unity plus the effective tax rate, t; the value of output at market prices is:

$$(1+t)qY = \sum(1+t_i)q_iY_i$$

where the prices paid by the consumers (q_i^+) are expressed in terms of prices received by producers (q_i) and tax rates (t_i). Accordingly, we construct an index of taxes $1+t$ by dividing the value of transactions at purchasers' prices by the value of transactions at producers' prices. It should be noted that price and quantity indexes at market prices differ from the corresponding indexes at producer prices since taxes enter the weights (w_i) employed in constructing the indexes.

4.4 Index Number Systems

In the U.S. national accounts only the output side of the production account is measured in current and constant prices. The index number system employed for the measurement of output in constant prices is based on the Fisher ideal index, a geometric average of Laspeyres and Paasche index numbers for the quantity of output. The Laspeyres index of quantity of output, say Y^L, is defined by:

$$Y_1^L = \frac{\sum q_{i0}Y_{i1}}{\sum q_{i0}Y_{i0}}.$$

The Paasche index uses current prices, rather than base period prices as weights:

$$Y_1^P = \frac{\sum q_{i1}Y_{i1}}{\sum q_{i1}Y_{i0}}.$$

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

5. Perpetual Inventory

5.1 Introduction

Index numbers of the price and quantity of capital assets are constructed from data on prices and quantities of individual assets. The quantities are estimated from data on past investments by the perpetual inventory method.[17] Our objective is to develop a system of accounts in constant prices, linking the output of investments goods in constant prices to stocks of assets in constant prices. To provide data on the prices of capital services we extend the perpetual inventory method to encompass prices as well as quantities of capital goods by vintage.

5.2 Relative Efficiency

We begin with a description of the price and quantity data required for a single capital good.[18] In the perpetual inventory method, the relative efficiency of a capital good depends on age and not on the time it was acquired. Replacement requirements are determined by losses in efficiency as well as retirements of capital goods. When a capital good is retired its efficiency drops to zero. The relative efficiency of capital goods of different ages can be described by a sequence of nonnegative numbers -- $d_0, d_1, \ldots$

We normalize the relative efficiency of a new capital good at unity and assume that relative efficiency is non-increasing so that:

$$d_0 = 1; \quad d_\tau - d_{\tau-1} \le 0; \quad \tau = 0,1,\ldots.$$

We also assume that every capital good is eventually retired or scrapped so that relative efficiency eventually drops to zero:

$$\lim_{\tau \to \infty} d_\tau = 0.$$

Subject to these restrictions, a wide variety of patterns of decline in efficiency can be employed in the perpetual inventory method.

For illustration we consider three patterns of decline in efficiency "one-hoss shay," straight-line, and declining balance. In the "one-hoss shay" pattern, efficiency is constant over the lifetime of the capital good. Where T is the lifetime, relative efficiency is:

$$d_\tau = 1; \quad \tau = 0,1,\ldots,T-1.$$

[17]The perpetual inventory method is used in BEA's Tangible Wealth Survey.

[18]A more detailed presentation of the economic theory of replacement and depreciation is given by Jorgenson (1996c).

In the straight-line pattern, efficiency declines linearly over the lifetime of the capital good:

$$d_\tau = 1 - \frac{1}{T}\tau; \quad \tau = 0,1,\ldots,T-1.$$

In the declining balance pattern, efficiency declines geometrically:

$$d_\tau = (1-\delta)^\tau; \quad \tau = 0,1,\ldots.$$

These patterns of decline in efficiency and many others are special cases of our extension of the perpetual inventory method.

Capital goods decline in efficiency at each point of time, giving rise to needs for replacement to maintain productive capacity. The proportion of an investment replaced during the τ-th period after its acquisition is the decline in efficiency. We refer to this as the mortality distribution of a capital good, say *m*, where:

$$m_\tau = -(d_\tau - d_{\tau-1}); \quad \tau = 1,2,\ldots.$$

By our assumption that relative efficiency is non-increasing, the mortality distribution may be represented by a sequence of nonnegative numbers, m_1, m_2,..., where:

$$\sum_{\tau=1}^{\infty} m_\tau = \sum_{\tau=1}^{\infty}(d_{\tau-1} - d_\tau) = d_0 = 1.$$

If efficiency is constant over the lifetime of the capital good, the mortality distribution is zero except for period T:

$$m_\tau = 1 \quad \tau = T.$$

For linear decline in efficiency, the mortality distribution is constant:

$$m_\tau = \frac{1}{T}; \quad \tau = 1,2,\ldots,T.$$

For geometric decline in efficiency, the mortality distribution declines geometrically:

$$m_\tau = \delta(1-\delta)^{\tau-1}; \quad \tau = 0,1,\ldots.$$

Replacement requirements can be expressed in terms of the proportion of an initial investment replaced τ periods after the initial acquisition. This includes replacement of the initial investment, as well as subsequent replacements. We refer to the sequence of these proportions as the replacement distribution of a capital good. The sequence of replacement rates (δ_τ) can be computed recursively for the sequence of mortality rates (m_τ). The proportion of an initial

investment replaced at time v and again at time $\tau > v$ is $m_v\delta_{\tau-v}$. The proportion of the stock replaced in the τ-th period is the sum of proportions replaced first in periods 1, 2,..., and later at period τ; hence,

$$\delta_\tau = m_1\delta_{\tau-1} + m_2\delta_{\tau-2} + \cdots + m_\tau\delta_0; \qquad \tau = 1,2,\ldots.$$

This equation is the renewal equation.[19]

For constant relative efficiency over the lifetime of capital goods, the replacement distribution is periodic with the period equal to the lifetime of the capital good:

$$\delta_\tau = 1; \qquad \tau = T,2T,\ldots.$$

For linear decline in efficiency, the replacement distribution may be represented in the form:

$$\delta_1 = \frac{1}{T};$$

$$\delta_2 = \frac{1}{T}\left(1 + \frac{1}{T}\right); \qquad \text{etc.}$$

For geometric decline in efficiency, the replacement distribution is constant:

$$\delta_\tau = \delta; \qquad \tau = 1,2,\ldots.$$

5.3.Quantities and Prices

The relative efficiencies of capital goods of different ages and the derived mortality and replacement distributions are useful in estimating the data required for income and wealth accounts. First, capital stock at the end of each period, say K_t, is the sum of past investments, say $A_{t-\tau}$, each weighted by its relative efficiency:

$$K_t = \sum_{\tau=0}^{\infty} d_\tau A_{t-\tau},$$

Vintage accounts containing data on investments of every age in every period are required.

Taking the first difference of the expression for capital stock in terms of past investments, we obtain:

[19]See Feller (1957).

$$K_t - K_{t-1} = A_t + \sum_{\tau-1}^{\infty}(d_\tau - d_{\tau-1})A_{t-\tau};$$
$$= A_t - \sum_{\tau-1}^{\infty} m_\tau A_{t-\tau};$$
$$= A_t - R_{t;}$$

where:

$$R_t = \sum_{\tau=1}^{\infty} m_\tau A_{t-\tau}$$

is replacement in period *t*. The change in capital stock is equal to the acquisition of investment goods less replacement.

Replacement requirements can also be expressed in terms of present and past changes in capital stock, using the replacement distribution:

$$R_t = \sum_{\tau=1}^{\infty}\delta_\tau (K_{t-\tau} - K_{t-\tau-1}).$$

The average replacement rate for capital stock at the beginning of the period,

$$\hat{\delta}_t = \frac{R_t}{K_{t-1}} = \sum_{\tau-1}^{\infty}\delta_\tau \frac{(K_{t-\tau} - K_{t-\tau-1})}{K_{t-1}},$$

is a weighted average of replacement rates with weights given by the relative proportions of changes in capital stock of each vintage in beginning-of-period capital stock.

We turn next to a description of the price data required for income and wealth accounts in constant prices. These accounts require an extension of the perpetual inventory method to incorporate prices of capital goods. This is dual to the usual method in the sense that there is a one-to-one correspondence between the quantities that appear in the perpetual inventory method and the prices that appear in our extension.[20] To bring out this correspondence and simplify the notation we use a system of present values or discounted prices. Taking the present as time zero, the discounted price of a commodity, say p_t, is the discounted value of the future price, say q_t:

$$p_t = \prod_{s=1}^{t}\frac{1}{1+r_s}q_t.$$

The notational convenience of discounted prices results from dispensing with explicit discount factors.

[20]The dual to the durable goods model was developed by Arrow (1964).

In the correspondence between the perpetual inventory method and its price counterpart, the price of acquisition of a capital good, say p_{At}, is analogous to capital stock. This price is the sum of future rental prices of capital services, say $p_{K,t}$, weighted by relative efficiencies:

$$p_{A,t} = \sum_{\tau=0}^{\infty} d_\tau \, p_{K,t+\tau} \ .$$

This expression may be compared with capital stock as weighted sum of past investments. The acquisition price of capital goods is the price of investment goods output in the production account and the price of capital formation in the accumulation account.

Taking the first difference of the expression for the acquisition price of capital goods in terms of future rentals, we obtain:

$$\begin{aligned} p_{A,t} - p_{A,t-1} &= -p_{K,t} - \sum_{\tau=1}^{\infty} (d_\tau - d_{\tau-1}) p_{K,1+\tau} \\ &= -p_{K,t} + \sum_{\tau=1}^{\infty} m_\tau p_{K,1+\tau} \\ &= -p_{K,t} + p_{D,t}; \end{aligned}$$

where

$$p_{D,t} = \sum_{\tau=1}^{\infty} m_\tau p_{K,1+\tau}$$

is depreciation on a capital good in period t. The change in the price of acquisition of a capital good is equal to depreciation less the rental price of capital. In the correspondence between the perpetual inventory method and its price counterpart, investment corresponds to the rental price of capital and replacement corresponds to depreciation.

We can rewrite the expression for the first difference of the acquisition price of capital goods in terms of undiscounted prices:

$$q_{K,t} = q_{A,t-1} r_t + q_{D,t} - (q_{A,t} - q_{A,t-1}),$$

where $q_{A,t}$ is the undiscounted price of acquisition of capital goods, $q_{K,t}$ the price of capital services, $q_{D,t}$ depreciation, and r_t the rate of return, all in period t. The price of capital services $q_{K,t}$ is the sum of return per unit of capital $q_{A,t-1} r_t$, depreciation $q_{D,t}$, and the negative of revaluation -($q_{A,t}$ - $q_{A,t-1}$). The service price enters the production and the income and expenditure accounts through the price component of capital input and property compensation. Depreciation enters the accumulation account as the price component of depreciation on existing capital assets. Revaluation enters the accumulation account as the price component of revaluation of existing assets.

Depreciation can also be expressed in terms of present and future changes in the price of acquisition of investment goods, using the replacement distribution:

$$p_{D,t} = -\sum_{\tau=1}^{\infty} \delta_{\tau} \left(p_{A,t+\tau} - p_{A,t+\tau-1} \right).$$

The average depreciation rate on the acquisition price of a capital good,

$$\bar{\delta}_t = \frac{p_{D,t}}{p_{A,t}} = -\sum_{\tau=1}^{\infty} \delta_{\tau} \frac{\left(p_{A,t+\tau} - p_{A,t+\tau-1} \right)}{p_{A,t}},$$

is a weighted average of replacement rates with weights given by the relative proportions of changes in futures prices in the acquisition price of investment goods in the current period. This expression may be compared with that for the average replacement rate $\hat{\delta}_t$ given above. Vintage data on the depreciation of capital goods of every age at every point of time are required.

The price of acquisition of an investment good of age *v* at time *t*, say $p_{A,t,v}$, is the weighted sum of future rental prices of capital prices. The weights are relative efficiencies of the capital good in each future period, beginning with age *v*:

$$p_{A,t,v} = \sum_{\tau=0}^{\infty} d_{\tau+v} p_{K,t+\tau+1}.$$

A new investment good has age zero so that:

$$p_{A,t,0} = p_{A,t}.$$

Given the acquisition prices, we require estimates of depreciation and the rental price for goods of each vintage.

To calculate depreciation on capital goods of each vintage we take the first difference of the acquisition prices across vintages at a given point in time:

$$\begin{aligned} p_{A,t,v} - p_{A,t,v+1} &= -\sum_{\tau=1}^{\infty} \left(d_{\tau+v} - d_{\tau+v-1} \right) p_{K,t+v+\tau} \\ &= \sum_{\tau=1}^{\infty} m_{\tau+v} p_{K,t+v+\tau} \\ &= p_{D,t,v}; \end{aligned}$$

where $p_{D,t,v}$ is depreciation on a capital good of age *v* at time *t*. Again a new investment good has age zero so that:

$$p_{D,t,0} = p_{D,t}.$$

The rental of a capital good of age *v* at time *t*, say $q_{K,t,v}$, is proportional to the rental of a new capital good,

$$q_{K,t,v} = d_v q_{K,t},$$

New and used capital goods are perfect substitutes in production. To calculate the service price for new capital goods, we use the formula derived above:

$$q_{K,t} = q_{A,t-1} r_t + q_{D,t} - (q_{A,t} - q_{A,t-1}).$$

This requires undiscounted acquisition prices for capital goods $(q_{A,t})$ rates of return (r_t), depreciation on new capital goods $(q_{D,t})$, and revaluation of existing capital goods $(q_{A,t} - q_{A,t-1})$.

We conclude that acquisition prices for capital goods of each vintage, together with current investment, capital stock, replacement, and investments of all vintages constitute the data on quantities and prices required for an extended perpetual inventory system. From this point we consider an accounting system for any number of investment goods. The price and quantity data we have described are required for each investment good in the system. The data for all investments goods are used to derive price and quantity index numbers.

5.4 Accounting System

The quantities of investment goods (A_t) enter the production account through investment goods output. These quantities are also part of capital formation in the accumulation account. The corresponding prices are the prices of acquisition of new investment goods ($q_{A,t}$). The value of investment goods output is price times quantity, say $q_{A,t}A_t$. For several investment goods the values are sums over the individual investment goods. The price and quantity components are derived by application of index number formulas.

Capital stock enters the production account through capital input; capital input also appears in the income and expenditure account as the quantity component of property compensation. The prices associated with capital services in the production and the income and expenditure accounts are rental prices. The value of capital input and property compensation is price times quantity. For several capital goods the values of capital services input and property compensation are sums over all types of capital goods. The price and quantity components are derived by application of index number formulas.

In the accumulation account capital stock must be distinguished by vintage; vintage accounts containing data on investment of every age (A_{t-v-1}) are part of the accumulation account in constant prices. The associated prices are the levels of depreciation $(q_{D,t,v})$. The value of depreciation for capital goods of age *v* is price times quantity, say $q_{D,t,v}A_{t-v-1}$; to obtain total depreciation we sum over vintages, obtaining

$$\sum_{v=0}^{\infty} q_{D,t,v} A_{t-v-1}.$$

The separation of prices and quantities of depreciation requires application of an index number formula to the underlying vintage data.

Capital stock also enters the accumulation account as the quantity component of revaluation. The prices associated with capital stock in measuring revaluation are the price changes $q_{A,t,v} - q_{A,t-1,v}$. Revaluation for capital goods of age v is price times quantity, say $(q_{A,t,v} - q_{A,t-1,v})A_{t-v-1}$; to obtain total revaluation we sum over vintages, obtaining

$$\sum_{v=0}^{\infty}(q_{A,t,v} - q_{A,t-1,v})A_{t-v-1}.$$

Separation of price and quantity components of revaluation requires the application of index number formulas, just as in the depreciation account. The prices used for depreciation and revaluation in the accumulation account must be consistent with those used for capital services in the production and income and expenditure accounts.

Gross capital formation is equal to investment. Net capital formation is equal to gross capital formation less replacement. Net capital formation is equal to the period-to-period change in capital stock. Replacement represents the change in the quantity of existing capital goods due to a decline in relative efficiency. Depreciation represents the change in the price of existing capital goods due to present and all future declines in efficiency. We have already described the separation of price and quantity components of gross capital formation. The methods for net capital formation and replacement are strictly analogous; quantities of gross capital formation or investment are replaced by quantities of net capital formation and replacement in index number formulas that also depend on prices of acquisition of investment goods.

Finally, capital stock appears in the wealth account as the quantity component of capital assets. The prices associated with capital stock are the acquisition prices ($q_{A,t,v}$). The value of wealth for capital goods of age v is price times quantity, say $q_{A,t,v}A_{t-v}$; to obtain the total value of wealth we sum over vintages, obtaining

$$\sum_{v=0}^{\infty}q_{A,t,v}A_{t-v}.$$

Price and quantity indexes can be constructed by applying index number formulas.

