THE NATIONAL INCOME AND PRODUCT ACCOUNTS

Roy H. Webb

It would be hard to overstate the value of the national income and product accounts to economists. They summarize the millions of economic transactions that occur in the nation each day and present the data in a readily comprehensible form. Their important role can be observed by noting that discussions of current economic conditions usually focus on real gross domestic product (GDP) and its components. In addition, macroeconomic research critically depends on the hundreds of interrelated items in the accounts.

This article is an introduction to the national income and product accounts. It briefly describes the history of the accounts, explains basic concepts, details the main structure of the accounts, and reviews the movement of key elements over time. Throughout the article there are cautions for users who might expect more than the accounts can deliver. And finally, it provides suggestions for additional reading for readers who would like to learn more than is provided in this brief introduction to the accounts.

INTRODUCTION

History National income and product accounts are a fairly recent invention. Prior to World War I they were prepared for only a few countries by individual investigators who wished to study particular questions, such as understanding the effects of government budgetary actions.

During the interwar period governments became increasingly involved in the preparation of national economic accounts. In part this was because governments had relatively inexpensive access to census data, tax returns, and other documents that individuals and firms were legally required to file. Also, a growing interest in using government fiscal actions to influence national economic performance increased the demand for detailed information on the current state of the economy.

In the United States, the Commerce Department first prepared national income estimates in the early 1930s; national product estimates followed in the early 1940s. These estimates played an important role in economic planning in the United States during World War II.

The widespread intellectual acceptance of John Maynard Keynes's *The General Theory of Employment, Interest, and Money* did much to stimulate interest in the accounts. Keynes emphasized macroeconomic relationships—that is, relationships stated at a highly aggregated level, such as the relation between national investment and national product. Keynes also strongly advocated the use of national fiscal policy to moderate fluctuations of national output and to stimulate long-term growth. The major uses of income and product accounts—appraisal of current conditions, the analysis of fiscal policy, forecasting economic activity, and research concerning the relations of macroeconomic aggregates—all fit comfortably within a Keynesian framework. Many users today, however, would not label themselves as Keynesian economists. Use of the accounts has grown far beyond any single group.

Preparation The national income and product accounts are now prepared by the Bureau of Economic Analysis (BEA), an agency of the United States Commerce Department. The BEA has prepared estimates for most items going back to 1929. Most of the data used by the BEA are first collected by other branches of the government for purposes other than constructing national income accounts. One important source of data is the tax returns of firms and individuals. Another is the large and varied group of surveys that are conducted at regular intervals. Important examples include Census Bureau surveys of retailers and manufacturers, and Labor Department surveys of prices.

Although some data series like personal income are published monthly, most items are available only

at quarterly or annual intervals. Estimates for a particular quarter are first released near the end of the first month following that quarter. The BEA then has data for items covering about two-thirds of GDP; it therefore estimates the remaining items. As the BEA continues to receive data, the preliminary estimates are revised twice at monthly intervals. Further revision occurs each year, and the results are usually published in July; revisions usually cover the previous three years. Finally, new information, conceptual changes, and statistical changes are incorporated by benchmark revisions, which occur about every five years.

Gross Domestic Product Defined

GDP is the most widely followed statistic in the income and product accounts. It can be succinctly defined as the market value of current, final, domestic production during a specific interval of time. That succinct definition, however, requires a bit of explanation.

Value Market value means that, when possible, goods and services are valued at prices actually paid in market transactions. In some cases, such as national defense and other services provided by the government, there are no market prices available. The BEA then substitutes an alternative estimate of the value of those products, such as the payroll cost for goods and services provided by government agencies. For another important item, owner-occupied housing, an estimated rental value is included in GDP.[1] And some transactions that occur outside the marketplace are excluded from GDP. Examples include production within households and illegal activities.

By focusing on market values, it is indeed possible to add apples and oranges. The focus on market values is a key insight that has powerfully aided economic analysts. It allows one to combine production from vastly different activities into a meaningful aggregate.

Current Current production simply means that GDP for a year includes only production that occurred during that year.

Final The concept of final product is less obvious; its necessity can be illustrated best with an example. Suppose that one farmer grows a bushel of wheat, mills the wheat, bakes bread, and sells the bread in front of the farmhouse. Another farmer grows a bushel of wheat but sells it to a miller, who sells flour to a baker, who then sells bread. In each case the contribution to GDP is the value of the bread, the final product. Yet if the dollar value of all sales in the market were simply added up, the second example would have a higher sum than the first. In other words, simply adding all sales would overstate GDP, an error that is often referred to as double counting. To avoid that error, one can focus on the value added in each step of production. In the second example, the contribution to GDP of the baker is the difference between the revenues from selling bread and the cost of the flour. The values added by the baker, miller, and farmer in the second example would sum to the value of the bread and would therefore equal the value added by the farmer-miller-baker in the first case.

Domestic Domestic product refers to the output of productive factors—labor, capital, and land—located in a particular nation. References are often made to a closely related item, gross national product (GNP), which is the output of productive factors owned by residents of a particular nation. For the United States, the quantitative difference between the two is not large; in 1993, GDP was less than 0.1 percent smaller than GNP. The difference can be much more significant for a smaller country with a large amount of cross-border economic activity, such as foreign business of multinational firms or citizens commuting to work in another country.

Gross The word "gross" refers to the fact that depreciation of structures and equipment is not subtracted from the value of output. Conceptually, it might seem preferable to recognize that some part of production just replaces the capital consumed in the production process, and in fact the BEA does estimate domestic product net of capital consumption, net domestic product. There are usually no direct measures of capital consumption, however. Capital consumption is therefore indirectly estimated for each type of capital good by statisticians who use a questionable accounting formula. Many analysts therefore prefer to focus on gross domestic product, because its calculation does not require an estimate for depreciation that inspires little confidence.

[1] In effect, the homeowner is treated as a business that rents the home to itself. This has several effects for the accounts, including: (1) spending for new homes is part of business investment; (2) estimated rental value of owner-occupied housing is part of consumer spending; and (3) the rental value minus expenses, such as interest, taxes, and depreciation, is part of personal income.

Real The concept of market value allows different products to be meaningfully added at a particular time. But since market value is expressed in dollars, another problem arises when comparing production at different times. Changes in the purchasing power of a dollar (which are reflected in statistics of inflation or deflation) will distort the meaning and relevance of comparative dollar magnitudes.

The concept of real GDP is an attempt to allow production in different years to be meaningfully compared. It is an estimate of GDP in dollars of constant purchasing power. (Estimates of real GDP are thus often referred to as "constant dollar" values.) In most cases, the dollar value of each particular good or service is divided by a relevant price index, yielding the constant dollar value. The constant dollar values for all items are then summed to yield real GDP. The ratio of current dollar GDP (often called nominal GDP) to real GDP is the GDP implicit price deflator. It is discussed in the chapter on price indexes.