For capital goods with quantities of investment and prices of acquisition for every vintage, accounts can be compiled for capital input, property compensation, depreciation, capital formation, replacement, and wealth in current and constant prices. Price data corresponding to each of the accounts in constant prices can also be compiled. For capital goods with a less complete set of data, a simplified system of accounts can be constructed on the basis of the assumption that decline in efficiency is geometric.

Under this assumption the rate of replacement and the rate of depreciation are constant and equal to the rate of decline in efficiency:

$$\hat{\delta}_t = \bar{\delta}_t = \delta.$$

Constant rates of replacement and depreciation lead to substantial simplifications in our system of income and wealth accounts in constant prices. Vintage accounts are no longer necessary, since replacement is proportional to capital stock and depreciation is proportional to the current acquisition price of investment goods.

As a first step in construction of a simplified accounting system we estimate capital stock at the end of each period as a weighted sum of past investments:

$$K_t = \sum_{\tau=0}^{\infty} (1-\delta)^{\tau} A_{t-\tau}.$$

With a constant rate of replacement, replacement becomes:

$$R_t = \delta K_{t-1}.$$

The price of acquisition of new investment goods is a weighted sum of future rentals:

$$p_{A,t} = \sum_{\tau=0}^{\infty} (1-\delta)^{\tau} \quad p_{K,t+\tau+1}.$$

With a constant rate of depreciation, depreciation becomes:

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

The acquisition price of investment goods of age *v* at time *t* is:

$$q_{A,t,v} = (1-\delta)^{v} q_{A,t}$$

The service price for new capital goods becomes:

$$q_{K,t} = q_{A,t-1} r_1 + \delta q_{A,t} - (q_{A,t} - q_{A,t-1}).$$

With constant replacement rates (δ_τ) the values of replacement and depreciation are equal and depend only on the price of acquisition of new capital goods and the stock of capital:

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

Similarly, the value of wealth is the product of the price acquisition and the stock of capital, $q_{A,t}K_t$. The change in wealth from period-to-period,

$$q_{A,t}K_t - q_{A,t-1}K_{t-1} = q_{A,t}(K_t - K_{t-1}) + (q_{A,t} - q_{A,t-1})K_{t-1},$$

is the sum of capital formation and revaluation. Of course, index number formulas must be employed to separate replacement, depreciation, capital formation, revaluation, and wealth into price and quantity components.

Geometric decline in efficiency is among the patterns most commonly employed in estimating capital stock by the perpetual inventory method.[21] A fundamental result of renewal theory is that δ_τ tends to a constant value for almost any pattern of decline in efficiency.[22] Geometric decline in efficiency, resulting in a constant rate of replacement δ, may provide a useful approximation to replacement requirements and depreciation for a wide variety of patterns of decline in efficiency. Where this approximation is unsatisfactory, a complete accounting system requires vintage accounts for capital goods quantities and prices.

5.5 Alternative Accounting Systems

We have outlined the development of a complete system of income and wealth accounts in constant prices. Only the measurement of the output side of the production account and the asset side of the wealth account in constant prices are well established in social accounting practice. In the study of total factor productivity, attempts have been made to measure the input side of the production account in constant prices. Jorgenson and Stiroh (2000) and Jorgenson (2001) have applied the methods we have described for a simplified accounting system to the measurement of factor input in constant prices and the measurement of total factor productivity.

6. Production Account

6.1 Introduction

In sections 4 and 5 we have developed methods for measuring income and wealth in constant prices. For this purpose we have extended the perpetual inventory method to incorporate data on prices as well as quantities. The task that remains is to implement production, income and expenditure, accumulation, and wealth accounts in constant prices. In this section we present the production account for the U.S. domestic economy. In the following section we present income and expenditure, accumulation, and wealth accounts. In section 8 we discuss possible extensions of our accounting system.

6.2 Output and Labor Input

To construct a quantity index for gross product we first 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 U.S. national accounts. We construct price and quantity index numbers for the services of consumer, institutional and government durables, as well as institutional and government real estate, as part of our imputation for the value of the capital services.

The value of output from the point of view of the producing sector excludes certain indirect taxes and includes subsidies. We have allocated these taxes in proportion to the consumption and

[21] See Hulten and Wykoff (1982) and Fraumeni (1997).

[22] For detailed discussion of the application of renewal theory to replacement and depreciation, see Jorgenson (1996c).

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 gross domestic product. We construct price and quantity indexes of gross output by applying index numbers to price and quantity data for consumption and investment goods product. The results are given in table 19.

Construction of a quantity index of labor input begins with data on hours worked and labor compensation per hour. Detailed cross-classifications of hours worked and compensation by sex, age, educational attainment, and employment class are taken 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 U.S. national accounts. These totals are based on establishment surveys and reflect payroll records.[23]

Denoting the labor input index by L and the labor compensation index by p_L, we first represent the value of labor input as 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 input are constructed by applying index number formulas to the detailed data. Price and quantity indexes of labor input for 1948-2002 are given for the U.S. domestic economy in table 20.

6.3 Capital Input

Estimates of capital input, property compensation, depreciation, and capital assets in constant prices require data on both prices and quantities of capital goods by vintage. We estimate capital stock and replacement for capital goods of different vintages, assuming that the decline in efficiency is geometric. We estimate capital service prices, depreciation, and acquisition prices for these capital goods on the basis of the same assumption. We continue our discussion of the production account for the U.S. domestic economy in constant prices by describing the construction of these prices and quantities.[24]

The starting point for a quantity index of capital input is an estimate of the stock of each type of capital, based on a perpetual inventory of investments in constant prices. Under the assumption that efficiency of capital goods declines geometrically, the rate of replacement, say δ, 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.

[23]Details are given by Jorgenson, Ho, and Stiroh (2004).
[24]Further details are given by Jorgenson, Ho, and Stiroh (2004).

Our perpetual inventory estimates of capital stocks are based on BEA's Tangible Wealth Survey, described by Herman (2000). These data include investment by asset class for 61 types of non-residential assets from 1901-2000, 48 types of residential assets for the same period, and 13 types of consumers' durables from 1925-2000. As described by Fraumeni (1997), the Tangible Wealth Survey uses efficiency functions for most assets that decline geometrically with age. In order to implement the simplified accounting system outlined above, we approximate age-efficiency profiles that are not geometric by Best Geometric Average (BGA) profiles that are geometric. Benchmark estimates of capital stocks in 2002, expressed in constant prices of 2000, rates of replacement, and price indexes for each type of capital are presented in table 21.

Our price indexes for tangible assets are taken from the U.S. national accounts. An important assumption is that these prices are measured in efficiency units that hold the quality of assets constant over time. In 1985 the Bureau of Economic Analysis incorporated constant quality price indexes for computers and peripheral equipment constructed by IBM into the NIPA. Triplett's (1989) discussion of the economic interpretation of these indexes brought the rapid decline of computer prices to the attention of a very broad audience.

Dulberger (1989) presented a more 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. Triplett (1989, 2004) has provided exhaustive surveys of research on hedonic price indexes for computers. Gordon (1989, 1990) gave an alternative model of computer prices and identified computers and communications equipment, along with commercial aircraft, as assets with the highest rates of price decline.

Communications technology is crucial for the rapid development and diffusion of the Internet, perhaps the most striking manifestation of information technology in the American economy. Kenneth Flamm (1989) was the first to compare the behavior of computer prices and the prices of communications equipment. He concluded that the communications equipment prices fell only a little more slowly than computer prices. Gordon (1990) compared Flamm's results with the official price indexes, revealing substantial bias in the official indexes.

Unfortunately, constant quality price indexes cover only a portion of communications equipment. Switching and terminal equipment rely heavily on semiconductor technology, so that product development reflects improvements in semiconductors. Grimm's (1997) constant quality price index for digital telephone switching equipment was incorporated into the national accounts in 1996. The output of communications equipment in the NIPA also incorporates a constant quality price index for cellular phones.

Much communications investment takes the form of the transmission gear, connecting data, voice, and video terminals to switching equipment. Technologies such as fiber optics, microwave broadcasting, and communications satellites have progressed at rates that outrun even the dramatic pace of semiconductor development. Mark Doms (2004) has provided comprehensive price indexes for terminals, switching gear, and transmission equipment. These have been incorporated into the Federal Reserve's Index of Industrial Production, as described by Carol Corrado (2003), but are not yet included in the U.S. National Income and Product Accounts.

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[25]. 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.

Parker and Grimm (2000) describe the new estimates of investment in software. BEA distinguishes among three types of software -- prepackaged, custom, and own-account software. Prepackaged software is sold or licensed in standardized form and is delivered in packages or electronic files downloaded from the Internet. Custom software is tailored to the specific application of the user and is delivered along with analysis, design, and programming services required for customization. Own-account software consists of software created for a specific application. However, only price indexes for prepackaged software hold performance constant.

Parker and Grimm (2000) present a constant quality price index for prepackaged software. This combines a hedonic model of prices for business applications software and a matched model index for spreadsheet and word processing programs developed by Oliner and Sichel (1994). Prepackaged software prices decline at more than ten percent per year over the period 1962-1998. Since 1998 the BEA has relied on a matched model price index for all prepackaged software from the Producers Price Index (PPI) program of the Bureau of Labor Statistics.

BEA's prices for own-account and custom software are based on programmer wage rates. This implicitly assumes no change in the productivity of computer programmers, even with growing investment in hardware and software to support the creation of new software. Custom and own-account software prices are a weighted average of prepackaged software prices and programmer wage rates with arbitrary weights of 75 percent for programmer wage rates and 25 percent for prepackaged software.

The official price indexes for computers provide the paradigm for economic measurement. These indexes capture the steady decline in IT prices and the recent acceleration in this decline. The official price indexes for central office switching equipment and prepackaged software also hold quality constant. BEA and BLS, the leading statistical agencies in price research, have carried out much of the best work in this area. However, a critical role has been played by price research at IBM, long the dominant firm in information technology[26].

We have described the measurement of capital stocks and capital asset prices. Our next step is to measure prices and quantities of capital services. To transform capital stocks into flows of capital services, we must introduce an assumption about the time required for new investment to

[25] Brent Moulton (2000) describes the 11th comprehensive revision of NIPA and the 1999 update.
[26] See Alfred Chandler (2000), Table 1.1, p. 26.

begin to contribute to production. We assume that the capital service from each asset is proportional to the arithmetic average of current and lagged capital stocks[27].

For property with an active rental market the price of capital services could be observed directly. 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.

Given 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. This method of imputation is used to estimate the rental value of owner-occupied dwellings in the U.S. national accounts. The total rental value is divided among taxes, capital consumption allowances, interest payments, and net rent. A somewhat similar method of imputation is used for the space rental value of institutional buildings, but net rent is omitted from the imputation. The main obstacle to broader application of this method is the lack of data on market rental prices.

Our extension of the perpetual inventory method provides an alternative approach for imputation of the rental values. For each type of capital we prepare perpetual inventory estimates of acquisition prices, service prices, depreciation, and revaluation by vintage. Under our assumption of geometrically declining relative efficiency of capital goods, the acquisition prices decline geometrically with vintage. The formula for the value of capital stock,

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

is the sum of past investments weighted by relative efficiency and evaluated at the price for new capital goods. Equivalently, this is the sum of the past investments evaluated at the acquisition price for the corresponding vintage of capital.

Second, depreciation is proportional to the value of beginning of period capital stock:

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

This measure of depreciation can also be obtained by estimating depreciation separately for each vintage and summing over vintages:

$$\sum q_{D,t,\tau} A_{t-\tau-1} = \left\| \sum \delta q_{A,t,\tau} A_{t-\tau-1} = \delta q_{A,t} K_{t-1}. \right.$$

[27] This assumption is employed by Jorgenson and Stiroh (2000), Jorgenson (2001), Jorgenson, Ho, and Stiroh (2004) and Oliner and Sichel (2000). Jorgenson, Gollop and Fraumeni (1987) had assumed that capital services were proportional to lagged capital stocks.

Finally, revaluation is equal to the change in the acquisition price of new capital goods multiplied by beginning of period capital stock. This measure can also be obtained by and summing over vintages:

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

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 we first allocate each class of assets among the five sectors of the U.S. domestic economy — corporations, non-corporate business, households and institutions and government. The relative proportions of capital stock by asset class for each sector for 2002 are given in table 22.

Given property compensation for a sector not subject to either direct or indirect taxes, we can solve for the rate of return by substituting the capital service price,

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

into the expression for property compensation. The rate of return is the ratio of property compensation, adjusted for depreciation and revaluation, to the value of capital services. This formula can be applied only to government and nonprofit institutions.

Given the rate of return for government and nonprofit institutions, we can construct estimates of 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. Price and quantity measures of capital input by class of asset can be combined into price and quantity index numbers of capital input by government and institutions.

Households hold consumer durables and owner-occupied dwellings taxed indirectly through property taxes. To incorporate property taxes into our estimates of the price and quantity of capital services we add taxes to the cost of capital, depreciation, and revaluation, obtaining the capital service price:

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

where τ_t is the rate of property taxation. The rate of return is the ratio of property compensation adjusted for depreciation, revaluation, and property taxes, to the value of capital services.

Given the rate of return for households, we can construct estimates of capital service prices for each class of assets held by households—land, residential structures, and consumer durables. We employ separate effective tax rates for owner-occupied residential property, both land and structures, and for consumer durables. Price and quantity measures of capital input by class of asset can be combined into price and quantity index numbers of capital input by households.

Our measure of the gross domestic product differs from the U.S. national accounts in the treatment of durables and real estate held by households and institutions and government. We assign personal and government consumption expenditures on durables to investment rather than consumption. This leaves gross domestic product unchanged. We add the service flow from household, institutional, and government durables to the value of output and the value of capital input. We also add the net rent component of the services of institutional and government real estate to values of both output and input.

We next consider the measurement of prices and quantities of capital services for non-corporate business. For the non-corporate sector we estimate property compensation as the sum of income originating in business, other than income originating in corporate business and government enterprises and net rent of owner-occupied dwellings, less labor compensation in the non-corporate sector, including imputed labor compensation of proprietors and unpaid family workers, plus non-corporate capital consumption allowances, less allowances for owner-occupied dwellings and institutional structures, and plus indirect business taxes allocated to the non-corporate sector. We also allocate the statistical discrepancy to non-corporate property compensation.

To obtain an estimate of the non-corporate rate of return we must take into account the personal income tax. The capital service price, modified to incorporate income tax and indirect business taxes, becomes:

$$q_{K,t} = \left[\frac{1 - u_t z_t - k_t + y_t}{1 - u_t}\right]\left[q_{A,t-1} r_t + q_{A,t}\delta - \left(q_{A,t} - q_{A,t-1}\right)\right] + q_{A,t}\tau_t,$$

where indirect business taxes $qA,t\ \tau_t$ are deducted from non-corporate property compensation before taxes as an expense, u_t is the average marginal tax rate on non-corporate property compensation, z_t is the present value of depreciation allowances on one dollar's worth of investment, k_t the investment tax credit, and $y_t = k_t u_t z_t$. The variable y_t is set equal to zero for all years but 1962 and 1963; it is used in accounting for the fact that the investment tax credit was deducted from the value of an asset for depreciation in those years. The tax credit is different from zero only for producer durables. Depreciation allowances are different from zero only for durables and structures.

We multiply the capital service price by the quantity of capital services for each asset held by non-corporate business, sum over assets, and solve for the rate of return. Given data on prices of acquisition, stocks, tax rates, and replacement rates, we can estimate capital service prices for each class of assets held by the non-corporate sector. Price and quantity measures of capital input by class of asset can be combined into price and quantity index numbers of capital input, using index number formulas as before.

We next consider the measurement of prices and quantities of capital services for corporate business. We measure corporate property compensation as income originating in corporate business, less compensation of employees, plus corporate capital consumption allowances, plus business transfer payments, plus the indirect business taxes allocated to the corporate sector. To

obtain an estimate of the corporate rate of return we must take into account the corporate income tax. The capital service price becomes:

$$q_{K,t} = \left[\frac{1 - u_t z_t - k_t + y_t}{1 - u_t}\right]\left[q_{A,t-1} r_t + q_{A,t}\delta - \left(q_{A,t} - q_{A,t-1}\right)\right] + q_{A,t}\tau_t,$$

where indirect business taxes $qA,t\ \tau_t$ are deducted from corporate property compensation before taxes as an expense, u_t is the corporate tax rate, z_t is the present value of depreciation allowances, k_t the investment tax credit, and $y_t = k_t u_t z_t$.[28]

Our 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. To estimate the rate of return in the corporate sector we require estimates of the variables that enter the value of capital services except, of course, for the rate of return. We then solve for the rate of return in terms of these variables and total property compensation. Price and quantity indexes of capital input by class of asset are combined into price and quantity indexes of capital input for the corporate sector, utilizing index number formulas.