COMPONENTS OF GDP

It is often useful to think of total spending rather than total production. That is facilitated in domestic product accounts by the way components of GDP are defined. Anything produced is either sold to its final purchaser or else held as inventory by some business, whether producer, wholesaler, or retailer. The sum of spending for final products plus changes in businesses' inventories is therefore equal to the market value of production.

GDP is traditionally divided into spending for final product in four categories, or sectors: consumer, business (including inventory change), government, and foreign. Each sector is described in this section, and numerical values for 1993 are presented in the accompanying table.

Consumer The consumer sector is the largest, accounting for 69 percent of GDP in 1993.[2] Spending by consumers is divided into spending for durable goods such as autos and appliances, nondurables such as food and clothing, and services. Services consist of a wide variety of components such as utilities, medical care, transportation, and the estimated rental value of owner-occupied housing.

Business Spending by the business sector, also labeled investment,[3] is composed of three major categories. The most obvious is business spending for plant and equipment. Also included are changes in business inventories, including raw materials, work in progress, and completed products awaiting resale to their final purchaser. The third category is spending on residential construction, which includes both residential structures owned by business enterprises and owner-occupied housing.

Government Government spending is divided between federal spending and spending by state and local governments. When GDP is divided into categories of spending, government spending refers solely to spending for goods and services; transfer payments, such as pensions, welfare, and interest, do not add to GDP. The income and product accounts do, however, contain additional information on transfer payments.

Foreign The foreign sector's effect on GDP is given by net exports, the difference between exports and imports. Net exports include both physical commodities and services, such as insurance, transportation, tourism, and education. The foreign sector is covered in greater detail in the chapter on foreign trade data.

INCOME

In the previous section the equality of production and spending was mentioned. There is another basic equality in the accounts, that of spending and income. Revenues from the sales of goods and services are collected by businesses. Payments by businesses for wages, rent, and the like are income for individuals. By definition, profits represent the difference between a firm's payments for inputs and its revenue from the sales of products. Adding up for all firms, their profits are therefore equal to the difference between aggregate revenues (spending) and costs (incomes to others); consequently, national income and national spending are equal by definition.

If all components of income and product were measured precisely, the value of production would equal the sum of incomes received. It is therefore possible to construct a national accounting statement

[2] The consumer sector also includes certain nonprofit institutions, personal trusts, and private pension funds. For most analysis it is probably appropriate to neglect this qualification; in the discussion below, however, it should be remembered that the words "consumer" and "person" often refer to both individuals and these institutions.

[3] The word "investment" in the income and product accounts refers only to spending for physical capital, or to the value of inventory change. It is therefore different from ordinary usage, in which, "investment" can also refer to the purchase of financial assets.

NATIONAL INCOME AND PRODUCT, 1993

Billions of Dollars

Product		Income	
Personal Consumption Expenditure	**4391.8**	**Compensation of Employees**	**3772.2**
Durables	537.9	Wages and salaries	3100.5
Nondurables	1350.0	Supplements	671.7
Services	2503.9		
		Proprietors' Income	**443.2**
Gross Private Domestic Investment	**891.7**	Farm	46.0
Business fixed investment	623.7	Nonfarm	397.3
Residential investment	252.4		
Inventory change	15.6	**Rental Income of Persons**	**12.6**
		Corporate Profits	**466.6**
Net Exports	**−63.6**	After-tax profits	275.4
Exports	661.7	Profits-tax liability	174.0
Imports	725.3	Adjustments	17.2
		Net Interest	**445.6**
Government Purchases	**1158.1**		
Federal	443.4	**Other Charges Against GDP**	**1237.6**
State and local	714.6	Capital consumption	671.3
		Indirect business taxes	530.5
		Other items, net	20.6
		Statistical discrepancy	15.2
Gross Domestic Product	**6377.9**	**Gross Domestic Product**	**6377.9**

Source: *Survey of Current Business*, April 1994, Tables 1.1, 1.9, and 1.14.

such as the table, with production on one side and income on the other. Since data collected by the government are necessarily less than perfect, errors in estimating the components of income and product are inevitable. One result is that total income and product are not exactly equal. The difference is referred to as the statistical discrepancy. Other items on the income side are described below.

Employee compensation Compensation of employees is the largest category of income. It includes not only wages and salaries, but also fringe benefits paid by employers, such as funding for pension plans and medical insurance. Also included are employer payments for social security and unemployment insurance taxes.

Corporate profits The estimated value of corporate profits is primarily derived from corporate income tax returns, but for many reasons do not precisely equal taxable profits of private corporations. One important reason is that the effect on profits from holding inventories when prices change is removed with an inventory valuation adjustment. Also, the difference between depreciation allowed by the tax code and the BEA's estimate of depreciation of corporate assets is removed with a capital consumption adjustment. In addition, Federal Reserve Banks are treated as part of the corporate sector. Their interest receipts are treated as income; their payments of most of their income to the U.S. Treasury are included in the BEA's measure of corporate tax payments.

Other income Proprietors' income includes earnings of individuals and partnerships from unincorporated businesses, such as physicians' practices, farms, and law firms. Rental income of persons includes items such as rental receipts and royalties. It also includes the estimated rental value of owner-occupied housing minus housing expenses. Net

interest is a fairly complicated item. In broad terms, it represents individuals' receipts of interest income from businesses and from foreign sources minus individuals' interest payments.[4]

Non-income items Other charges against GDP are non-income items, most importantly capital consumption allowances and indirect business taxes. The latter includes federal excise taxes and state and local sales and property taxes.

Definitions of income There are several definitions of income that are published in the income and product accounts. National income, the total income from current production, is the sum of employee compensation, proprietors' and rental income, corporate profits, and net interest. More attention is paid to personal income, which includes wages, salaries and other labor income; proprietors' and rental income; and personal receipts of interest, dividends, and transfer payments. A closely related measure, disposable personal income, is personal income minus personal tax payments and other payments to government agencies.

Other Items

While aggregate spending and income figures get the most attention, there are many other statistics that are routinely compiled and published (although not as frequently as other income and product data). For example, production, employment, and income are presented by industry in considerable detail. Personal income is also reported by state and locality. Capital stocks are reported by type and by owner. Finally, a new effort values stocks of mineral resources, additions, and depletions beginning in 1958.

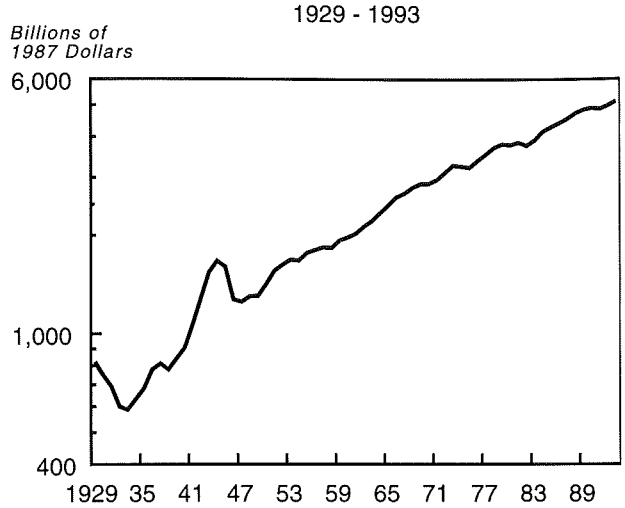
Movements over Time

Countless books and articles containing studies of long-term growth, cyclical change, and shifting patterns of economic life have been based on data from the national income and product accounts. Only a few broad features will be mentioned in this section.