We assume that the rate of return is the same for all assets within a given sector. This rate of return is inferred from the value of property compensation, acquisition prices and stocks of capital goods, rates of replacement, and variables describing the tax structure. To obtain price and quantity indexes of capital input for the domestic sector we apply the index number formulas to price and quantity indexes for each of the five sub-sectors—corporations, non-corporate business, households, institutions, and government. Price and quantity indexes of capital services for corporations, non-corporate business, households, institutions, and government, as well as the U.S. domestic economy are given for 1948-2002 in table 23.

6.4 Total Factor Productivity

We construct price and quantity index numbers for total factor input by combining indexes of labor and capital input into an index of total factor input. The weights for labor and capital are the relative shares of labor and property compensation in the value of total factor outlay. Indexes for the price and quantity of total factor input for the U.S. domestic economy are given for 1948-2002 in table 20.Total factor productivity is defined as the ratio of real product to real factor input or, equivalently, as the ratio of the price of factor input to the product price.[29] Growth in total factor productivity may be regarded as an increase in the 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. An index of total factor productivity is given in table 25.

[28]A detailed derivation of prices of capital services is given by Jorgenson and Yun (2001).
[29]For further discussion of this index of total factor productivity, see Jorgenson (2001).

7. Income and Expenditure, Accumulation, and Wealth Accounts

7.1 Introduction

In section 6 we have presented the production account for the U.S. domestic economy in constant prices. In this section we present income and expenditure, accumulation, and wealth accounts in constant prices. The fundamental accounting identity for the income and expenditure account is that receipts are equal to outlays plus saving. The corresponding identity for the accumulation account is that saving is equal to capital formation. The income and expenditure account is linked directly to the production account through factor income and consumption outlays. The accumulation account is linked to the production account through capital formation. The change in wealth from period to period is equal to capital formation less depreciation plus revaluation of assets.

Consumption expenditures include sales and excise taxes and customs duties on consumption goods. These taxes are excluded from the value of consumption output in the production account. Factor outlay in the production account includes both direct taxes on factor income and indirect taxes that form part of outlays on factors of production. Similarly, capital formation in the accumulation account includes sales and excise taxes and customs duties on investment goods—taxes excluded from the value of investment output in the production account.

7.2 Labor Income and Consumer Outlays

We begin with estimates of labor income and household and government consumption outlays in constant prices for the U.S. domestic economy. To construct price and quantity indexes of household and government outlays, we obtain data for consumption expenditures on non-durable goods and services, excluding the services of institutional real estate, from the production account. We combine these data with imputed values of the services of household, institutional, and government durables and the services of institutional and government real estate. We have described price indexes for capital services in section 6 above.

The value of consumption expenditures includes customs duties, excise and sales taxes, and excludes subsidies. We construct a quantity index of consumption expenditures from the quantity indexes of non-durables, services, and our estimate of imputed capital services. The price index is the ratio of consumption expenditures to the quantity index. Similarly, quantities of the different categories of labor services are combined into a quantity index of labor income. Price, quantity, and tax indexes for consumption outlays and price and quantity indexes for labor income are presented in table 26.

7.3 Property Income

The starting point for estimating price and quantity components of property income is the price and quantity of capital input in the production account. To construct price and quantity indexes of property income for the income and expenditure account our procedure is analogous to the methods we have used for the production account. The price and quantity indexes of property income are presented in table 27.

7.4 Accumulation Account

The fundamental accounting identity for the accumulation account is that gross saving, taken from the income and expenditure account, is equal to capital formation. Gross saving is the sum of depreciation and net saving. Net saving is equal to the change in wealth from period to period less revaluation of assets. The capital formation and saving sides of the accumulation account are equal in both current and constant prices. To construct the saving side of the accumulation account in constant prices we begin with capital formation in constant prices. To complete the saving side of the accumulation account in constant prices we require depreciation and revaluation of assets in constant prices.

For a single capital good the value of wealth is the sum of values of investment goods of each vintage, summed over all vintages:

$$W_t = \sum_{v=0}^{\infty} q_{A,t,v} A_{t-v}.$$

The change in wealth from period to period may be written:

$$\begin{aligned} W_t - W_{t-1} &= \sum_{v=0}^{\infty} q_{A,t,v} A_{t-v} - \sum_{v=0}^{\infty} q_{A,t-1,v} A_{t-v-1} \\ &= q_{A,t,0} A_t + \sum_{v=0}^{\infty} q_{A,t,v-1} A_{t-v-1} - \sum_{v=0}^{\infty} q_{A,t-1,v} A_{t-v-1} \\ &= q_{A,t} A_t + \sum_{v=0}^{\infty} (q_{A,t,v-1} - q_{A,t,v}) A_{t-v-1} + \sum_{v=0}^{\infty} (q_{A,t,v} - q_{A,t-1,v}) A_{t-v-1}. \end{aligned}$$

In this expression for change in the value of wealth, the first term is the value of gross capital formation, the second is the negative of depreciation on capital goods of all vintages, and the third is the revaluation of assets of all vintages.

Treating the change in prices across vintages, $q_{A,t,v} - q_{A,t,v-1}$, as the price component of depreciation and A_{t-v-1} as the quantity component, we apply index number formulas to perpetual inventory data on prices and quantities of each vintage of a capital good to obtain price and quantity index numbers for depreciation on a single capital good. To obtain index numbers for several capital goods we again apply index number formulas, this time to the price and quantity indexes for each capital good. Similarly, treating the change in prices across time periods, $q_{A,t,v} - q_{A,t-1,v}$, as the price component of revaluation, we obtain price and quantity index numbers of revaluation.

The value of gross saving is equal to change in wealth plus depreciation less revaluation of assets. We can define the quantity of gross saving as the sum of quantities of change in wealth and depreciation less the quantity of revaluation. The quantity of change in wealth itself is the sum of quantities of gross capital formation and revaluation less the quantity of depreciation. Price and quantity numbers of investment and capital formation are presented in table 28. The

quantity of net saving is equal to the quantity of gross saving less the quantity of depreciation. Quantities of gross saving and gross capital formation are, of course, identical.

If the decline in efficiency of capital goods is geometric the change in wealth from period to period for a single capital good may be 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 capital formation and has the same price and quantity components.

Depreciation is represented by $q_{A,t}\delta K_{t-1}$ and is equal to replacement; the price and quantity components of depreciation differ from the price and quantity components of replacement. We construct the quantity index of depreciation from the lagged stocks, K_{t-1}, with depreciation shares as weights. The price index of depreciation is computed as the ratio of depreciation to the quantity index of depreciation. Revaluation is represented by $(q_{At} - q_{A,t-1})K_{t-1}$. We construct a quantity index of revaluation from lagged capital stocks with revaluation shares as weights. The price index of revaluation is computed as the ratio of revaluation to the quantity index of revaluation. Price and quantity index numbers of private national saving, depreciation, and revaluation are presented in table 29.

Price and quantity index numbers for total receipts can be constructed by combining index numbers of labor and property income into an index of factor income. The weights for labor and property are the relative shares of labor and property compensation in the value of total factor income. We use the price index of factor income to deflate government transfer payments to persons, except for social insurance benefits. Adding deflated transfer payments to the quantity index of factor income provides an index of total real consumer receipts.

Price and quantity index numbers for total outlays can be constructed by combining index numbers of household and government consumption outlays and capital formation. The weights are the relative shares of these components of expenditure in the value of total expenditure. The price and quantity indexes of expenditures are analogous to indexes for total product in the production account; the scope of transactions is different and expenditures include sales and excise taxes, while the value of total product excludes such taxes.

7.5 Wealth Account

In section 3 we described the asset side of the wealth account for the U.S. private national economy in current prices. Changes in the value of wealth from period to period can be separated into price and quantity components. Net capital formation, like net saving, can be interpreted as the quantity component of the change in the value of wealth under the assumption of geometric decline in efficiency of capital goods. To construct price and quantity indexes of wealth we require a perpetual inventory of prices and quantities of capital goods.

For a single capital good, the value of wealth, as given above, is the sum of values of investment goods of all vintages:

$$W_t = \sum_{v=0}^{\infty} q_{A,t,v} A_{t-v}.$$

Price and quantity indexes of wealth may be constructed from price and quantity data for each vintage, treating $q_{A,t,v}$ as the price and A_{t-v} as the quantity. Price and quantity indexes for several capital goods may be constructed by applying index numbers to price and quantity indexes of wealth for each capital good. With geometric decline in efficiency the expression for the value of wealth reduces to:

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

For several capital goods the acquisition price $q_{A,t}$ and quantity of capital K_t for each capital good can be combined into price and quantity indexes for wealth.

Our wealth account for the U.S. domestic economy includes tangible assets held by businesses, households and institutions, and government. This account also includes net claims on foreigners. We estimate the price and quantity of assets for each of the five sectors by applying index number formulas to price and quantity data for each class of capital assets held by the sector. We construct price and quantity index numbers for the U.S. domestic economy by applying these index number formulas to price and quantity indexes for the five sectors. Price and quantity indexes of wealth for 1948-2002 are given in table 30.

8. Extending the Accounting Framework

8.1 Introduction

As a long-term objective the basic accounting framework could be expanded to incorporate investment in human capital. Investment in human capital is primarily a product of the education sector, which is not included in the private domestic sector of the economy. In addition to data on education already incorporated into the national accounts, data on physical investment and capital stock in the educational sector would be required for incorporation of investment in human capital into a complete accounting system.[30]

A second objective for long-term research is the incorporation of research and development into a complete system of accounts.[31] At present research and development expenditures are treated as a current expenditure. Labor and capital employed in research and development activities are commingled with labor and capital used to produce marketable output. The first step in accounting for research and development is to develop data on factors of production devoted to research. The second step is to develop measures of investment in research and development. The final step is to develop data on the stock of accumulated research.

[30]Estimates of the stock of educational capital have been compiled by Jorgenson and Fraumeni (1996b).
[31]The incorporation of research and development into a complete system of accounts has been discussed by Fraumeni and Okubo (2004).

Both education and investment in research and development are heavily subsidized in the United States, so that private costs and returns are not equal to social costs and returns. The effects of these subsidies would have to be taken into account in measuring the effects of human capital and accumulated research on productivity in the private sector. If the output of research activities is associated with external benefits in use, these externalities would not be reflected in the private cost of investment in research.

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Table 1: NIPA Summary Accounts, 2002

Account 1. Domestic Income and Product Account

Line			Line		
1	Compensation of employees, paid	6,024.3	15	Personal consumption expenditures (3-3)	7,385.3
2	Wage and salary accruals	4,979.8	16	Durable goods	911.3
3	Disbursements (3-12 and 5-11)	4,979.8	17	Nondurable goods	2,086.0
4	Wage accruals less disbursements (4-9 and 6-11)	0.0	18	Services	4,388.0
5	Supplements to wages and salaries (3-14)	1,044.5	19	Gross private domestic investment	1,589.2
6	Taxes on production and imports (4-16)	760.1	20	Fixed investment (6-2)	1,583.9
7	*Less:* Subsidies (4-8)	38.2	21	Nonresidential	1,080.2
8	Net operating surplus	2,523.2	22	Structures	266.3
9	Private enterprises (2-19)	2,520.3	23	Equipment and software	813.9
10	Current surplus of government enterprises (4-26)	2.8	24	Residential	503.7
11	Consumption of fixed capital (6-13)	1,288.6	25	Change in private inventories (6-4)	5.4
			26	Net exports of goods and services	-426.3
12	**Gross domestic income**	**10,558.0**	27	Exports (5-1)	1,006.8
			28	Imports (5-9)	1,433.1
13	Statistical discrepancy (6-19)	-77.2	29	Government consumption expenditures and gross investment (4-1 and 6-3)	1,932.5
			30	Federal	679.5
			31	National defense	438.3
			32	Nondefense	241.2
			33	State and local	1,253.1
14	**GROSS DOMESTIC PRODUCT**	**10,480.8**	34	**GROSS DOMESTIC PRODUCT**	**10,480.8**

Account 2. Private Enterprise Income Account

Line			Line		
1	Income payments on assets	2,316.7	19	Net operating surplus (1-9)	2,520.3
2	Interest and miscellaneous payments (3-20 and 4-21)	2,267.7	20	Income receipts on assets	1,761.1
3	Dividend payments to the rest of the world (5-14)	42.1	21	Interest (3-20)	1,558.7
4	Reinvested earnings on foreign direct investment in the U.S. (5-15)	6.9	22	Dividend receipts from the rest of the world (5-6)	81.5
5	Business current transfer payments (net)	89.8	23	Reinvested earnings on U.S. direct investment abroad (5-7)	121.0
6	To persons (net) (3-24)	42.6			
7	To government (net) (4-24)	46.8			
8	To the rest of the world (net) (5-19)	0.4			
9	Proprietors' income with inventory valuation and capital consumption adjustments (3-17)	797.7			
10	Rental income of persons with capital consumption adjustment (3-18)	173.0			
11	Corporate profits with inventory valuation and capital consumption adjustments	904.2			
12	Taxes on corporate income	195.0			
13	To government (4-17)	185.9			
14	To the rest of the world (5-19)	9.2			
15	Profits after tax with inventory valuation and capital consumption adjustments	709.1			
16	Net dividends (3-21 plus 4-22)	398.3			
17	Undistributed corporate profits with inventory valuation and capital consumption adjustments (6-10)	310.8			
18	**USES OF PRIVATE ENTERPRISE INCOME**	**4,281.5**	24	**SOURCES OF PRIVATE ENTERPRISE INCOME**	**4,281.5**

Account 3. Personal Income and Outlay Account

Line			Line		
1	Personal current taxes (4-15)	1,053.1	10	Compensation of employees, received	6,019.1
2	Personal outlays	7,674.0	11	Wage and salary disbursements	4,974.6
3	Personal consumption expenditures (1-15)	7,385.3	12	Domestic (1-3 less 5-11)	4,971.4
4	Personal interest payments (3-20)	194.7	13	Rest of the world (5-3)	3.2
5	Personal current transfer payments	94.0	14	Supplements to wages and salaries (1-5)	1,044.5
6	To government (4-25)	58.6	15	Employer contributions for employee pension and insurance funds	680.4
7	To the rest of the world (net) (5-17)	35.4	16	Employer contributions for government social insurance	364.1
8	Personal saving (6-9)	183.2	17	Proprietors' income with inventory valuation and capital consumption adjustments (2-9)	797.7
			18	Rental income of persons with capital consumption adjustment (2-10)	173.0
			19	Personal income receipts on assets	1,378.5
			20	Personal interest income (2-2 and 3-4 and 4-7 and 5-5 less 2-21 less 4-21 less 5-13)	982.4
			21	Personal dividend income (2-16 less 4-22)	396.2
			22	Personal current transfer receipts	1,292.2
			23	Government social benefits (4-4)	1,249.5
			24	From business (net) (2-6)	42.6
			25	Less: Contributions for government social insurance (4-19)	750.3
9	**PERSONAL TAXES, OUTLAYS, AND SAVING**	**8,910.3**	26	**PERSONAL INCOME**	**8,910.3**

Source: Bureau of Economic Analysis (2004). Dollars in billions.