A striking feature is the amount of economic growth that is revealed. Chart 1 illustrates the movement of real GDP from 1929 to 1993. Despite the Great Depression and other fluctuations, real GDP increased more than sixfold during that interval—a

Chart 1

Real GDP
1929 - 1993

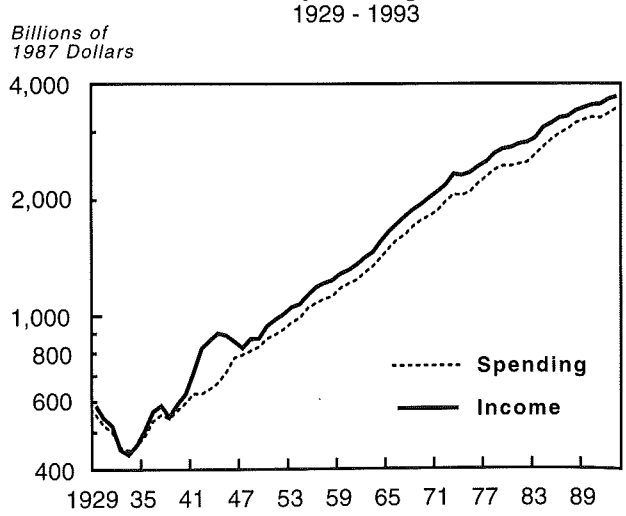


2.9 percent compound annual rate of growth. Chart 1 also illustrates the massive decline of real GDP during the Great Depression, the equally massive expansion during World War II, and the smaller fluctuations of output in the postwar period. Chart 2 reveals similar growth, but less fluctuation relative to trend, in real consumer spending and disposable income.

The accounts also reveal some important changes in the structure of the economy. The expanded role of government is illustrated by its spending for goods and services, which has risen from 8 percent of GDP in 1929 to more than 18 percent in 1993. Foreign

Chart 2

Consumer Spending & Income
1929 - 1993



[4] Some arcane adjustments for households' dealing with financial institutions are also included. Those adjustments also affect estimates of consumer spending for financial services.

trade also plays a more important role in the economy than it has in the past, with imports rising from 5 percent of GDP in 1929 to 11 percent in 1993.

CAUTIONS

Considering the amount of data consistently measured over time and the complex interrelations revealed among disparate items, the national income and product accounts are a remarkable achievement. In part because the accounts do so much so well, users can be tempted to expect more of the accounts than they can deliver. A few potential problems have already been mentioned; in this section other potential pitfalls are discussed. Examples of each problem are marked with a bullet (•).

First, it should be emphasized that the national income and product accounts measure only production, spending, and income. They were not designed to measure economic welfare—that is, how highly individuals evaluate the economic rewards they receive minus the cost of obtaining them. Despite the limited focus of the accounts, it is still common for some observers to see differences in national product between nations as evidence of different standards of living. Such comparisons should be discounted for many reasons, a few of which follow:

- Some items included in GDP do not directly raise individual welfare. For example, military spending is like intermediate product—it can provide necessary protection that allows other economic activity to proceed, but is not valued for its own sake. Citizens of a nation that is able to obtain adequate defense for 1 percent of GDP can consume and invest more, thus having a higher standard of living, than citizens of a nation with the same GDP who had to spend 10 percent of GDP for defense.
- Some items are not included in GDP that do make people better off. For example, unpaid household work may be highly productive but is not included in the national income and product accounts.
- There may be unmeasured external effects that result from productive activity. For example, the production of electric power may involve an unmeasured damage of pollution from burning coal. Two countries could have the same GDP but differ in the cleanliness of air and water.
- Other countries may use different data sources or even different concepts to produce income and product estimates. Socialist countries, for example, will lack many market prices used in the U.S. accounts. Also, different governments may not have access to similar quantities or qualities of data.

A second caution is that it is possible that the definition of an item in the accounts may not be the best definition for a particular study.

- For example, many economists have studied the relationship between consumer saving at one time and consumer spending during later time periods. The definition of saving in the accounts is probably not appropriate for that question, however, since capital gains and losses are excluded from personal income and saving (because those gains and losses do not result from current production). Their potential importance is illustrated by a rising stock market in 1991, which added over $500 billion dollars to household wealth. Personal saving that year was reported at $200 billion in the income and product accounts.

Third, calculation of real levels and real growth rates depends on accurate data on prices.

- As indicated in the chapter on price indexes, advancing technology and new products create statistical problems that make it likely that there is an upward bias both to the level and rate of change of aggregate price measures. If so, there would be a corresponding downward bias to real levels and real growth rates. Moreover, in some cases such as commercial construction and banking there are no good data on prices. The BEA then uses a measure of input costs as a proxy for prices. Since that procedure may assume zero productivity growth, as in banking, it also adds an upward bias to price measures and a downward bias to real output statistics.

Fourth, the data that the BEA receives from other government agencies may not be accurate.

- For example, to the extent that individuals or firms file inaccurate tax returns in order to reduce their tax liabilities, the tax collectors will give the BEA inaccurate data. Moreover, if someone has given false information to one government agency, the likelihood of that person giving false reports to other agencies is increased. Census surveys, therefore, could also

be affected by the tax-induced misreporting of income and expenditure. Although the BEA does attempt to estimate tax-induced misreporting, there is no way to determine the accuracy of those estimates.

These cautions should not prevent one from using the accounts. Rather, the cautions should prompt the user to think about the problem and the data before simply assuming that the data are appropriate. The limitations of the accounts are real, but should be kept in perspective. The accounts provide consistently estimated data for 65 years for hundreds of items. They provide an unsurpassed picture of economic performance. As the longtime head of the BEA George Jaszi put it, the income and product accounts "are eminently useful in macroeconomic analysis if they are not regarded as a precision instrument and . . . may be lethal if they are."

SUGGESTIONS FOR ADDITIONAL READING

There is a large literature on the subject of national income and product accounts. Rather than attempting to survey the whole field, a few sources are mentioned which should be especially helpful to readers who wish to pursue the subject.

The *Survey of Current Business (SCB)*, published monthly by the Commerce Department, contains recent estimates of items in the income and product accounts and articles on selected topics related to national income accounting. One of the most useful publications on the subject is the *National Income* supplement to *SCB*, 1954 edition, parts II-IV. It contains 132 large format pages of detailed definitions and discussion of the methodology for estimating components of the accounts. More recent general discussions are contained in "The National Income and Product Accounts of the United States: An Overview," *SCB* February 1981, "An Introduction to National Economic Accounting," *SCB* March 1985, and "GNP: An Overview of Source Data and Estimating Methods," *SCB* July 1987. "Accounting for Mineral Resources: Issues and BEA's Initial Estimates," *SCB* April 1994, explains the new satellite account that was added to the income and product accounts in 1994.

For many readers, less technical summaries of the accounts may be useful. Introductory economics textbooks usually contain descriptions of the accounts. Also, *The U.S. Economy Demystified* by Albert T. Sommers has a clear, user-oriented description and discussion of the accounts.

Building on the framework of the BEA's accounts, Robert Eisner has constructed a set of statistics that attempt to narrow the gap between national product accounts and statistics that more directly attempt to estimate economic welfare. "The Total Incomes System of Accounts," *SCB* January 1985, contains a discussion of his approach and detailed tables of data for selected years. A fuller presentation is in *The Total Incomes System of Accounts*, University of Chicago Press, 1989.

Individual researchers have estimated GDP and related series before 1929. Since they have access to *much* less detailed data than the BEA currently uses, the early statistics should be approached with extra caution. That said, the historical series may prove useful for studying subjects such as the business cycle or long-run growth. Two notable presentations of data and methods of estimation are contained in the *Journal of Political Economy*, vol. 97, no. 1 (February 1989): "The Prewar Business Cycle Reconsidered: New Estimates of Gross National Product, 1869-1908," by Christina D. Romer, pp. 1-37; and "The Estimation of Prewar Gross National Product: Methodology and New Evidence," by Nathan S. Balke and Robert J. Gordon, pp. 38-92.

Finally, it may be of interest to study the history of national income accounts. A prime source is John W. Kendrick, "The Historical Development of National Income Accounts," *History of Political Economy*, Fall 1970. A more narrow focus on U.S. accounts is given by Carol S. Carson, "The History of the United States National Income and Product Accounts," *Review of Income and Wealth*, June 1975. Further insight into the design of the U.S. accounts can be found in George Jaszi's "An Economic Accountant's Audit," *American Economic Review*, May 1986.

LABOR MARKET DATA

Roy H. Webb and William Whelpley

Aggregate data on jobs, unemployment and earnings are closely watched by millions of Americans. The unemployment rate may be the single economic indicator most closely followed by journalists and the general population. Among financial market participants, the number of people employed receives particular scrutiny. These and other selected labor market indicators are described in this article.

HISTORICAL DEVELOPMENT

Statistics describing the labor market were estimated as early as 1820, based on questions from the decennial Population Census. In the last decade of the nineteenth century, the newly formed Bureau of Labor—the predecessor of the Bureau of Labor Statistics (BLS)—began to collect detailed data on wages and earnings. In 1915, the Bureau began a monthly survey of employers to produce data on wages and employment. This survey is still conducted, and data from it are reported on a monthly basis; it is often referred to as the *establishment survey*, or the *payroll survey*.

After a century of collecting data on labor markets, there was surprisingly little systematic information on the extent of unemployment. When national attention focused on unemployment during the Great Depression, it was not immediately obvious how to define or to gather relevant information. In 1940 a monthly survey was designed, which is now known as the *Current Population Survey*. Information from the survey allowed an unemployment rate to be calculated. By 1945 the questions were developed that form the basis of the Survey used today, which is usually referred to as the *household survey*.

MAJOR DATA SERIES

Data from the Household Survey

Each month 60,000 households are interviewed by the Census Bureau as part of the household survey. The survey covers economic activity of respondents during the calendar week that includes the twelfth day of the month. The BLS then analyzes the survey results and reports its findings near the beginning of the next month, usually on the first Friday. Many statistics from this survey could be discussed; the key concepts in this section are the unemployment rate, the number of people employed, and the labor force participation rate.

Unemployment rates are calculated for the entire nation and also for more narrowly defined demographic groups and geographic areas. An unemployment rate is defined as the number of people unemployed as a percentage of the *labor force*. The size of the labor force, in turn, is defined as the number of people *employed* plus those *unemployed*, that is, people without jobs who are willing and able to work.

All three terms, employed, unemployed, and labor force, have very specific definitions. A person is counted as unemployed if he or she did not work during the survey week and:

(a) took a specific action to contact a potential employer within the previous four weeks, and was available for work during the survey week; or

(b) was waiting to be called back, within six months, to a job after being laid off.

A person is defined to have been employed if he or she:

(a) did any work at all as a paid employee, as a proprietor or farmer, or worked at least 15 hours as an unpaid worker in a family business; or

(b) had a job but did not work during the survey week due to a temporary absence such as illness, bad weather, a vacation, labor-management disputes, or other personal reasons.

Finally, the labor force is simply the sum of persons who are employed plus those who are unemployed. The overall *participation rate* is defined as the labor force as a percentage of the population at least 16 years of age. Participation rates are also calculated for smaller segments of the population, again defined as the labor force as a percentage of the relevant population segment.

There are many reasons why a person may not be in the labor force, such as age, health, home responsibilities, being in school, not wanting to be employed, or not believing that job search would be fruitful. The latter category is referred to as discouraged workers; they are counted as those who would like to work, have looked for work in the past year, but are not now actively looking for work for a reason such as:

thought no jobs were available in their line of work or area;

previously tried unsuccessfully to find work;

lacked the necessary schooling, training, experience, or skills;

felt employers considered the person too young or too old;

had some other personal handicap in finding work.

More detail is also provided about persons in the labor force. The number of part-time employees is given, as is the reason for part-time work. The major division is involuntary versus voluntary part-time workers. Unemployed persons are asked how long they have been unemployed and why they became unemployed; the latter category includes those who quit their last job, those on temporary layoff, permanent job losers, those who completed temporary jobs, and those who were not in the labor force.

One's intuitive definitions of employment or unemployment may be somewhat different from the specific definitions given above. In particular, people who are not working vary tremendously in the amount of thought and effort spent on finding work; it is inherently arbitrary to divide people without jobs into only two categories, unemployed or not in the labor force. Some analysts would add discouraged workers to the unemployed, thereby boosting the reported unemployment rate. Others would lower the unemployment rate by defining those who did not actually contact potential employers in the survey week as being out of the labor force.

Behavior over time Chart 1 shows the unemployment rate over the post-World War II period. One notable feature is that sharp swings are associated with the business cycle, the alternating periods of expansion and recession in the whole economy. Another feature is the general upward drift for much of the chart after abstracting from business cycles.

Chart 2 shows the participation rate. Especially notable is the substantial increase over time. The major factor behind that increase can be seen in the table, which contains the current demographic composition of the labor force and contrasts it with the labor force in 1948 and 1969. The rapidly growing fraction of adult women in the labor force more than offset a decline in the fraction of men in the labor force, resulting in a growing participation rate for the whole population. The table also reveals relatively high unemployment rates for blacks and teenagers.