Table 1: NIPA Summary Accounts, 2002--Continued

Account 4. Government Receipts and Expenditures Account

Line			Line		
1	Consumption expenditures (1-29)	1,595.4	14	Current tax receipts	2,006.2
2	Current transfer payments	1,271.1	15	Personal current taxes (3-1)	1,053.1
3	Government social benefits	1,252.3	16	Taxes on production and imports (1-6)	760.1
4	To persons (3-23)	1,249.5	17	Taxes on corporate income (2-13)	185.9
5	To the rest of the world (5-18)	2.7	18	Taxes from the rest of the world (5-18)	7.2
6	Other current transfer payments to the rest of the world (net) (5-18)	18.8	19	Contributions for government social insurance (3-25)	750.3
7	Interest payments (3-20)	319.3	20	Income receipts on assets	116.1
8	Subsidies (1-7)	38.2	21	Interest and miscellaneous receipts (2-2 and 3-20)	114.0
9	Less: Wage accruals less disbursements (1-4)	0.0	22	Dividends (3-21)	2.1
10	Net government saving (6-12)	-243.3	23	Current transfer receipts	105.3
11	Federal	-240.0	24	From business (net) (2-7)	46.8
12	State and local	-3.2	25	From persons (3-6)	58.6
			26	Current surplus of government enterprises (1-10)	2.8
13	**GOVERNMENT CURRENT EXPENDITURES AND NET SAVING**	**2,980.7**	27	**GOVERNMENT CURRENT RECEIPTS**	**2,980.7**

Account 5. Foreign Transactions Current Account

Line			Line		
1	Exports of goods and services (1-27)	1,006.8	9	Imports of goods and services (1-28)	1,433.1
2	Income receipts from the rest of the world	299.1	10	Income payments to the rest of the world	277.6
3	Wage and salary receipts (3-13)	3.2	11	Wage and salary payments (1-3)	8.4
4	Income receipts on assets	296.0	12	Income payments on assets	269.2
5	Interest (3-20)	93.5	13	Interest (3-20)	220.2
6	Dividends (2-22)	81.5	14	Dividends (2-3)	42.1
7	Reinvested earnings on U.S. direct investment abroad (2-23)	121.0	15	Reinvested earnings on foreign direct investment in the United States (2-4)	6.9
			16	Current taxes and transfer payments to the rest of the world (net)	59.3
			17	From persons (net) (3-7)	35.4
			18	From government (net) (4-5 and 4-6 less 4-18)	14.3
			19	From business (net) (2-8 and 2-14)	9.6
			20	Balance on current account, national income and product accounts (7-1)	-464.1
8	**CURRENT RECEIPTS FROM THE REST OF THE WORLD**	**1,306.0**	21	**CURRENT PAYMENTS TO THE REST OF THE WORLD AND BALANCE ON CURRENT ACCOUNT**	**1,306.0**

Account 6. Domestic Capital Account

Line			Line		
1	Gross domestic investment	1,926.3	8	Net saving	250.8
2	Private fixed investment (1-20)	1,583.9	9	Personal saving (3-8)	183.2
3	Government fixed investment (1-29)	337.1	10	Undistributed corporate profits with inventory valuation and capital consumption adjustments (2-17)	310.8
4	Change in private inventories (1-25)	5.4	11	Wage accruals less disbursements (private) (1-4)	0.0
5	Capital account transactions (net) (7-2)	1.3	12	Net government saving (4-10)	-243.3
6	Net lending or net borrowing (-), national income and product accounts (7-3)	-465.4	13	Plus: Consumption of fixed capital (1-11)	1,288.6
			14	Private	1,077.8
			15	Government	210.8
			16	General government	177.6
			17	Government enterprises	33.2
			18	Equals: Gross saving	1,539.4
			19	Statistical discrepancy (1-13)	-77.2
7	**GROSS DOMESTIC INVESTMENT, CAPITAL ACCOUNT TRANSACTIONS, AND NET LENDING**	**1,462.2**	20	**GROSS SAVING AND STATISTICAL DISCREPANCY**	**1,462.2**

Account 7. Foreign Transactions Capital Account

Line			Line		
			2	Capital account transactions (net) (6-5)	1.3
			3	Net lending or net borrowing (-), national income and product accounts (6-6)	-465.4
1	**BALANCE ON CURRENT ACCOUNT, NATIONAL INCOME AND PRODUCT ACCOUNTS (5-20)**	**-464.1**	4	**CAPITAL ACCOUNT TRANSACTIONS (NET) AND NET LENDING, NATIONAL INCOME AND PRODUCT ACCOUNTS**	**-464.1**

Source: Bureau of Economic Analysis (2004). Dollars in billions.

Table 2: System of National Accounts 1993

	Non-financial corp.	Financial corp.	General govern-ment	House-holds	NPISHs	Total economy	Rest of the world	Total
Current accounts	**Uses & Resources**							
Production/external account of goods & services								
Generation of income account								
Allocation of primary income account								
Secondary distribution of income account								
Redistribution of income in kind account								
Use of income account								
Accumulation accounts	**Changes in assets & Changes in liabilities and net worth**							
Capital account								
Financial account								
Other changes in volume of assets account								
Revaluation account								
Balance sheets	**Assets & Liabilities**							
Opening balance sheet								
Changes in balance sheet								
Closing balance sheet								

Source: System of National Accounts (1993), pp. 29, 58-65.

Table 3: IEESA Production Account

	Row	Industries				Final uses (GDP)						Total commodity output
						Final consumption						
		Agriculture, forestry, & fisheries	Mining, utilities, water, & sanitary services	Other industries	Total	House-hold	Govern-ment	Gross domestic capital formation	Exports	Imports	GDP	
COMMODITIES												
Made	**1**											
Assets	2											
Fixed assets	3											
Environmental management	4											
Pollution abatement and control	5											
Other	6											
Inventories	7											
Government	8											
Nonfarm	9											
Farm	10											
Other	11											
Environmental cleanup and waste disposal services	12											
Other	13											
Natural and environmental assets	**14**											
Fixed	15											
Cultivated biological resources: Natural growth	16											
Proved subsoil assets	17											
Developed land	18											
Uncultivated biological resources: Natural growth	19											
Unproved subsoil assets	20											
Undeveloped land	21											
Water	22											
Air	23											
Work-in-progress inventories (natural growth products)	24											
Total intermediate inputs	**25**											
VALUE ADDED												
Compensation of employees	26											
Indirect business taxes, etc.	27											
Corporate profits and other property income	28											
Depreciation of fixed made assets: Structures and equipment	**29**											
Environmental management	30											
Pollution abatement and control	31											
Other	32											
Depletion and degradation of fixed natural and environmental assets	**33**											
Growth products: Fixed	34											
Proved subsoil assets	35											
Developed land	36											
Uncultivated biological resources	37											
Unproved subsoil assets	38											
Undeveloped land	39											
Water	40											
Air	41											
Gross value added (GDP) (row 25+27+28+29+33)	42											
Depreciation, depletion, and degradation (rows 29+33)	43											
Net value added (NDP) (rows 42-43)	44											
TOTAL INDUSTRY OUTPUT	**45**											

Source: Landefeld, Carson, et al (1994).

Table 4: IEESA Asset Account

	Row	Opening stock	Change				Closing stocks
			Depreciation, depletion, degradation	Capital formation	Revaluation and other changes	Total, net	
PRODUCED ASSETS							
Made assets	**1**						
Fixed assets	2						
Residential structures and equipment, private and government	3						
Fixed nonresidential structures and equipment, private and government	4						
Natural resource related	5						
Environmental management	6						
Conservation and development	7						
Water supply facilities	8						
Pollution abatement and control	9						
Sanitary services	10						
Air pollution abatement and control	11						
Water pollution abatement and control	12						
Other	13						
Inventories	14						
Government	15						
Nonfarm	16						
Farm (harvested crops, and livestock other than cattle and claves)	17						
Corn	18						
Soybeans	19						
All wheat	20						
Other	21						
Developed natural assets	**22**						
Cultivated biological resources	23						
Cultivated fixed natural growth assets	24						
Livestock for breeding, dairy, draught, etc.	25						
Cattle	26						
Fish stock	27						
Vineyards, orchards	28						
Trees on timberland	29						
Work-in-progress on natural growth products	30						
Livestock raised for slaughter	31						
Cattle	32						
Fish stock	33						
Calves	34						
Crops and other produced plants, not yet harvested	35						
Proved subsoil assets	36						
Oil (including natural gas liquids)	37						
Gas (including natural gas liquids)	38						
Coal	39						
Metals	40						
Other minerals	41						
Developed land	42						
Land underlying structures (private)	43						
Agricultural land (excluding vineyards, orchards)	44						
Soil	45						
Recreational land and water (public)	46						
Forest and other wooded land	47						
NONPRODUCED/ENVIRONMENTAL ASSETS							
Uncultivated biological resources	48						
Wild fish	49						
Timber and other plants of uncultivated forests	50						
Other uncultivated biological resources	51						
Unproved subsoil assets	52						
Undeveloped land	53						
Water (economic effects of changes in the stock)	54						
Air (economic effects of changes in the stock)	55						

Source: Landefeld, Carson, et al (1994).

Table 5: Production Account, 2002

Line		Product	Source	Total
1		GDP (NIPA)	NIPA 1.1.5 line 1	10,480.8
2	+	Services of consumers' durables	our imputation	1,046.0
3	+	Services of durables held by institutions	our imputation	33.1
4	+	Services of durables and structures held by government	our imputation	450.4
5	-	General government consumption of fixed capital	NIPA 3.10.5 line 5	177.6
6	+	Extra imputation for Owner Occupied Housing Services	our imputation	-122.8
7	-	Federal taxes on production and imports	NIPA 3.2 line 4	87.6
8	-	Federal Income receipts on rents and royalties	NIPA 3.2 line 14	4.7
9	-	Federal current transfer receipts from business	NIPA 3.2 line 16	14.1
10	-	S&L taxes on production and imports	NIPA 3.3 line 6	672.5
11	-	S&L Income receipts on rents and royalties	NIPA 3.3 line 15	7.4
12	-	S&L current transfer receipts fom business	NIPA 3.3 line 18	32.7
13	+	Capital Stock Tax	-	0.0
14	+	MV Tax	NIPA 3.5 line 28	6.8
15	+	Property Taxes	NIPA 3.3 line 8	291.0
16	+	Severance and Other Taxes	NIPA 3.5 line 29,31	41.7
17	+	Subsidies	NIPA 3.1 line 25	38.2
18	-	Adjustment for government enterprise consumption of fixed capital	our imputation	31.8
19	=	Gross Domestic Product		11,236.8

Line		Outlay	Source	Total
1	+	Capital Consumption Allowances	NIPA 5.1 line 13	1,288.6
2	+	Statistical Discrepancy	NIPA 5.1 line 26	-77.2
3	+	Services of consumers' durables	our imputation	1,046.0
4	+	Services of durables held by institutions	our imputation	33.1
5	+	Services of durables and structures held by government	our imputation	450.4
6	-	General government consumption of fixed capital	NIPA 3.10.5 line 5	177.6
7	+	Extra imputation for Owner Occupied Housing Services	our imputation	-122.8
8	+	National Income	NIPA 1.7.5 line 16	9,290.8
9	-	ROW Income	NIPA 1.7.5 line 2-3	21.5
10	-	Sales Tax(product account)		479.5
11	+	Subsidies	NIPA 1.12 line 20	38.2
12	-	Adjustment for government enterprise consumption of fixed capital	NIPA 5.1 line 17 less NIPA 3.10.5	31.8
13	=	Gross Domestic Factor Outlay		11,236.7

Table 6: Gross Domestic Product and Factor Outlay, 1948-2002

(Billions of Current $)

Year	Gross Domestic Product	Investment Goods Product	Consumption Goods Product	Labor Outlay	Property Outlay
1948	320.8	79.9	241.0	149.9	170.2
1949	321.8	73.6	248.2	165.3	155.8
1950	343.2	94.6	248.6	181.1	161.4
1951	381.9	111.1	270.8	210.5	170.6
1952	394.9	112.1	282.8	222.3	172.2
1953	436.3	120.2	316.2	238.2	198.2
1954	427.8	114.4	313.4	240.4	187.7
1955	471.5	133.5	338.0	252.4	219.4
1956	493.4	138.7	354.7	272.1	221.5
1957	536.9	142.3	394.6	292.7	243.7
1958	512.2	134.2	378.0	307.0	205.3
1959	556.6	150.7	405.8	316.6	239.9
1960	572.8	153.4	419.4	341.4	231.2
1961	587.0	154.4	432.7	351.6	235.1
1962	630.8	171.0	459.8	373.6	257.2
1963	675.4	181.8	493.6	382.2	293.0
1964	737.1	196.0	541.1	411.5	325.5
1965	806.3	218.5	587.8	447.6	358.7
1966	881.1	242.3	638.8	494.2	386.9
1967	927.9	244.5	683.4	518.1	409.9
1968	981.0	265.7	715.3	581.7	399.3
1969	1,051.5	284.1	767.4	640.4	411.3
1970	1,110.2	281.1	829.1	682.1	427.8
1971	1,181.3	309.7	871.6	739.5	441.8
1972	1,322.4	351.4	971.0	811.9	510.4
1973	1,507.6	405.9	1,101.8	902.4	605.3
1974	1,626.9	423.3	1,203.6	977.4	649.4
1975	1,806.9	437.0	1,369.9	1,053.3	753.5
1976	2,052.9	518.5	1,534.4	1,180.6	872.2
1977	2,268.5	602.3	1,666.2	1,318.9	949.7
1978	2,545.2	700.4	1,844.8	1,494.4	1,050.6
1979	2,875.0	791.5	2,083.5	1,657.0	1,218.2
1980	3,005.7	802.0	2,203.7	1,804.3	1,201.2
1981	3,334.9	905.9	2,429.0	1,927.8	1,407.4
1982	3,524.9	863.3	2,661.6	2,049.2	1,475.5
1983	3,878.3	936.4	2,941.8	2,226.9	1,651.5
1984	4,366.2	1,128.3	3,237.8	2,449.5	1,916.8
1985	4,615.7	1,178.0	3,437.8	2,637.2	1,978.4
1986	4,745.1	1,215.6	3,529.5	2,895.4	1,850.1
1987	5,111.3	1,284.3	3,827.0	3,009.7	2,101.4
1988	5,696.5	1,367.1	4,329.3	3,166.9	2,529.5
1989	6,022.2	1,459.5	4,562.7	3,446.2	2,576.2
1990	6,332.9	1,482.8	4,850.1	3,666.4	2,666.7
1991	6,457.1	1,423.2	5,033.9	3,799.0	2,657.8
1992	6,787.7	1,497.4	5,290.3	4,080.0	2,707.5
1993	7,031.3	1,590.8	5,440.5	4,316.5	2,714.7
1994	7,572.3	1,743.5	5,828.8	4,465.2	3,107.0
1995	7,950.2	1,820.2	6,130.0	4,654.5	3,295.7
1996	8,466.8	1,972.9	6,493.9	4,869.9	3,597.2
1997	8,951.7	2,170.3	6,781.4	5,177.1	3,774.6
1998	9,338.5	2,304.9	7,033.7	5,511.0	3,827.1
1999	9,815.6	2,447.3	7,368.3	5,899.6	3,916.1
2000	10,388.2	2,567.1	7,821.1	6,257.1	4,131.5
2001	10,615.0	2,497.4	8,117.6	6,523.9	4,091.2
2002	11,236.8	2,481.0	8,755.8	6,575.2	4,661.6

Table 7: Domestic Receipts and Outlays, 2002

Line	Receipts	Source	Total
1	+ Gross Domestic Factor Outlays	Production Account	11,236.7
2	+ Production Taxes	Production Account	479.5
3	- Subsidies	Production Account	38.2
4	+ Adjustment for government enterprise consumption of fixed capital	Production Account	31.8
5	= Gross Domestic Income at Market Prices		11,709.8
6	+ Income receipts from the rest of the world	NIPA 1.7.5 line 2	299.1
7	- Income payments to the rest of the world	NIPA 1.7.5 line 3	277.6
8	- Current taxes and transfers to the rest of the world (net)	NIPA 4.1 line 25	59.3
9	= Domestic Receipts		11,672.0

Line	Outlays	Source	Total
1	+ Personal consumption expenditures		7,430.3
2	PCE nondurable goods (NIPA)	NIPA 2.3.5 line 6	2,086.0
3	PCE Services	NIPA 2.3.5 line 13	4,388.0
4	less Space Rental Value of Inst Building and Nonfarm Dwellings	our imputation	3,608.8
5	Services of consumers' durables	our imputation	1,046.0
6	Services of structures and land	our imputation	656.4
7	Services of durables held by institutions	our imputation	33.1
8	+ Government consumption expenditures		1,820.9
9	Government consumption nondurable goods (NIPA)	NIPA 3.10.5 line 8	156.0
10	Government consumption services total		224.3
11	Government Consumption services (NIPA)	NIPA 3.10.5 line 9	486.8
12	less Sales to other sectors (NIPA)	NIPA 3.10.5 line 11	262.5
13	Services of durables and structures held by government	our imputation	450.4
14	Government compensation of employees exluding force account labor (NIPA)	NIPA 3.10.5 line 4-10	990.2
15	+ Gross savings and statistical discrepancy	Capital Account	2,420.8
16	= Domestic Outlays		11,672.0

Table 8: Domestic Receipts and Expenditures, 1948-2002

(Billions of Current $)

Year	Gross Domestic Receipts	Labor Compensation	Property Compensation	Personal Consumption Expenditures	Government Consumption Expenditures	Gross Savings and Statistical Discrepancy
1948	329.7	150.0	179.7	181.2	67.1	81.4
1949	329.6	165.4	164.3	181.8	74.1	73.7
1950	353.9	181.1	172.7	193.0	66.1	94.7
1951	394.5	210.5	184.0	211.1	70.3	113.2
1952	410.5	222.3	188.3	222.9	72.8	114.6
1953	453.8	238.2	215.7	234.7	97.8	121.3
1954	445.5	240.4	205.1	245.7	84.1	115.7
1955	491.0	252.3	238.7	264.2	91.2	135.6
1956	514.4	272.0	242.4	289.4	82.7	142.2
1957	558.5	292.7	265.9	297.7	114.0	146.7
1958	535.0	306.9	228.1	303.7	94.4	136.7
1959	579.9	316.5	263.4	320.9	104.1	155.0
1960	598.7	341.3	257.4	333.9	106.3	158.7
1961	613.3	351.5	261.9	348.5	105.3	159.7
1962	659.9	373.5	286.3	366.1	116.3	177.6
1963	706.5	382.1	324.3	391.6	125.5	189.6
1964	771.0	411.4	359.6	421.9	143.3	205.9
1965	842.3	447.6	394.7	457.0	156.6	228.7
1966	916.4	494.2	422.2	495.1	170.4	250.8
1967	965.7	518.2	447.6	523.2	189.5	253.0
1968	1,025.0	581.7	443.3	552.4	196.5	276.3
1969	1,099.8	640.4	459.4	604.3	200.1	295.5
1970	1,160.1	682.1	478.0	672.9	194.4	292.9
1971	1,236.5	739.5	497.0	698.0	214.4	324.1
1972	1,380.6	811.9	568.7	777.8	237.7	365.1
1973	1,578.6	902.4	676.2	866.8	279.3	432.3
1974	1,706.9	977.3	729.5	954.9	309.1	443.0
1975	1,887.9	1,053.3	834.6	1,069.1	361.2	457.6
1976	2,146.6	1,180.6	966.0	1,175.7	434.8	536.0
1977	2,371.5	1,318.9	1,052.6	1,286.2	472.0	613.3
1978	2,659.0	1,494.3	1,164.7	1,426.2	512.2	720.7
1979	3,007.0	1,656.9	1,350.1	1,651.4	541.7	813.9
1980	3,152.2	1,804.2	1,348.0	1,797.7	530.8	823.9
1981	3,501.6	1,927.7	1,573.9	1,996.3	565.5	939.8
1982	3,688.9	2,049.0	1,639.9	2,171.7	620.9	896.4
1983	4,054.1	2,226.8	1,827.3	2,363.5	721.5	969.0
1984	4,559.3	2,449.3	2,110.0	2,599.9	809.0	1,150.4
1985	4,811.4	2,637.0	2,174.4	2,787.0	838.1	1,186.2
1986	4,935.4	2,893.7	2,041.8	2,854.7	855.2	1,225.6
1987	5,308.7	3,008.3	2,300.4	3,112.8	911.2	1,284.9
1988	5,915.8	3,166.0	2,749.8	3,484.9	1,036.7	1,394.2
1989	6,261.2	3,444.9	2,816.3	3,704.0	1,056.4	1,500.9
1990	6,593.3	3,664.1	2,929.2	3,976.5	1,090.9	1,526.0
1991	6,777.3	3,796.2	2,981.1	4,111.4	1,130.0	1,535.8
1992	7,081.2	4,077.0	3,004.2	4,307.1	1,196.2	1,577.8
1993	7,334.7	4,313.2	3,021.5	4,443.9	1,220.4	1,670.4
1994	7,906.6	4,461.1	3,445.4	4,778.2	1,293.9	1,834.5
1995	8,303.8	4,650.4	3,653.4	5,036.3	1,332.0	1,935.6
1996	8,835.2	4,865.8	3,969.4	5,368.5	1,390.5	2,076.0
1997	9,334.7	5,172.7	4,162.0	5,611.5	1,459.3	2,264.0
1998	9,721.0	5,506.5	4,214.6	5,881.3	1,464.7	2,375.2
1999	10,226.7	5,894.4	4,332.3	6,200.5	1,527.1	2,499.2
2000	10,822.8	6,252.5	4,570.3	6,673.8	1,598.1	2,550.7
2001	11,052.4	6,518.8	4,533.6	6,931.7	1,647.2	2,473.4
2002	11,672.1	6,570.0	5,102.1	7,430.3	1,820.9	2,420.9

Table 9: Foreign Transactions Current Account, 2002

Line	Receipts from the Rest of the World	Source	Total
1	+ Exports of goods and services	NIPA 4.1 line 2	1,006.8
2	+ Income receipts from the rest of the world	NIPA 4.1 line 7	299.1
3	Wage and salary receipts	NIPA 4.1 line 8	3.2
4	Income receipts on assets	NIPA 4.1 line 9	296.0
5	= Current receipts from the rest of the world	NIPA 4.1 line 1	1,305.9

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	1,433.1
2	+ Income payments to the rest of the world	NIPA 4.1 line 19	277.6
3	Wage and salary payments	NIPA 4.1 line 20	8.4
4	Income payments on assets	NIPA 4.1 line 21	269.2
5	+ Current taxes and transfer payments to the rest of the world (net)	NIPA 4.1 line 25	59.3
6	+ Balance on current account	NIPA 4.1 line 29	-464.1
	= Current payments to the rest of the world and balance on current account		1,305.9

Table 10: Foreign Accounts Transactions, 1948-2002

(Billions of Current $)

Year	Current Receipts from the ROW	Exports of Goods and Services	Income Receipts from the ROW	Current Payments to ROW and Balance on Current Account	Imports of Goods and Services	Income Payments to ROW	Current Taxes and Transfers to ROW (net)	Balance on Current Account
1948	17.6	15.5	2.0	17.6	10.1	0.6	4.5	2.4
1949	16.4	14.5	1.9	16.5	9.2	0.7	5.6	0.9
1950	14.5	12.4	2.2	14.6	11.6	0.7	4.0	-1.8
1951	19.9	17.1	2.8	19.9	14.6	0.9	3.5	0.9
1952	19.3	16.5	2.9	19.3	15.3	0.9	2.5	0.6
1953	18.2	15.3	2.8	18.1	16.0	0.9	2.5	-1.3
1954	18.9	15.8	3.0	18.8	15.4	0.9	2.3	0.2
1955	21.2	17.7	3.5	21.1	17.2	1.1	2.5	0.4
1956	25.2	21.3	3.9	25.3	18.9	1.1	2.4	2.8
1957	28.3	24.0	4.3	28.3	19.9	1.2	2.3	4.8
1958	24.4	20.6	3.9	24.4	20.0	1.2	2.3	0.9
1959	27.0	22.7	4.3	27.0	22.3	1.5	4.3	-1.2
1960	31.9	27.0	4.9	31.9	22.8	1.8	4.1	3.2
1961	32.9	27.6	5.3	32.9	22.7	1.8	4.2	4.3
1962	35.0	29.1	5.9	35.0	25.0	1.8	4.3	3.9
1963	37.6	31.1	6.5	37.6	26.1	2.1	4.4	5.0
1964	42.3	35.0	7.2	42.2	28.1	2.3	4.3	7.5
1965	45.0	37.1	7.9	45.0	31.5	2.6	4.7	6.2
1966	49.0	40.9	8.1	49.0	37.1	3.0	5.0	3.9
1967	52.1	43.5	8.7	52.2	39.9	3.3	5.4	3.6
1968	58.0	47.9	10.1	58.0	46.6	4.0	5.7	1.7
1969	63.7	51.9	11.8	63.7	50.5	5.7	5.8	1.8
1970	72.5	59.7	12.8	72.5	55.8	6.4	6.3	4.0
1971	77.0	63.0	14.0	77.0	62.3	6.4	7.6	0.6
1972	87.1	70.8	16.3	87.1	74.2	7.7	8.8	-3.6
1973	118.8	95.3	23.5	118.8	91.2	10.9	7.4	9.3
1974	156.5	126.7	29.8	156.4	127.5	14.3	8.1	6.6
1975	166.7	138.7	28.0	166.8	122.7	15.0	7.6	21.4
1976	181.9	149.5	32.4	181.9	151.1	15.5	6.3	8.9
1977	196.6	159.4	37.2	196.6	182.4	16.9	6.2	-9.0
1978	233.1	186.9	46.3	233.2	212.3	24.7	6.7	-10.4
1979	298.5	230.1	68.3	298.4	252.7	36.4	8.0	1.4
1980	359.9	280.8	79.1	359.9	293.8	44.9	9.8	11.4
1981	397.3	305.2	92.0	397.2	317.8	59.1	14.1	6.3
1982	384.2	283.2	101.0	384.2	303.2	64.5	16.7	-0.2
1983	378.9	277.0	101.9	378.8	328.6	64.8	17.5	-32.1
1984	424.2	302.4	121.9	424.3	405.1	85.6	20.5	-86.9
1985	414.5	302.0	112.4	414.5	417.2	85.9	22.2	-110.8
1986	431.9	320.5	111.4	432.0	453.3	93.6	24.3	-139.2
1987	487.1	363.9	123.2	487.1	509.1	105.3	23.5	-150.8
1988	596.2	444.1	152.1	596.2	554.5	128.5	25.5	-112.2
1989	681.0	503.3	177.7	681.0	591.5	151.5	26.4	-88.3
1990	741.5	552.4	189.1	741.4	630.3	154.3	26.9	-70.1
1991	765.7	596.8	168.9	765.8	624.3	138.5	-10.6	13.5
1992	788.0	635.3	152.7	788.0	668.6	123.0	33.4	-36.9
1993	812.1	655.8	156.2	812.1	720.9	124.3	37.3	-70.4
1994	907.3	720.9	186.4	907.3	814.5	160.2	37.8	-105.2
1995	1,046.1	812.2	233.9	1,046.1	903.6	198.1	35.4	-91.0
1996	1,117.3	868.6	248.7	1,117.3	964.8	213.7	39.1	-100.3
1997	1,242.0	955.3	286.7	1,242.0	1,056.9	253.7	41.6	-110.2
1998	1,243.1	955.9	287.1	1,243.1	1,115.9	265.8	48.8	-187.4
1999	1,312.1	991.2	320.8	1,312.0	1,251.7	287.0	47.2	-273.9
2000	1,478.9	1,096.3	382.7	1,479.0	1,475.8	343.7	56.1	-396.6
2001	1,354.1	1,035.1	319.0	1,354.1	1,401.7	283.8	47.0	-378.4
2002	1,306.0	1,006.8	299.1	1,306.0	1,433.1	277.6	59.3	-464.1

Table 11: Domestic Capital Account, 2002

Line	Gross Domestic Capital Formation	Source	Total
1	+ Private fixed investment, Nonresidential Structures (NIPA)	NIPA 5.4.5 line 2	266.3
2	+ Private fixed investment, Equipment and Software (NIPA)	NIPA 5.5.5 line 1	821.4
3	+ Change in Private Inventories, Nonfarm (NIPA)	NIPA 5.6.5 line 19	8.7
4	+ Change in Private Inventories, Farm (NIPA)	NIPA 5.6.5 line 2	-3.4
5	+ Private fixed investment, Residential Structures (NIPA)	NIPA 5.4.5 line 35	496.1
6	+ Personal Consumption Expenditures, durable goods (NIPA)	NIPA 1.1.5 line 3	911.3
7	= Gross Private Domestic Investment		2,500.4
8	+ Government Intermediate Purchases, durable goods (NIPA)	NIPA 3.10.5 line 7	47.4
9	+ Government Investment, structures (NIPA)	NIPA 5.8.5 line 6	212.4
10	+ Government Investment, equipment and software (NIPA)	NIPA 5.8.5 line 46	124.7
11	= Gross Domestic Investment		2,884.9
12	+ Net lending or borrowing on rest of world account (NIPA)	NIPA 4.1 line 30	-465.4
13	+ Capital Accounts Transaction (net) (NIPA)	NIPA 4.1 line 32	1.3
14	= Gross Domestic Capital Formation		2,420.8

Line	Saving	Source	Total
1	+ Net saving (NIPA)	NIPA 5.1 line 26	250.7
2	Personal saving (NIPA)	NIPA 2.1 line 33	183.2
3	Undistributed corporate profits with IVA and capital consumption adjustments (NIPA)	NIPA 5.1 line 5	310.8
4	Wage accruals less disbursements (private) (NIPA)	NIPA 5.1 line 9	0.0
5	Net Government saving (NIPA)	NIPA 4.1 line 27	-243.3
6	+ Consumption of fixed capital (NIPA)	NIPA 1.7.5 line 5	1,288.6
7	= Gross saving (NIPA)	NIPA 5.1 line 1	1,539.3
8	+ Personal consumption expenditures, durable goods (NIPA)	NIPA 1.1.5 line 3	911.3
9	+ Government Intermediate Purchases, durable goods (NIPA)	NIPA 3.10.5 line 7	47.4
10	= Gross saving		2,498.0
11	+ Statistical Discrepency (NIPA)	NIPA 5.1 line 26	-77.2
12	= Gross Saving and Statistical Discrepancy		2,420.8
13	- Depreciation	our imputation	1,918.1
14	= Net National Saving		502.7
15	+ Revaluation	our imputation	2,681.9
16	= Change in national wealth		3,184.6

Table 12: Foreign Transactions Capital Account, 2002

Line	Balance on Current Account	Source	Total
1	Balance on current account (NIPA)	NIPA 4.1 line 29	-464.1

Line	Capital Account Transactions and Net Lending	Source	Total
1	Capital account transactions (net) (NIPA)	NIPA 4.1 line 32	1.3
2	Net lending or borrowing (NIPA)	NIPA 4.1 line 30	-465.4
3	= Current account transactions and net lending (NIPA)		-464.1

Table 13: Gross national capital formation, saving, and revaluation, 1948-2002

(Billions of Current $)

Year	Gross Saving	Replacement and depreciation	Net Saving and Capital Formation	Revaluation	Change in Wealth
1948					
1949	73.7	40.6	33.1	43.0	76.1
1950	94.7	44.2	50.5	23.2	73.7
1951	113.2	51.2	62.0	70.5	132.5
1952	114.6	54.9	59.7	25.1	84.9
1953	121.3	59.0	62.3	12.5	74.9
1954	115.7	62.3	53.4	5.9	59.2
1955	135.6	66.0	69.6	30.4	100.0
1956	142.2	72.7	69.5	79.5	149.0
1957	146.7	78.5	68.2	42.8	111.0
1958	136.7	81.6	55.1	21.6	76.8
1959	155.0	85.9	69.1	32.4	101.5
1960	158.7	89.2	69.5	39.0	108.5
1961	159.7	91.7	68.0	46.1	114.2
1962	177.6	95.2	82.4	49.7	132.1
1963	189.6	99.5	90.1	27.1	117.2
1964	205.9	104.9	101.0	1.1	102.2
1965	228.7	110.8	117.9	35.0	152.9
1966	250.8	119.0	131.8	76.3	208.1
1967	253.0	129.8	123.2	72.5	195.7
1968	276.3	142.6	133.7	174.4	308.1
1969	295.5	156.9	138.6	210.1	348.7
1970	292.9	172.3	120.6	187.1	307.7
1971	324.1	187.2	136.9	203.3	340.2
1972	365.1	205.0	160.1	376.2	536.3
1973	432.3	222.6	209.7	365.7	575.4
1974	443.0	255.7	187.3	239.8	427.1
1975	457.6	294.2	163.4	661.0	824.4
1976	536.0	320.5	215.5	382.4	597.9
1977	613.3	354.1	259.2	483.0	742.2
1978	720.7	398.9	321.8	720.4	1,042.2
1979	813.9	455.9	358.0	970.8	1,328.8
1980	823.9	523.4	300.5	1,104.3	1,404.8
1981	939.8	587.4	352.4	1,356.2	1,708.6
1982	896.4	638.8	257.6	847.8	1,105.4
1983	969.0	663.1	305.9	219.9	525.8
1984	1,150.4	696.3	454.1	847.5	1,301.6
1985	1,186.2	745.6	440.6	1,130.2	1,570.8
1986	1,225.6	804.8	420.8	650.2	1,071.0
1987	1,284.9	868.5	416.4	759.9	1,176.3
1988	1,394.2	932.1	462.1	1,008.1	1,470.2
1989	1,500.9	997.5	503.4	1,200.2	1,703.6
1990	1,526.0	1,059.1	466.9	310.7	777.6
1991	1,535.8	1,112.4	423.4	182.8	606.2
1992	1,577.8	1,142.4	435.4	21.0	456.4
1993	1,670.4	1,193.8	476.6	-410.7	65.9
1994	1,834.5	1,259.8	574.7	451.0	1,025.7
1995	1,935.6	1,336.6	599.0	833.0	1,432.0
1996	2,076.0	1,398.1	677.9	678.4	1,356.3
1997	2,264.0	1,462.5	801.5	601.9	1,403.4
1998	2,375.2	1,528.3	846.9	1,623.3	2,470.2
1999	2,499.2	1,619.5	879.7	1,720.7	2,600.5
2000	2,550.7	1,742.7	808.0	2,027.6	2,835.6
2001	2,473.4	1,855.7	617.7	1,638.8	2,256.5
2002	2,420.9	1,918.1	502.8	2,681.9	3,184.7