Data from the Establishment Survey

The establishment survey covers the industry, hours, and earnings of most employed members of the labor force. State agencies collect data from more than 390,000 establishments employing over 49 million workers. Most of the data comes from employers who extract the requested information from their payroll records and mail the forms to the state agencies for processing. The state agencies then forward the tabulated information to the BLS. The forms are then sent back and forth between the collecting agencies and participating establishments; a written record of the numbers can therefore be reviewed by both the providers and collector of the information.

Employment and earnings figures are classified by each worker's characteristics, such as sex, industry, and job category. A person is counted as employed if he or she is on the payroll of an establishment for the pay period which includes the twelfth of the month.[1] This measurement excludes proprietors, unpaid volunteers, family workers, farmers and farm workers, and domestic household workers. Salaried officers of corporations, civilian government employees, and part-time workers are included, however.[2]

Industry *hours and earnings* figures also originate in the establishment survey. Figures are presented in detail for production and related workers in manufacturing and mining, construction workers, and nonsupervisory employees in service industries. The *hours* statistic reports the number of hours paid for by the employer in the current reporting period, not

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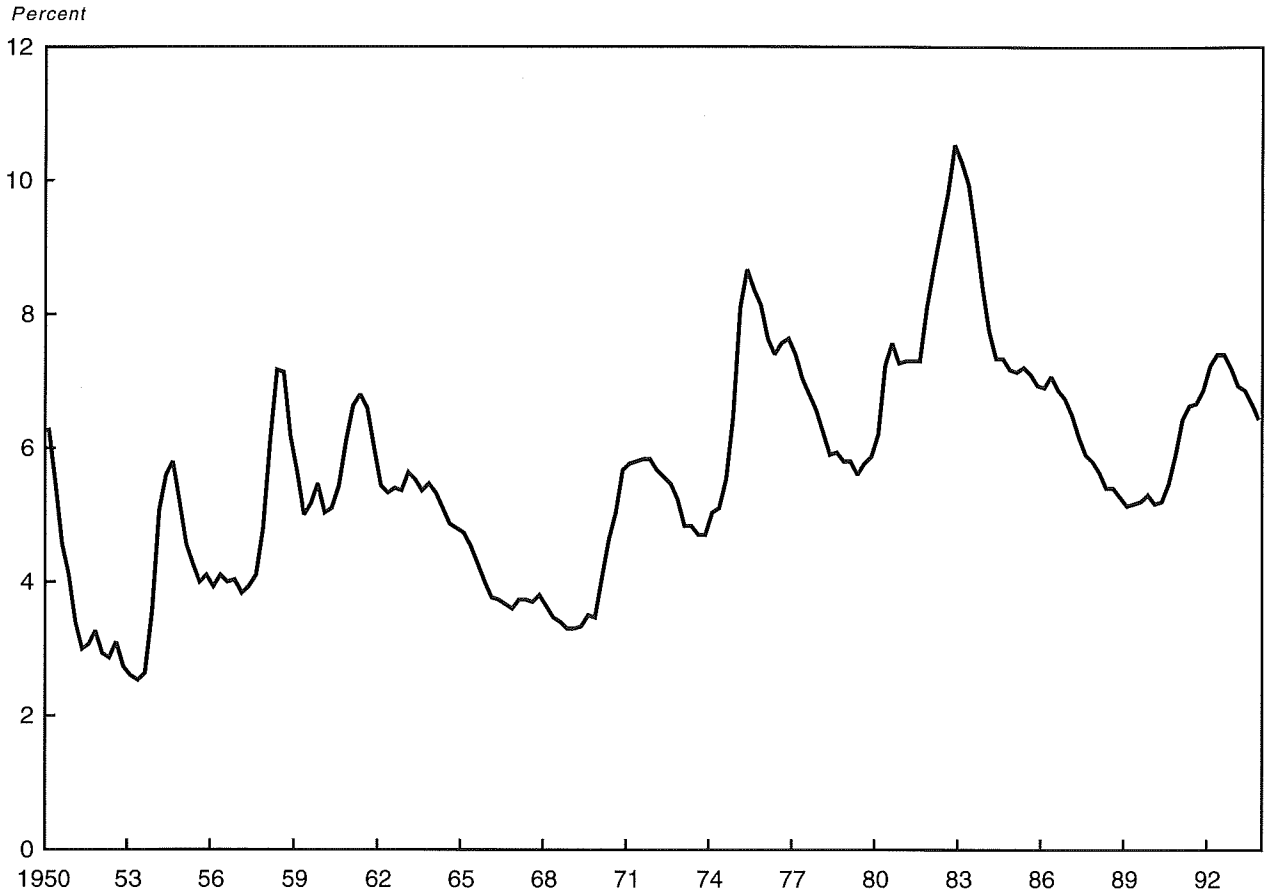
[1] Employees of the federal government are counted if they occupy a position on the last day of the month.

[2] Employees of the Central Intelligence Agency and the National Security Agency are excluded from the survey.

Chart 1

Unemployment Rate
January 1950 - December 1993



the number of hours actually worked. This figure therefore includes items like holidays, vacations, and sick leave. Overtime hours include that time for which a premium is paid. Weekend and holiday hours are included separately only if overtime premiums are paid. Hours which have only incentive premiums attached, such as shift differential and hazard premiums, are excluded from the overtime hours measurement.