Table 14: Foreign Transactions Capital Account, 1948-2002

(Billions of Current $)

Year	Balance on Current Account	Capital Account Transactions (net)	Net lending or borrowing
1948	2.4	.....	2.4
1949	0.9	.....	0.9
1950	-1.8	.....	-1.8
1951	0.9	.....	0.9
1952	0.6	.....	0.6
1953	-1.3	.....	-1.3
1954	0.2	.....	0.2
1955	0.4	.....	0.4
1956	2.8	.....	2.8
1957	4.8	.....	4.8
1958	0.9	.....	0.9
1959	-1.2	.....	-1.2
1960	3.2	.....	3.2
1961	4.3	.....	4.3
1962	3.9	.....	3.9
1963	5.0	.....	5.0
1964	7.5	.....	7.5
1965	6.2	.....	6.2
1966	3.9	.....	3.9
1967	3.6	.....	3.6
1968	1.7	.....	1.7
1969	1.8	.....	1.8
1970	4.0	.....	4.0
1971	0.6	.....	0.6
1972	-3.6	.....	-3.6
1973	9.3	.....	9.3
1974	6.6	.....	6.6
1975	21.4	.....	21.4
1976	8.9	.....	8.9
1977	-9.0	.....	-9.0
1978	-10.4	.....	-10.4
1979	1.4	.....	1.4
1980	11.4	.....	11.4
1981	6.3	.....	6.3
1982	-0.2	-0.2	0.0
1983	-32.1	-0.2	-31.8
1984	-86.9	-0.2	-86.7
1985	-110.8	-0.3	-110.5
1986	-139.2	-0.3	-138.9
1987	-150.8	-0.4	-150.4
1988	-112.2	-0.5	-111.7
1989	-88.3	-0.3	-88.0
1990	-70.1	6.6	-76.6
1991	13.5	4.5	9.0
1992	-36.9	0.6	-37.5
1993	-70.4	1.3	-71.7
1994	-105.2	1.7	-106.9
1995	-91.0	0.9	-91.9
1996	-100.3	0.7	-101.0
1997	-110.2	1.0	-111.3
1998	-187.4	0.7	-188.1
1999	-273.9	4.8	-278.7
2000	-396.6	0.8	-397.4
2001	-378.4	1.1	-379.5
2002	-464.1	1.3	-465.4

Table 15: Domestic Balance Sheet, 2002

Line	Domestic Wealth	Source	Total
1	+ Private domestic tangible assets	our imputation	39,610.5
2	+ Government tangible assets	our imputation	6,251.0
3	= Domestic tangible assets		45,861.6
4	+ Net international investment position of the United States		-2,605.2
5	= Domestic wealth		43,256.4

Table 16: U.S. International Position, 2002

Line	Domestic Wealth	Source	Total
1	+ U.S. owned assets abroad		6,473.6
2	- Foreign-owned assets in the United States		9,078.7
3	= Net international investment position of the United States		-2,605.2

Table 17: Domestic Balance Sheet, 1948-2002

(Billions of Current $)

Year	Private domestic tangible assets	Government tangible assets	Net international investment position of the United States	Domestic Wealth
1948	527.4	227.5		754.9
1949	565.8	221.3		787.2
1950	647.1	216.4		863.5
1951	745.1	245.4		990.5
1952	798.1	268.4		1,066.5
1953	865.5	270.8		1,136.3
1954	909.9	277.8		1,187.7
1955	990.2	289.2		1,279.4
1956	1,096.0	321.9		1,417.9
1957	1,192.9	324.0		1,517.0
1958	1,249.9	336.2		1,586.1
1959	1,330.2	352.3		1,682.6
1960	1,418.8	362.1		1,780.9
1961	1,500.8	380.2		1,881.1
1962	1,605.0	402.3		2,007.3
1963	1,687.6	427.9		2,115.5
1964	1,752.8	448.4		2,201.3
1965	1,864.5	474.9		2,339.4
1966	2,024.6	510.4		2,534.9
1967	2,165.8	548.1		2,713.9
1968	2,411.0	593.6		3,004.6
1969	2,687.5	651.6		3,339.1
1970	2,893.1	724.4		3,617.5
1971	3,146.7	795.5		3,942.2
1972	3,565.6	898.1		4,463.7
1973	4,040.5	980.9		5,021.4
1974	4,284.8	1,157.5		5,442.4
1975	4,946.4	1,296.2		6,242.6
1976	5,436.2	1,359.0		6,795.2
1977	6,157.8	1,445.0		7,602.8
1978	7,138.0	1,563.7		8,701.7
1979	8,302.7	1,746.8		10,049.5
1980	9,437.4	1,989.1		11,426.6
1981	10,811.8	2,245.8		13,057.6
1982	11,590.3	2,430.5	235.9	14,256.8
1983	12,082.5	2,507.0	257.4	14,846.9
1984	13,300.7	2,600.4	134.1	16,035.2
1985	14,893.7	2,722.7	96.9	17,713.3
1986	16,033.8	2,878.6	100.8	19,013.1
1987	17,202.7	3,060.8	50.5	20,314.0
1988	18,712.2	3,220.2	10.5	21,942.9
1989	20,284.3	3,394.0	-47.0	23,631.3
1990	20,806.2	3,592.8	-164.5	24,234.6
1991	21,148.5	3,747.9	-260.8	24,635.6
1992	21,348.6	3,869.7	-452.3	24,766.0
1993	21,679.8	4,053.1	-144.3	25,588.7
1994	22,150.6	4,253.7	-123.7	26,280.6
1995	23,509.4	4,494.3	-343.3	27,660.4
1996	24,557.7	4,689.2	-386.5	28,860.4
1997	26,263.5	4,882.7	-835.2	30,311.0
1998	28,804.8	5,083.7	-1,094.1	32,794.5
1999	30,954.0	5,353.6	-1,068.8	35,238.8
2000	33,913.0	5,684.1	-1,588.2	38,008.9
2001	36,597.1	5,969.7	-2,314.3	40,252.6
2002	39,610.5	6,251.0	-2,605.2	43,256.4

Table 18: U.S. International Position, 1948-2002

(Billions of Current $)

Year	U.S. owned assets abroad	Foreign-owned assets in the United States	Net international investment position of the United States
1948			
1949			
1950			
1951			
1952			
1953			
1954			
1955			
1956			
1957			
1958			
1959			
1960			
1961			
1962			
1963			
1964			
1965			
1966			
1967			
1968			
1969			
1970			
1971			
1972			
1973			
1974			
1975			
1976			
1977			
1978			
1979			
1980			
1981			
1982	961.0	725.1	235.9
1983	1,129.7	872.3	257.4
1984	1,127.1	993.0	134.1
1985	1,302.7	1,205.8	96.9
1986	1,594.7	1,493.9	100.8
1987	1,758.7	1,708.2	50.5
1988	2,008.4	1,997.9	10.5
1989	2,350.2	2,397.2	-47.0
1990	2,294.1	2,458.6	-164.5
1991	2,470.6	2,731.4	-260.8
1992	2,466.5	2,918.8	-452.3
1993	3,091.4	3,235.7	-144.3
1994	3,326.7	3,450.4	-123.7
1995	3,930.3	4,273.6	-343.3
1996	4,631.3	5,017.8	-386.5
1997	5,379.1	6,214.3	-835.2
1998	6,174.5	7,268.6	-1,094.1
1999	7,390.4	8,459.2	-1,068.8
2000	7,393.7	8,981.8	-1,588.2
2001	6,891.3	9,205.5	-2,314.3
2002	6,473.6	9,078.7	-2,605.2

Table 19: Gross Domestic Product, 1948-2002

(Constant prices of 2000)

	Gross Domestic Product		Investment Goods Product		Consumption Goods Product	
Year	Price	Quantity	Price	Quantity	Price	Quantity
1948	0.192	1,667.7	0.252	317.0	0.178	1,356.3
1949	0.189	1,703.2	0.250	294.9	0.174	1,426.3
1950	0.186	1,843.9	0.252	376.0	0.170	1,461.2
1951	0.191	1,996.3	0.277	400.8	0.170	1,591.8
1952	0.188	2,099.0	0.279	401.3	0.166	1,707.2
1953	0.198	2,199.8	0.279	430.4	0.178	1,773.0
1954	0.195	2,195.5	0.280	409.2	0.174	1,801.9
1955	0.202	2,333.7	0.284	469.5	0.182	1,860.6
1956	0.207	2,387.2	0.301	461.6	0.184	1,933.0
1957	0.220	2,442.9	0.311	457.4	0.197	2,002.3
1958	0.209	2,446.1	0.314	427.1	0.184	2,055.7
1959	0.215	2,593.2	0.314	479.6	0.190	2,134.1
1960	0.216	2,654.4	0.317	483.3	0.191	2,197.2
1961	0.216	2,721.6	0.319	484.6	0.191	2,270.9
1962	0.220	2,871.6	0.319	535.3	0.195	2,356.5
1963	0.226	2,983.2	0.321	566.3	0.203	2,431.6
1964	0.234	3,146.9	0.323	606.3	0.212	2,551.2
1965	0.242	3,328.8	0.328	666.8	0.221	2,660.4
1966	0.248	3,555.3	0.333	728.5	0.227	2,817.3
1967	0.264	3,513.3	0.400	611.8	0.231	2,956.0
1968	0.267	3,677.3	0.414	642.7	0.232	3,090.0
1969	0.277	3,790.4	0.428	664.3	0.241	3,181.6
1970	0.293	3,791.9	0.453	620.5	0.254	3,261.3
1971	0.303	3,904.9	0.473	655.4	0.262	3,329.0
1972	0.323	4,096.3	0.484	726.1	0.284	3,424.6
1973	0.351	4,293.9	0.491	827.2	0.316	3,482.2
1974	0.379	4,288.0	0.537	788.1	0.340	3,536.9
1975	0.423	4,275.8	0.613	712.5	0.376	3,644.5
1976	0.461	4,456.2	0.661	784.1	0.411	3,731.0
1977	0.486	4,670.2	0.681	884.5	0.437	3,810.8
1978	0.515	4,945.0	0.719	974.1	0.464	3,976.8
1979	0.563	5,102.8	0.778	1,017.8	0.510	4,084.3
1980	0.587	5,118.4	0.846	948.0	0.523	4,211.3
1981	0.639	5,222.5	0.938	965.8	0.565	4,299.3
1982	0.685	5,142.7	1.010	854.6	0.606	4,394.1
1983	0.721	5,378.4	1.008	929.1	0.648	4,538.8
1984	0.755	5,779.8	1.010	1,117.7	0.689	4,697.4
1985	0.761	6,064.4	1.009	1,167.0	0.696	4,937.2
1986	0.753	6,304.3	1.002	1,213.6	0.688	5,131.8
1987	0.783	6,526.4	1.017	1,262.4	0.722	5,303.9
1988	0.842	6,763.0	1.033	1,323.1	0.791	5,475.9
1989	0.859	7,008.3	1.045	1,396.6	0.809	5,641.4
1990	0.885	7,155.6	1.071	1,385.2	0.834	5,812.5
1991	0.903	7,153.2	1.096	1,298.7	0.850	5,921.2
1992	0.920	7,380.4	1.100	1,361.4	0.870	6,081.9
1993	0.927	7,588.1	1.105	1,439.4	0.877	6,203.0
1994	0.958	7,904.7	1.106	1,576.8	0.916	6,366.3
1995	0.975	8,152.5	1.108	1,643.3	0.937	6,545.5
1996	0.996	8,498.5	1.093	1,804.4	0.967	6,717.6
1997	1.000	8,952.9	1.071	2,026.6	0.978	6,936.9
1998	0.994	9,392.6	1.044	2,207.7	0.978	7,189.3
1999	0.989	9,923.9	1.016	2,409.2	0.980	7,515.5
2000	1.000	10,388.2	1.000	2,567.1	1.000	7,821.1
2001	1.013	10,474.2	1.026	2,433.4	1.009	8,042.1
2002	1.039	10,818.0	1.006	2,467.1	1.048	8,351.7

Table 20: Domestic Labor Input, 1948-2002

(Constant Prices of 2000)

Year	Labor Services				Employment	Weekly Hours	Hourly Compensation	Hours Worked
	Price	Quantity	Value	Quality				
1948	0.06	2,320.6	149.9	0.73	61,536	40.6	1.2	129,846
1949	0.07	2,258.7	165.3	0.73	60,437	40.2	1.3	126,384
1950	0.08	2,346.3	181.1	0.75	62,424	39.8	1.4	129,201
1951	0.08	2,526.9	210.5	0.76	66,169	39.7	1.5	136,433
1952	0.09	2,593.4	222.3	0.77	67,407	39.2	1.6	137,525
1953	0.09	2,648.1	238.2	0.79	68,471	38.8	1.7	138,134
1954	0.09	2,583.9	240.4	0.79	66,843	38.4	1.8	133,612
1955	0.09	2,670.9	252.4	0.80	68,367	38.7	1.8	137,594
1956	0.10	2,733.0	272.1	0.80	69,968	38.4	1.9	139,758
1957	0.11	2,735.9	292.7	0.81	70,262	37.9	2.1	138,543
1958	0.12	2,666.9	307.0	0.82	68,578	37.6	2.3	134,068
1959	0.11	2,757.7	316.6	0.82	70,149	37.8	2.3	137,800
1960	0.12	2,801.5	341.4	0.83	71,128	37.6	2.5	139,150
1961	0.12	2,838.2	351.6	0.84	71,183	37.4	2.5	138,493
1962	0.13	2,939.1	373.6	0.85	72,673	37.4	2.6	141,258
1963	0.13	2,976.8	382.2	0.86	73,413	37.3	2.7	142,414
1964	0.13	3,050.1	411.5	0.86	74,990	37.2	2.8	144,920
1965	0.14	3,143.9	447.6	0.86	77,239	37.2	3.0	149,378
1966	0.15	3,272.8	494.2	0.87	80,802	36.8	3.2	154,795
1967	0.16	3,321.2	518.1	0.87	82,645	36.3	3.3	156,016
1968	0.17	3,399.1	581.7	0.88	84,733	36.0	3.7	158,604
1969	0.18	3,484.7	640.4	0.88	87,071	35.9	3.9	162,414
1970	0.20	3,433.0	682.1	0.88	86,867	35.3	4.3	159,644
1971	0.22	3,433.2	739.5	0.89	86,715	35.2	4.7	158,943
1972	0.23	3,522.3	811.9	0.89	88,838	35.3	5.0	162,890
1973	0.25	3,665.7	902.4	0.89	92,542	35.2	5.3	169,329
1974	0.27	3,654.2	977.4	0.89	94,121	34.5	5.8	168,800
1975	0.29	3,599.8	1,053.3	0.90	92,575	34.2	6.4	164,460
1976	0.32	3,701.2	1,180.6	0.90	94,922	34.2	7.0	168,722
1977	0.35	3,822.8	1,318.9	0.90	98,202	34.1	7.6	174,265
1978	0.37	3,987.6	1,494.4	0.90	102,931	34.0	8.2	181,976
1979	0.40	4,115.1	1,657.0	0.90	106,463	33.9	8.8	187,589
1980	0.44	4,098.1	1,804.3	0.90	107,061	33.4	9.7	186,202
1981	0.47	4,140.2	1,927.8	0.91	108,050	33.3	10.3	186,887
1982	0.50	4,102.6	2,049.2	0.92	106,749	33.1	11.2	183,599
1983	0.53	4,164.7	2,226.9	0.92	107,810	33.2	12.0	186,175
1984	0.56	4,409.3	2,449.5	0.93	112,604	33.3	12.5	195,221
1985	0.58	4,523.4	2,637.2	0.93	115,201	33.3	13.2	199,424
1986	0.64	4,559.1	2,895.4	0.93	117,158	33.0	14.4	200,998
1987	0.64	4,727.9	3,009.7	0.94	120,456	33.1	14.5	207,119
1988	0.65	4,879.9	3,166.9	0.94	123,916	33.0	14.9	212,882
1989	0.68	5,042.1	3,446.2	0.95	126,743	33.2	15.7	218,811
1990	0.72	5,128.2	3,666.4	0.96	128,290	33.0	16.6	220,475
1991	0.75	5,077.5	3,799.0	0.96	127,022	32.7	17.6	216,281
1992	0.80	5,096.6	4,080.0	0.97	127,100	32.8	18.8	216,873
1993	0.82	5,258.0	4,316.5	0.97	129,556	32.9	19.5	221,699
1994	0.83	5,408.3	4,465.2	0.98	132,459	33.0	19.6	227,345
1995	0.84	5,563.1	4,654.5	0.98	135,297	33.1	20.0	232,675
1996	0.86	5,673.2	4,869.9	0.99	137,571	33.0	20.6	235,859
1997	0.89	5,832.6	5,177.1	0.99	140,432	33.2	21.4	242,242
1998	0.92	6,009.8	5,511.0	0.99	143,557	33.3	22.2	248,610
1999	0.96	6,140.9	5,899.6	1.00	146,468	33.3	23.3	253,276
2000	1.00	6,257.1	6,257.1	1.00	149,364	33.1	24.3	257,048
2001	1.05	6,239.2	6,523.9	1.00	149,020	32.9	25.6	255,054
2002	1.06	6,177.4	6,575.2	1.01	147,721	32.9	26.1	252,399

Table 21: Benchmarks, rates of replacement, and price indexes used in estimating capital, 2002

(Constant Prices of 2000)

	Asset Class	2002 Benchmark (billions)	Replacement Rate	Deflator
1.	Consumer Durables	3,831.3	0.20	NIPA
2.	Nonresidential Structures	6,415.1	0.03	NIPA
3.	Equipment and Software	4,807.2	0.15	NIPA
4.	Residential Structures	10,505.0	0.02	NIPA
5.	Nonfarm inventories	1,355.6	-	NIPA
6.	Farm inventories	123.8	-	NIPA
7.	Land	8,374.5	-	Implicit price of household land, Flow of Funds

Table 22: Relative Proportion of Capital Stock by Asset Class and Sector, 2002

		Sector				
	Asset Class	Corporate Business	Noncorporate Business	Households and Institutions	Government	Total
1.	Consumer Durables	-	-	0.081	-	0.081
2.	Nonresidential Structures	0.105	0.028	0.018	0.114	0.264
3.	Equipment and Software	0.087	0.012	0.003	0.015	0.118
4.	Residential Structures	0.002	0.042	0.200	0.005	0.249
5.	Nonfarm inventories	0.028	0.002	-	-	0.029
6.	Farm inventories	-	0.003	-	-	0.003
7.	Land	0.061	0.086	0.109	-	0.256
	Total	0.283	0.173	0.411	0.134	1.000

Table 23: Domestic Capital Input, 1948-2002

(Constant Prices of 2000)

	Corporate Capital Input		Noncorporate Capital Input		Household Capital Input		Government Capital Input		Domestic Capital Input	
Year	Price Index	Quantity Index	Price Index	Quantity Index	Price Index	Quantity Index	Price Index	Quantity Index	Price Index	Quantity Index
1948	0.304	144	0.340	130	0.362	105	0.374	117	0.352	483
1949	0.282	153	0.201	137	0.312	124	0.409	114	0.305	512
1950	0.316	161	0.199	144	0.304	142	0.342	113	0.298	542
1951	0.334	173	0.227	151	0.285	160	0.290	112	0.295	577
1952	0.310	184	0.244	156	0.276	174	0.251	115	0.283	609
1953	0.306	193	0.231	161	0.277	187	0.423	119	0.310	639
1954	0.295	200	0.205	164	0.286	199	0.306	124	0.281	667
1955	0.339	210	0.239	168	0.306	213	0.336	128	0.315	697
1956	0.328	221	0.222	171	0.345	227	0.250	130	0.304	729
1957	0.324	231	0.200	174	0.315	240	0.443	132	0.322	757
1958	0.301	238	0.150	178	0.287	250	0.259	137	0.262	783
1959	0.342	244	0.216	182	0.286	261	0.300	141	0.297	809
1960	0.329	254	0.157	186	0.282	273	0.286	146	0.276	839
1961	0.330	262	0.166	189	0.290	282	0.236	151	0.272	865
1962	0.353	272	0.181	194	0.295	292	0.256	157	0.287	896
1963	0.363	285	0.229	202	0.325	304	0.275	162	0.314	934
1964	0.378	299	0.232	208	0.337	320	0.337	167	0.334	976
1965	0.402	317	0.221	216	0.356	337	0.370	171	0.350	1,023
1966	0.406	340	0.246	226	0.360	358	0.365	176	0.358	1,082
1967	0.390	363	0.278	237	0.359	377	0.367	183	0.359	1,142
1968	0.398	384	0.234	248	0.322	397	0.321	189	0.333	1,200
1969	0.392	406	0.225	256	0.339	419	0.270	194	0.327	1,258
1970	0.365	427	0.244	265	0.391	436	0.184	197	0.326	1,311
1971	0.396	442	0.233	276	0.353	454	0.212	198	0.326	1,356
1972	0.422	463	0.254	287	0.399	477	0.259	198	0.361	1,415
1973	0.437	490	0.310	300	0.430	507	0.409	197	0.407	1,485
1974	0.433	519	0.342	310	0.438	529	0.443	197	0.420	1,547
1975	0.495	541	0.352	315	0.485	544	0.556	199	0.473	1,593
1976	0.534	564	0.373	320	0.509	564	0.808	204	0.530	1,645
1977	0.589	589	0.377	324	0.513	591	0.852	208	0.557	1,706
1978	0.632	622	0.408	333	0.530	621	0.910	212	0.590	1,780
1979	0.637	660	0.530	346	0.652	646	0.895	216	0.655	1,859
1980	0.640	696	0.539	355	0.645	663	0.620	220	0.624	1,924
1981	0.726	731	0.730	363	0.722	670	0.567	226	0.711	1,980
1982	0.722	764	0.613	370	0.812	679	0.630	231	0.726	2,033
1983	0.819	751	0.649	367	0.842	694	0.905	237	0.810	2,040
1984	0.901	786	0.725	374	0.934	723	1.074	244	0.905	2,119
1985	0.898	831	0.763	385	0.925	760	0.933	253	0.891	2,221
1986	0.870	868	0.606	394	0.808	803	0.777	266	0.795	2,326
1987	0.905	898	0.766	401	0.884	847	0.828	281	0.868	2,422
1988	0.888	1,005	0.908	419	1.048	887	1.118	293	0.974	2,597
1989	0.918	1,022	0.897	425	1.030	925	1.007	303	0.965	2,670
1990	0.913	1,054	0.941	432	1.058	957	0.908	314	0.969	2,753
1991	0.912	1,082	0.880	439	1.023	981	0.867	324	0.942	2,821
1992	0.923	1,110	0.828	443	0.997	1,004	0.947	334	0.938	2,886
1993	0.940	1,147	0.811	447	0.921	1,035	0.935	343	0.914	2,970
1994	0.995	1,193	0.988	453	1.031	1,075	1.045	349	1.013	3,067
1995	1.031	1,253	0.959	458	1.063	1,119	1.056	355	1.036	3,182
1996	1.067	1,324	1.019	465	1.117	1,170	1.115	361	1.084	3,319
1997	1.097	1,412	0.992	475	1.074	1,232	1.172	367	1.083	3,485
1998	1.054	1,514	0.976	488	1.036	1,307	1.074	374	1.040	3,682
1999	1.032	1,623	0.937	501	0.987	1,395	1.032	382	1.004	3,901
2000	1.000	1,738	1.000	514	1.000	1,488	1.000	392	1.000	4,132
2001	0.948	1,832	0.933	524	0.949	1,578	0.917	401	0.944	4,335
2002	0.993	1,890	1.127	531	1.043	1,664	1.098	410	1.037	4,496

Table 24: Gross Domestic Factor Input, 1948-2002

(Constant Prices of 2000)

	Gross Domestic Factor Input		
Year	Price Index	Quantity Index	Property Outlay, Relative Share
1948	0.136	2,357	0.532
1949	0.134	2,393	0.485
1950	0.137	2,509	0.471
1951	0.142	2,690	0.448
1952	0.141	2,795	0.437
1953	0.151	2,887	0.454
1954	0.148	2,903	0.438
1955	0.156	3,016	0.465
1956	0.158	3,118	0.449
1957	0.169	3,173	0.454
1958	0.162	3,172	0.401
1959	0.170	3,279	0.431
1960	0.171	3,359	0.404
1961	0.171	3,428	0.401
1962	0.178	3,550	0.408
1963	0.186	3,640	0.434
1964	0.196	3,761	0.442
1965	0.206	3,907	0.445
1966	0.215	4,095	0.439
1967	0.220	4,227	0.442
1968	0.224	4,376	0.407
1969	0.232	4,526	0.391
1970	0.244	4,557	0.385
1971	0.256	4,617	0.374
1972	0.277	4,767	0.386
1973	0.303	4,978	0.402
1974	0.322	5,049	0.399
1975	0.357	5,066	0.417
1976	0.393	5,218	0.425
1977	0.420	5,398	0.419
1978	0.452	5,631	0.413
1979	0.492	5,840	0.424
1980	0.509	5,909	0.400
1981	0.554	6,016	0.422
1982	0.583	6,051	0.419
1983	0.635	6,112	0.426
1984	0.680	6,418	0.439
1985	0.695	6,646	0.429
1986	0.698	6,804	0.390
1987	0.723	7,068	0.411
1988	0.768	7,415	0.444
1989	0.788	7,645	0.428
1990	0.810	7,821	0.421
1991	0.822	7,855	0.412
1992	0.854	7,946	0.399
1993	0.859	8,188	0.386
1994	0.898	8,436	0.410
1995	0.913	8,709	0.415
1996	0.945	8,965	0.425
1997	0.963	9,299	0.422
1998	0.964	9,682	0.410
1999	0.978	10,040	0.399
2000	1.000	10,389	0.398
2001	1.005	10,568	0.385
2002	1.054	10,659	0.415

Table 25: Total Factor Productivity

(2000=1.000)

Year	Labor Services and Capital Services
1949	0.711
1950	0.735
1951	0.742
1952	0.751
1953	0.762
1954	0.756
1955	0.774
1956	0.766
1957	0.770
1958	0.771
1959	0.791
1960	0.790
1961	0.794
1962	0.809
1963	0.820
1964	0.837
1965	0.852
1966	0.868
1967	0.831
1968	0.840
1969	0.837
1970	0.832
1971	0.846
1972	0.859
1973	0.863
1974	0.849
1975	0.844
1976	0.854
1977	0.865
1978	0.878
1979	0.874
1980	0.866
1981	0.868
1982	0.850
1983	0.880
1984	0.901
1985	0.912
1986	0.927
1987	0.923
1988	0.912
1989	0.917
1990	0.915
1991	0.911
1992	0.929
1993	0.927
1994	0.937
1995	0.936
1996	0.948
1997	0.963
1998	0.970
1999	0.989
2000	1.000
2001	0.991
2002	1.015

Table 26: Consumption expenditures and labor compensation, 1948-2002

(Constant Prices of 2000)

Year	Personal Consumption Expenditures (price index)	Personal Consumption Expenditures (quantity index)	Government Consumption Expenditures (price index)	Government Consumption Expenditures (quantity index)	National Labor Compensation		
					Price Index	Quantity Index	Effective Tax Rate
1948	0.181	999.8	0.146	458.3	0.065	2,320.6	0.094
1949	0.174	1047.8	0.157	472.1	0.073	2,258.6	0.074
1950	0.174	1108.4	0.142	466.4	0.077	2,346.3	0.076
1951	0.181	1165.9	0.133	529.2	0.083	2,526.6	0.094
1952	0.183	1221.4	0.125	580.2	0.086	2,593.0	0.106
1953	0.185	1271.3	0.161	605.9	0.090	2,647.6	0.102
1954	0.188	1308.7	0.141	597.5	0.093	2,583.1	0.092
1955	0.192	1378.1	0.151	601.8	0.094	2,670.0	0.095
1956	0.201	1442.2	0.136	607.2	0.100	2,732.1	0.099
1957	0.200	1486.8	0.181	631.5	0.107	2,735.1	0.097
1958	0.199	1523.7	0.146	644.7	0.115	2,666.1	0.092
1959	0.202	1590.4	0.155	672.9	0.115	2,756.8	0.097
1960	0.204	1636.0	0.154	689.5	0.122	2,800.5	0.098
1961	0.207	1681.3	0.147	717.7	0.124	2,837.4	0.098
1962	0.210	1742.9	0.154	756.4	0.127	2,938.4	0.100
1963	0.217	1802.1	0.161	781.7	0.128	2,976.3	0.104
1964	0.222	1900.1	0.178	806.0	0.135	3,049.7	0.092
1965	0.228	2001.7	0.188	830.9	0.142	3,143.8	0.094
1966	0.235	2110.2	0.193	882.0	0.151	3,272.7	0.098
1967	0.239	2187.1	0.200	948.2	0.156	3,321.1	0.103
1968	0.240	2299.2	0.199	986.9	0.171	3,399.0	0.109
1969	0.253	2392.5	0.198	1,009.6	0.184	3,484.6	0.120
1970	0.272	2474.6	0.194	1,002.4	0.199	3,432.8	0.110
1971	0.274	2548.1	0.212	1,010.7	0.215	3,433.0	0.100
1972	0.290	2679.9	0.236	1,009.0	0.231	3,522.2	0.112
1973	0.310	2798.8	0.280	997.4	0.246	3,665.5	0.108
1974	0.339	2820.8	0.304	1,015.8	0.267	3,654.1	0.113
1975	0.369	2899.8	0.348	1,037.8	0.293	3,599.6	0.103
1976	0.388	3028.2	0.415	1,048.7	0.319	3,701.0	0.107
1977	0.408	3149.9	0.443	1,065.7	0.345	3,822.6	0.110
1978	0.434	3284.4	0.472	1,084.7	0.375	3,987.4	0.113
1979	0.489	3377.8	0.494	1,095.6	0.403	4,114.9	0.120
1980	0.528	3403.4	0.476	1,115.3	0.440	4,097.9	0.122
1981	0.580	3443.2	0.500	1,131.3	0.466	4,139.7	0.133
1982	0.621	3497.5	0.538	1,153.6	0.500	4,102.2	0.128
1983	0.647	3652.4	0.613	1,176.2	0.535	4,164.2	0.117
1984	0.684	3801.2	0.678	1,193.8	0.556	4,408.8	0.114
1985	0.699	3985.5	0.670	1,251.4	0.583	4,522.9	0.117
1986	0.688	4146.9	0.650	1,315.0	0.635	4,558.6	0.112
1987	0.722	4313.7	0.681	1,337.7	0.636	4,727.4	0.120
1988	0.778	4481.7	0.762	1,359.7	0.649	4,879.3	0.118
1989	0.801	4621.4	0.761	1,388.1	0.683	5,041.5	0.121
1990	0.838	4744.8	0.768	1,420.9	0.715	5,127.6	0.119
1991	0.856	4802.8	0.784	1,440.6	0.748	5,076.8	0.114
1992	0.871	4942.6	0.824	1,450.9	0.800	5,095.9	0.110
1993	0.872	5095.1	0.841	1,451.7	0.821	5,254.4	0.111
1994	0.909	5259.0	0.885	1,461.9	0.826	5,403.9	0.114
1995	0.931	5410.3	0.906	1,469.7	0.837	5,558.7	0.118
1996	0.960	5591.7	0.941	1,477.8	0.858	5,669.4	0.127
1997	0.967	5804.1	0.970	1,503.9	0.887	5,828.5	0.133
1998	0.967	6079.1	0.959	1,526.7	0.917	6,005.8	0.138
1999	0.974	6368.7	0.973	1,569.7	0.961	6,136.4	0.139
2000	1.000	6673.8	1.000	1,598.1	1.000	6,252.5	0.147
2001	1.008	6879.4	1.003	1,641.8	1.046	6,234.4	0.142
2002	1.043	7124.6	1.074	1,694.9	1.064	6,172.3	0.119

Table 27: Property Compensation, 1948-2002

(Constant Prices of 2000)