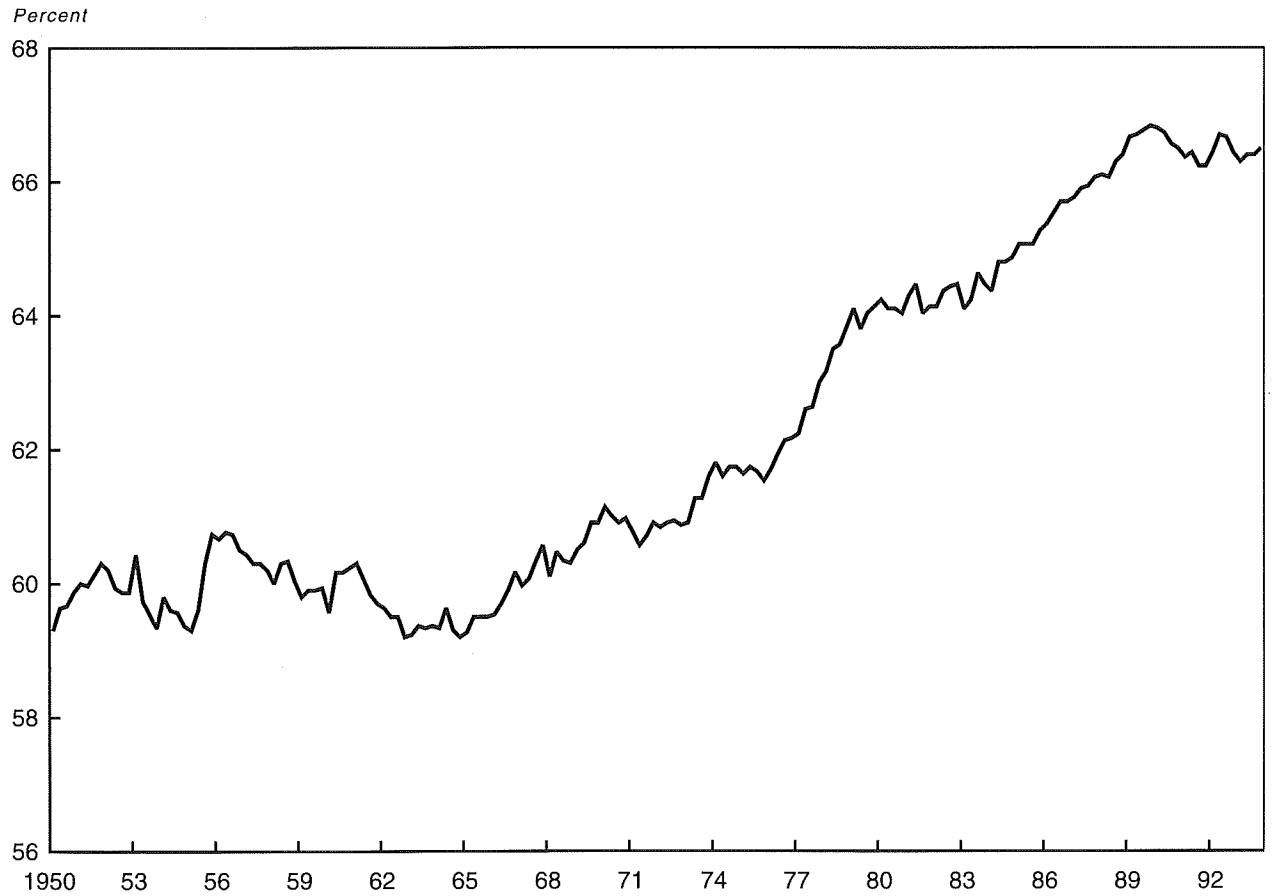
Average hourly and weekly earnings for nonsupervisory workers are estimated from data reported in the establishment survey. Three features have led some observers to question the relevance of that concept for studying certain problems. First, the data do not include fringe benefits, which play a major role in the compensation of most workers. Second, the data do not cover executive, administrative, and managerial workers in private industry, nor do they cover state and local government workers. They do not include bonuses, profit-sharing, and other contingent payments. And finally, the data are affected by changes in the composition of employment.

To address those problems, the BLS also publishes a quarterly *employment cost index* (ECI), which is based on a special survey of employers.[3] It is designed to cover all workers in private industry plus state and local government. The ECI adds contingent payments and the cost of providing a wide range of fringe benefits to basic wage and salary payments. Some of the most expensive benefits are social security and unemployment insurance taxes, paid vacation, sick leave, health and disability insurance, and retirement plans. The ECI is also based on a fixed industry and occupational structure. Shifts

[3] A more accurate title might be employee compensation index, however, since it excludes important labor costs such as training and hiring expenses.

Chart 2

Participation Rate
January 1950 - December 1993



between industries or occupations do not directly affect the index.

Chart 3 compares the ECI and average hourly earnings statistics. Both show a substantial decline in the growth rate of compensation since the early 1980s, as general price inflation also declined substantially. The ECI has grown faster than average hourly earnings for much of the period, however, reflecting the growing relative importance of fringe benefits.

CAUTIONS

The data series described above provide a wealth of timely, relevant information. The data can be misinterpreted, however. The following cautions are designed to help place data series in perspective. The first two concern the exact meaning of widely used terms.

Meaning of Terms

Unemployment Some observers tend to equate the level of unemployment with an unambiguous measure of economic hardship. The unemployment rate, however, is a much more complex statistic. It does not refer to an unchanging group totally composed of desperate individuals. It instead is a snapshot—a view at an instant of time—of people who are starting and ending particular jobs. Some unemployed persons find jobs quickly, others more slowly, and some people move directly from outside the labor force to employment. Some job changes are voluntary, others are involuntary.[4]

[4] In July 1994, for example, 49 percent of the unemployed had lost their last job, 9 percent had quit their last job, and 42 percent were reentrants or new entrants into the labor force. Of the unemployed, 36 percent had been unemployed less than 5 weeks while 20 percent had been unemployed 27 weeks or longer.

Demographic Composition of the Labor Force in the United States

(Thousands of persons unless otherwise indicated)

	1948	1969	1993
TOTAL			
Civilian labor force	60,621	80,733	128,040
Percent of total population	58.8	60.1	66.2
Employed	58,344	77,902	119,306
Unemployed	2,276	2,831	8,734
Unemployment rate	3.8	3.5	6.8
MEN, AGE 20 & OVER			
Civilian labor force	40,687	46,351	66,069
Percent of adult male population	86.6[a]	83.0	76.9
Employed	39,382	45,398	61,865
Unemployed	1,305	963	4,204
Unemployment rate	3.2	2.1	6.4
WOMEN, AGE 20 & OVER			
Civilian labor force	15,500	27,413	55,146
Percent of adult female population	31.3[a]	41.5	58.4
Employed	14,936	26,397	51,912
Unemployed	564	1,016	3,234
Unemployment rate	3.6	3.7	5.9
TEENAGERS (16-19)			
Civilian labor force	4,435	6,969	6,826
Percent of teenage population	52.5	49.4	51.5
Employed	4,026	6,117	5,530
Unemployed	409	852	1,296
Unemployment rate	9.2	12.2	19.0
WHITE			
Civilian labor force		71,778	109,359
Percent of white population	58.2[b]	59.9	66.7
Employed		69,518	102,812
Unemployed		2,260	6,547
Unemployment rate	3.5	3.1	6.0
BLACK[c]			
Civilian labor force		8,959	13,943
Percent of black population	64.0[b]	62.1	62.4
Employed		8,384	12,146
Unemployed		570	1,796
Unemployment rate	5.9	6.4	12.9

[a] Age 14 and over.

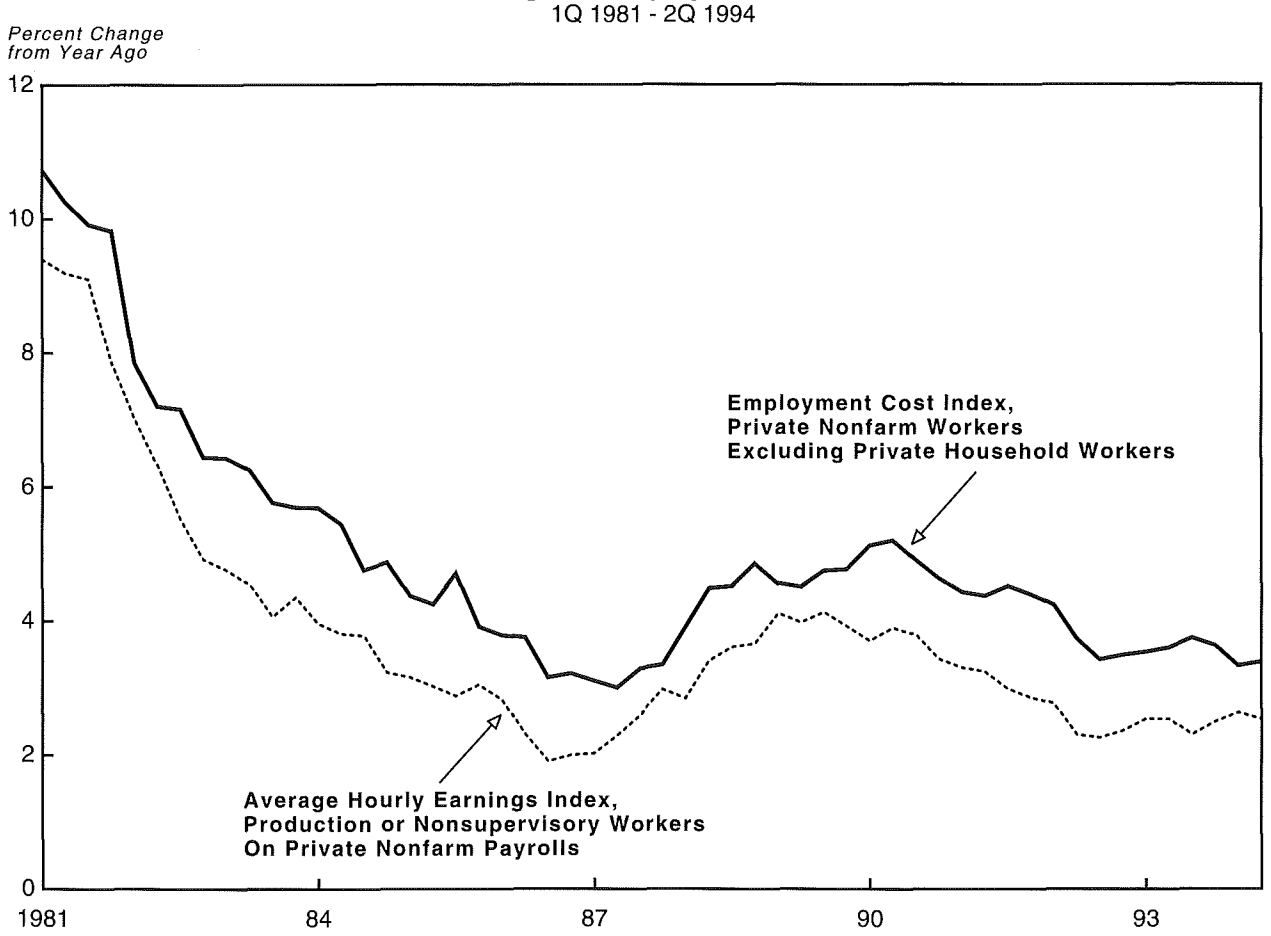
[b] Data are for 1954, not 1948.

[c] Nonwhite before 1972.

Note: Data represent full years and are taken from the *Monthly Labor Review* and the *Economic Report of the President*, various issues. Population figures exclude military and institutionalized personnel, and young persons less than 16 years old unless otherwise indicated.

Chart 3

Changes in Employment Costs
1Q 1981 - 2Q 1994



To help put unemployment rates in perspective, note that it is often not in the best interest of an unemployed person to take the first available job. It may take time to achieve a good match between a person's interests, skills, and abilities on the one hand, and a job's skill requirements, working conditions, and promotion possibilities on the other. Recognizing the inevitability of such *search unemployment* implies a positive unemployment rate.

A normally functioning economy will therefore have some unemployment, and unemployment may or may not imply personal hardship. To provide a perspective for business cycle analysis, some economists refer to a *natural rate of unemployment*, defined in one textbook[5] as "that rate of unemployment at which flows in and out of unemployment just balance, and at which expectations of firms and workers as to the behavior of prices and wages are correct." The natural rate is neither constant nor precisely known; at the present time many economists believe that it is between 5.5 and 7 percent in the United States. If actual unemployment were much higher, that would be evidence of cyclical slack in the economy; and if the actual rate were much lower, that would signal an overheated economy.

The term "natural" is widely used but may be misinterpreted; there should be no presumption that the current natural rate is either optimal or immutable. The natural rate is affected by the incentives and constraints facing persons and firms; anything that affects the average frequency or duration of unemployment will therefore affect the natural rate. Some important factors affecting the natural rate are the unemployment insurance system, family

[5] Rudiger Dornbusch and Stanley Fischer, *Macroeconomics*, 3rd ed. (New York: McGraw-Hill, 1984), p. 466.

structure, household wealth, minimum wage legislation, the demographic composition of the labor force, the mobility of labor, and the dispersion of skill levels in the labor force.

Compensation of employees Many forms of compensation are ignored in the average wage figures reported each month, including some that are growing especially rapidly. Fringe benefits such as health insurance are excluded, as are contingent payments such as lump sum payments in lieu of wage increases, bonuses, profit-sharing payments, and stock options. While the ECI includes these additional forms of compensation, there are two drawbacks to its use. It is only available quarterly, and the data for important parts of compensation are derived from a relatively small survey, rather than the larger payroll survey.

Two Definitions of Employment

The next caution involves one concept, employment, that is estimated from both the household and establishment surveys. The two should move together closely in the long run; however, in any month they can diverge substantially.

To see why employment totals can differ, note the slightly different definitions of employment for each survey. The establishment survey counts jobs, not people; dual job holders are therefore double-counted. The household survey only covers the number of people employed, so that a person is never double-counted. The household survey also counts self-employed persons, agricultural workers, and household workers, all of whom are omitted from the establishment survey.

Many observers may prefer to ignore monthly changes and focus on the longer run; for them it probably does not matter which series they focus on. But those with a short-run perspective often have to choose one or the other when the two series give conflicting signals. Many choose the establishment series, since the number of firms surveyed is much larger than the number of households surveyed and thus could be expected to have more precise estimates. Also, some analysts question the accuracy of survey responses from households.

The main drawback to using the payroll employment estimate as an indicator of recent employment activity is that it is often revised substantially after its initial release. For example, from 1970 to 1991 the average first revision was 86,000 workers; after four months the average revision was 148,000 workers. One reason for such large revisions is that many firms respond slowly to the survey, and the process for tabulating the late reports can be time consuming. The initial sample is thus smaller than subsequent samples.

Even after the survey is complete, the 390,000 establishments account for less than half of total employment; new businesses and very small firms are most likely to be missed by the survey. To estimate the rest, unemployment insurance tax records that cover almost all private workers are used to compute an annual benchmark adjustment. (Other changes are also made in the benchmark adjustments.) There is, however, a lag in receiving this information. If the BLS waited for unemployment insurance data before releasing employment figures, the data would be over a year old. To estimate employment without having current unemployment insurance data, the BLS uses a *bias adjustment* to account for employment in establishments that are not surveyed. The bias adjustment is based on the difference between payroll employment from the monthly sample and the virtually complete account from tax records for the last few years.