Year	Domestic Capital Input (price index)	Domestic Capital Input (quantity index)	Rest of World Property Compensation (price index)	Rest of World Property Compensation (quantity index)	National Property Compensation (price index)	National Property Compensation (quantity index)
1948	0.352	483.5	0.139	68.5	0.326	551.4
1949	0.305	511.5	0.132	62.8	0.284	579.0
1950	0.298	541.5	0.149	76.4	0.280	617.9
1951	0.295	577.5	0.151	90.6	0.277	663.8
1952	0.283	609.4	0.153	103.5	0.267	705.0
1953	0.310	638.8	0.154	114.3	0.291	742.2
1954	0.281	666.9	0.157	113.2	0.266	771.4
1955	0.315	697.1	0.160	119.4	0.296	806.9
1956	0.304	729.3	0.168	123.2	0.287	843.3
1957	0.322	757.4	0.175	125.6	0.304	874.4
1958	0.262	782.8	0.181	127.0	0.253	901.9
1959	0.297	809.2	0.184	125.3	0.284	928.2
1960	0.276	838.7	0.183	141.5	0.265	969.9
1961	0.272	865.3	0.186	142.5	0.262	998.2
1962	0.287	895.7	0.192	152.0	0.276	1,036.5
1963	0.314	934.3	0.192	161.2	0.300	1,082.9
1964	0.334	975.6	0.198	170.7	0.318	1,132.2
1965	0.350	1,023.5	0.205	177.4	0.333	1,186.8
1966	0.358	1,082.0	0.212	164.5	0.340	1,240.3
1967	0.359	1,141.8	0.217	173.7	0.342	1,308.9
1968	0.333	1,199.9	0.228	192.2	0.321	1,382.1
1969	0.327	1,258.1	0.235	204.7	0.317	1,451.4
1970	0.326	1,310.8	0.249	203.5	0.318	1,504.7
1971	0.326	1,356.3	0.266	206.6	0.320	1,553.8
1972	0.361	1,415.3	0.279	207.0	0.352	1,614.4
1973	0.407	1,485.5	0.298	240.5	0.395	1,712.4
1974	0.420	1,546.8	0.318	250.9	0.409	1,783.5
1975	0.473	1,593.3	0.351	230.5	0.460	1,815.5
1976	0.530	1,645.2	0.379	248.1	0.513	1,882.3
1977	0.557	1,705.9	0.404	253.7	0.540	1,949.1
1978	0.590	1,779.8	0.434	264.1	0.573	2,033.1
1979	0.655	1,858.6	0.468	283.2	0.634	2,128.6
1980	0.624	1,923.9	0.507	291.1	0.612	2,201.7
1981	0.711	1,979.9	0.555	299.6	0.695	2,265.9
1982	0.726	2,033.3	0.594	275.3	0.713	2,300.6
1983	0.810	2,039.8	0.626	279.9	0.791	2,310.9
1984	0.905	2,118.9	0.647	297.4	0.877	2,405.6
1985	0.891	2,221.4	0.674	289.4	0.868	2,505.0
1986	0.795	2,325.7	0.654	294.6	0.781	2,615.9
1987	0.868	2,422.2	0.694	285.3	0.850	2,706.6
1988	0.974	2,597.1	0.724	304.2	0.948	2,900.7
1989	0.965	2,670.1	0.768	311.9	0.945	2,981.6
1990	0.969	2,753.2	0.807	323.7	0.952	3,076.1
1991	0.942	2,821.0	0.831	389.7	0.931	3,202.5
1992	0.938	2,886.4	0.832	356.7	0.927	3,239.1
1993	0.914	2,969.5	0.879	349.7	0.911	3,316.4
1994	1.013	3,067.2	0.900	375.8	1.002	3,439.0
1995	1.036	3,182.3	0.932	382.5	1.026	3,561.3
1996	1.084	3,318.6	0.956	389.0	1.071	3,705.1
1997	1.083	3,484.6	0.973	398.7	1.072	3,881.6
1998	1.040	3,681.6	0.973	396.5	1.033	4,078.2
1999	1.004	3,900.7	0.980	424.6	1.002	4,325.2
2000	1.000	4,131.5	1.000	438.8	1.000	4,570.3
2001	0.944	4,335.2	1.014	434.9	0.951	4,769.2
2002	1.037	4,495.6	0.991	444.3	1.033	4,938.9

Table 28: Capital Formation, 1948-2002

(Constant Prices of 2000)

Year	Private Domestic Investment (price index)	Private Domestic Investment (quantity index)	Government Investment (price index)	Government Investment (quantity index)	Gross Domestic Capital Formation (price index)	Gross Domestic Capital Formation (quantity index)	Effective Sales Tax Rate of Investment Goods
1948	0.251	285.9	0.177	46.4	0.240	343.1	0.046
1949	0.253	246.7	0.176	63.2	0.240	310.4	0.048
1950	0.259	330.2	0.174	68.6	0.241	397.4	0.046
1951	0.280	324.8	0.192	115.6	0.264	432.2	0.044
1952	0.280	299.9	0.197	155.1	0.266	433.4	0.047
1953	0.286	312.4	0.196	170.6	0.264	460.9	0.048
1954	0.286	299.7	0.196	151.2	0.269	429.2	0.046
1955	0.291	368.9	0.201	136.4	0.275	491.9	0.045
1956	0.302	363.4	0.218	135.3	0.290	490.2	0.044
1957	0.312	354.7	0.227	139.5	0.301	488.3	0.044
1958	0.314	324.2	0.227	150.0	0.301	453.4	0.047
1959	0.321	376.9	0.230	151.6	0.294	526.0	0.049
1960	0.323	378.8	0.228	145.4	0.311	510.2	0.053
1961	0.321	373.5	0.230	155.0	0.311	514.5	0.051
1962	0.325	415.9	0.234	164.6	0.315	563.6	0.051
1963	0.325	446.6	0.241	162.9	0.317	598.3	0.051
1964	0.328	483.3	0.243	163.1	0.320	644.1	0.051
1965	0.332	546.6	0.249	164.2	0.325	703.7	0.049
1966	0.336	593.8	0.256	184.6	0.330	760.1	0.045
1967	0.343	579.8	0.263	191.6	0.338	749.2	0.046
1968	0.357	621.8	0.274	191.8	0.349	792.5	0.050
1969	0.371	652.5	0.290	177.4	0.364	811.2	0.051
1970	0.385	616.3	0.312	165.6	0.385	761.8	0.051
1971	0.403	682.3	0.334	145.6	0.395	820.6	0.053
1972	0.417	761.7	0.361	140.6	0.393	929.3	0.049
1973	0.436	843.6	0.385	142.9	0.441	979.7	0.050
1974	0.476	781.4	0.437	148.0	0.474	935.3	0.051
1975	0.527	690.4	0.473	153.5	0.529	865.2	0.050
1976	0.557	810.1	0.492	154.6	0.555	966.5	0.048
1977	0.592	916.3	0.517	154.4	0.593	1,033.9	0.046
1978	0.637	1,004.6	0.552	165.7	0.634	1,136.8	0.045
1979	0.692	1,022.0	0.598	175.8	0.678	1,200.6	0.043
1980	0.755	919.2	0.657	181.2	0.723	1,139.7	0.047
1981	0.823	976.2	0.722	179.8	0.800	1,174.3	0.050
1982	0.865	876.0	0.770	181.0	0.852	1,052.0	0.046
1983	0.871	969.8	0.791	197.3	0.835	1,160.7	0.046
1984	0.877	1,210.6	0.807	217.0	0.860	1,337.3	0.046
1985	0.887	1,239.7	0.811	243.5	0.878	1,350.6	0.046
1986	0.901	1,276.0	0.815	264.0	0.890	1,377.3	0.045
1987	0.922	1,308.8	0.821	279.1	0.895	1,435.5	0.043
1988	0.945	1,348.8	0.828	279.4	0.914	1,525.7	0.043
1989	0.967	1,393.4	0.843	287.5	0.932	1,610.1	0.043
1990	0.982	1,360.3	0.864	301.8	0.934	1,634.5	0.043
1991	0.993	1,266.2	0.879	302.3	0.925	1,660.7	0.047
1992	0.994	1,357.0	0.884	301.2	0.852	1,851.9	0.047
1993	1.007	1,469.9	0.903	288.8	0.972	1,719.0	0.047
1994	1.024	1,640.4	0.923	281.9	0.997	1,840.5	0.049
1995	1.037	1,693.3	0.946	286.3	1.006	1,923.2	0.047
1996	1.032	1,834.7	0.956	296.6	1.009	2,058.5	0.046
1997	1.022	2,036.8	0.960	304.0	1.017	2,226.0	0.046
1998	1.005	2,249.1	0.964	314.6	1.025	2,317.8	0.047
1999	0.996	2,452.2	0.978	337.3	1.011	2,473.2	0.046
2000	1.000	2,598.9	1.000	348.6	1.000	2,550.9	0.046
2001	0.997	2,497.0	1.013	358.0	1.014	2,440.3	0.045
2002	0.984	2,542.5	1.025	375.2	1.007	2,403.5	0.045

Table 29: National Saving, depreciation, and revaluation, 1948-2002

(Constant Prices of 2000)

Year	Gross Saving (price index)	Gross Saving (quantity index)	Depreciation (price index)	Depreciation (quantity index)	Revaluation (price index)	Revaluation (quantity index)
1948	0.240	343.1	0.084	434.9		
1949	0.240	310.4	0.090	451.5	0.510	84.4
1950	0.241	397.4	0.094	468.6	0.259	89.7
1951	0.264	432.2	0.103	496.0	0.739	95.4
1952	0.266	433.4	0.107	514.1	0.249	101.1
1953	0.264	460.9	0.112	528.4	0.120	103.9
1954	0.269	429.2	0.114	549.2	0.058	101.5
1955	0.275	491.9	0.117	563.6	0.314	96.9
1956	0.290	490.2	0.123	590.7	0.805	98.8
1957	0.301	488.3	0.129	606.2	0.421	101.6
1958	0.301	453.4	0.132	616.4	0.207	104.3
1959	0.294	526.0	0.138	622.5	0.315	102.8
1960	0.311	510.2	0.141	632.8	0.402	97.0
1961	0.311	514.5	0.143	642.9	0.477	96.6
1962	0.315	563.6	0.147	649.8	0.515	96.6
1963	0.317	598.3	0.150	663.1	0.279	97.0
1964	0.320	644.1	0.155	677.5	0.013	87.5
1965	0.325	703.7	0.160	694.0	0.336	104.1
1966	0.330	760.1	0.166	716.4	0.707	108.0
1967	0.338	749.2	0.175	742.1	0.649	111.8
1968	0.349	792.5	0.186	766.6	1.511	115.4
1969	0.364	811.2	0.197	796.5	1.771	118.7
1970	0.385	761.8	0.209	826.2	1.530	122.3
1971	0.395	820.6	0.222	845.1	1.815	112.0
1972	0.393	929.3	0.230	890.7	3.345	112.5
1973	0.441	979.7	0.244	912.7	3.201	114.2
1974	0.474	935.3	0.269	950.6	1.922	124.8
1975	0.529	865.2	0.303	971.1	4.980	132.7
1976	0.555	966.5	0.325	987.4	2.752	139.0
1977	0.593	1,033.9	0.349	1,014.8	3.397	142.2
1978	0.634	1,136.8	0.381	1,047.9	4.404	163.6
1979	0.678	1,200.6	0.422	1,079.8	5.525	175.7
1980	0.723	1,139.7	0.472	1,109.8	6.095	181.2
1981	0.800	1,174.3	0.520	1,128.8	6.777	200.1
1982	0.852	1,052.0	0.558	1,143.9	3.634	233.3
1983	0.835	1,160.7	0.575	1,152.5	0.939	234.2
1984	0.860	1,337.3	0.593	1,173.8	3.636	233.1
1985	0.878	1,350.6	0.618	1,207.3	4.835	233.7
1986	0.890	1,377.3	0.645	1,248.4	2.682	242.5
1987	0.895	1,435.5	0.671	1,293.7	2.658	285.9
1988	0.914	1,525.7	0.700	1,332.5	2.419	416.7
1989	0.932	1,610.1	0.727	1,372.0	2.854	420.6
1990	0.934	1,634.5	0.752	1,408.7	0.617	503.4
1991	0.925	1,660.7	0.773	1,439.2	0.409	446.5
1992	0.852	1,851.9	0.786	1,454.2	0.018	1,160.8
1993	0.972	1,719.0	0.809	1,476.3	-0.338	1,216.8
1994	0.997	1,840.5	0.837	1,504.8	0.372	1,213.1
1995	1.006	1,923.2	0.868	1,539.0	0.700	1,189.5
1996	1.009	2,058.5	0.891	1,568.7	0.573	1,183.6
1997	1.017	2,226.0	0.914	1,600.2	0.519	1,160.4
1998	1.025	2,317.8	0.934	1,636.4	0.794	2,045.3
1999	1.011	2,473.2	0.961	1,685.0	0.848	2,030.0
2000	1.000	2,550.9	1.000	1,742.7	1.000	2,027.6
2001	1.014	2,440.3	1.033	1,797.2	0.808	2,028.9
2002	1.007	2,403.5	1.039	1,846.5	1.322	2,028.9

Table 30: Domestic Balance Sheet, 1948-2002

(Constant Prices of 2000)

Year	Private domestic tangible assets (price index)	Private domestic tangible assets (quantity index)	Government tangible assets (price index)	Government tangible assets (quantity index)	Domestic Wealth (price index)	Domestic Wealth (quantity index)
1948	0.100	5,275.1	0.152	1,498.9	0.103	7,347.0
1949	0.101	5,615.3	0.148	1,496.1	0.103	7,675.6
1950	0.106	6,123.7	0.146	1,487.2	0.106	8,166.9
1951	0.113	6,573.0	0.161	1,523.1	0.114	8,664.1
1952	0.115	6,930.2	0.170	1,576.1	0.117	9,092.4
1953	0.119	7,289.1	0.163	1,660.5	0.119	9,567.2
1954	0.120	7,596.3	0.161	1,722.5	0.119	9,959.5
1955	0.123	8,037.4	0.163	1,770.6	0.122	10,468.0
1956	0.130	8,427.8	0.177	1,819.3	0.130	10,926.1
1957	0.136	8,773.7	0.170	1,900.8	0.133	11,383.6
1958	0.138	9,030.7	0.171	1,970.1	0.135	11,734.3
1959	0.142	9,381.8	0.172	2,052.8	0.138	12,198.2
1960	0.146	9,686.6	0.170	2,127.9	0.141	12,604.8
1961	0.151	9,957.9	0.171	2,219.2	0.145	12,995.6
1962	0.155	10,321.6	0.174	2,314.9	0.149	13,487.5
1963	0.157	10,726.8	0.178	2,403.7	0.151	14,014.6
1964	0.157	11,163.8	0.180	2,493.5	0.151	14,575.9
1965	0.159	11,695.6	0.184	2,581.4	0.154	15,233.4
1966	0.165	12,300.7	0.190	2,686.5	0.159	15,987.4
1967	0.169	12,830.1	0.196	2,798.9	0.163	16,671.5
1968	0.180	13,387.4	0.205	2,902.5	0.173	17,374.3
1969	0.193	13,934.8	0.218	2,991.0	0.185	18,049.1
1970	0.201	14,406.4	0.236	3,065.6	0.194	18,628.1
1971	0.211	14,929.6	0.255	3,120.0	0.205	19,234.5
1972	0.230	15,535.4	0.284	3,158.8	0.224	19,904.8
1973	0.249	16,226.6	0.307	3,199.9	0.243	20,664.6
1974	0.255	16,836.0	0.356	3,254.5	0.255	21,353.5
1975	0.286	17,275.5	0.391	3,317.7	0.285	21,881.0
1976	0.305	17,812.0	0.402	3,380.5	0.302	22,506.2
1977	0.334	18,439.8	0.421	3,436.0	0.327	23,216.2
1978	0.371	19,243.5	0.447	3,501.1	0.361	24,121.2
1979	0.415	19,998.0	0.489	3,575.6	0.402	24,990.0
1980	0.460	20,512.7	0.544	3,653.2	0.446	25,615.6
1981	0.512	21,102.1	0.603	3,721.8	0.496	26,307.3
1982	0.540	21,482.8	0.642	3,785.3	0.532	26,773.6
1983	0.552	21,904.1	0.650	3,858.4	0.546	27,180.4
1984	0.587	22,668.8	0.658	3,949.7	0.575	27,881.1
1985	0.637	23,387.6	0.670	4,062.0	0.619	28,600.3
1986	0.666	24,060.3	0.688	4,184.6	0.649	29,300.4
1987	0.698	24,636.9	0.710	4,309.4	0.681	29,851.5
1988	0.741	25,242.8	0.728	4,421.9	0.722	30,389.7
1989	0.785	25,853.0	0.748	4,536.7	0.759	31,132.7
1990	0.790	26,341.6	0.771	4,660.0	0.765	31,697.4
1991	0.792	26,693.5	0.785	4,776.4	0.767	32,122.5
1992	0.788	27,100.6	0.792	4,887.2	0.761	32,554.5
1993	0.785	27,631.1	0.814	4,980.5	0.781	32,748.8
1994	0.783	28,307.6	0.840	5,065.1	0.785	33,494.4
1995	0.809	29,050.2	0.872	5,152.0	0.814	33,996.9
1996	0.823	29,848.9	0.894	5,245.8	0.838	34,456.7
1997	0.853	30,780.7	0.914	5,342.2	0.853	35,555.1
1998	0.905	31,823.0	0.934	5,444.6	0.897	36,577.2
1999	0.942	32,848.9	0.962	5,562.3	0.947	37,215.9
2000	1.000	33,913.0	1.000	5,684.1	1.000	38,008.9
2001	1.052	34,781.2	1.028	5,808.2	1.041	38,665.4
2002	1.118	35,417.7	1.052	5,942.3	1.111	38,925.7