The bias adjustment can make monthly employment changes difficult to interpret in the neighborhood of turning points of the business cycle. Consider reported employment growth in 1992. A recession had begun in 1990 and ended in 1991, and real growth was slow immediately before and after the recession. Since the bias adjustment is based on recent experience, in 1992 it was based on a period when net job formation by new and small firms was unusually low; it could therefore be expected to understate employment growth. In January 1993 the BLS reported that payroll employment grew by 557,000 persons in 1992. After the benchmark revision, that figure changed to 962,000. Similarly, the bias adjustment procedure can overstate employment growth near cyclical peaks.

If one suspects faulty bias adjustment then one can usually check household employment figures. For example, a newspaper column suggested that the bias adjustment overstated employment growth in June 1993.[6] If the bias adjustment had been systematically overstating monthly employment growth in the

[6] Gene Epstein, "Economic Beat," *Barrons*, July 5, 1993, pp. 53-54.

payroll survey, then growth reported by the household survey should have been lower. However, from June 1992 to June 1993 household employment grew by 1.709 million persons while payroll employment grew by 1.645 million persons. That difference suggests that the bias adjustment may have been too small, and in 1994 the BLS revised payroll employment growth in June 1993 from 13,000 to 87,000.

In 1994, however, that check is not available. The questions asked in the household survey were changed in January 1994 to reduce possible ambiguity to some respondents, and new survey procedures were also introduced. While results from the revised survey should be more accurate, they are also not directly comparable to earlier figures. The BLS also adjusted its population estimates to incorporate 1990 census data, beginning in 1994, which also created a discontinuity with earlier data. Finally, the BLS is currently using seasonal adjustment factors, based on data from the old survey, that may be inappropriate. Monthly reports of employment change or labor force growth from the household survey are thus especially hard to interpret. Expressing the frustration of many, "I'm confused and embarrassed by these numbers," adds John Bregger, assistant commissioner for current employment analysis at the BLS. "It doesn't make any sense. The numbers are in fact illogical."[7] The situation will improve as more data become available. In January 1995 one can look at 12-month changes in not seasonally adjusted data, and after several years there will be enough data to calculate new seasonal adjustment factors.

Volatile Monthly Observations

Sampling error A final set of cautions warns a user not to overemphasize a single month's data. A basic reason is sampling error—that is, statisticians are attempting to estimate a statistic for a large population from a relatively small survey. It is especially important as smaller segments of the labor force or smaller geographic areas are studied. As Geoffrey Moore put it:

> A rise, say, from 5.0 to 5.3 percent in the unemployment rate is statistically significant, whereas a rise from 9.7 to 10.4 percent in the unemployment rate for blacks is not. The reason is that the population of whites is about ten times that of blacks, so that the sample of whites is also about ten times as large. Coupled with the fact that the unemployment rate for blacks is about twice that for whites, this means that the sampling error of the unemployment rate for blacks is about four times as large as for whites.[8]

The key concept is that of *statistical significance*, that is, whether a result is likely to have occurred simply from chance; a statistically significant result is not likely to be due to sampling error. Moore uses a 0.2 percent change for the total unemployment rate and a 0.8 percent change for the black unemployment rate as thresholds for statistical significance.

One should therefore be cautious in attaching much importance to a single month's changes without having some idea of how large a change must be to be statistically significant. This caution applies more forcefully as the size of the relevant population becomes smaller. On the other hand, consistent movements for several months considerably reduce the likelihood of the fluctuations being due to chance. Also, one's confidence in a single month's change can be bolstered or reduced by movements in related statistics. For example, suppose that a month's employment growth was reported to have been relatively strong, but that average weekly hours were relatively soft. In that case one could reasonably question the economic importance of either figure since the overall report gave mixed signals on the strength of labor demand.

Responses to survey data Individuals responding to the household survey may respond for themselves and any other adults in the household without checking written records. Some observers have questioned the reliability of that information. It is, of course, difficult to know the exact relevance of answers to questions from any survey. One piece of evidence is a test in 1977 that compared individual responses with employer records. Relative to employers' records, household respondents overstated the number of hours worked and understated both average hourly and weekly earnings.[9]

Irregular events All the monthly data series described in this article are adjusted to remove predictable seasonal fluctuations such as the swell in Christmas employment or the effects of summer vacations for students. Events that occur on an

[7] Amanda Bennett, "Numbers Game: Half-Million People Are 'Lost' from Work Force in Jobs Survey," *The Wall Street Journal*, August 8, 1994, p. A14.

[8] Geoffrey H. Moore, *Business Cycles, Inflation, and Forecasting* (Cambridge: Ballinger Publishing Company for the National Bureau of Economic Research, 1980), p. 111.

[9] Accounts of this test are taken from Joseph R. Antos, "Analysis of Labor Cost," in Jack E. Triplett ed., *The Measurement of Labor Cost* (University of Chicago Press for the National Bureau of Economic Research, 1983), p. 162.

irregular basis can be more difficult to take into account. Strikes, for example, lower employment estimates from the establishment survey but do not directly lower employment (or raise unemployment) estimates from the household survey. And while the BLS may note an estimate for the direct effect of a strike, the indirect effects may be substantial but not estimated; an example of an indirect effect would be layoffs of railway and port workers after a coal strike reduced coal shipments. Extreme weather conditions can also affect the data, even after routine seasonal adjustment.

SUGGESTIONS FOR FURTHER READING

Many books, professional journals and government reports have been written about labor market data. For an overview of labor markets and how they fit into the larger economy, readers may wish to look at a macroeconomics textbook, or for a more detailed analysis of labor supply and demand and market institutions, a text on labor economics. A good discussion of problems in the data can be found in the report of the *1979 National Commission on Employment and Unemployment Statistics*. The report contains a number of background papers in addition to the summary of recommendations.

The data series described in this article only hint at the large quantity of statistics that describe the labor market; many more series can be found in two monthly publications of the BLS. *Employment and Earnings* summarizes current and historical statistics collected from both the household and establishment surveys. The *Monthly Labor Review* also summarizes labor market statistics, and contains articles that discuss many aspects of labor markets, data concepts, data collection procedures, and the series themselves. Several of the articles were helpful in preparing this paper, such as an article contrasting the payroll and household estimates of employment in the August 1989 issue. Finally, the *BLS Handbook of Methods*, revised and published periodically, presents a discussion of the technical aspects of how the BLS collects, transforms, estimates, and presents labor market data. The September 1992 edition was used in revising this article.

MACROECONOMIC PRICE INDEXES

Roy H. Webb and Rob Willemse

Price indexes allow one to compare the average levels of prices at different times. By summarizing information on price trends, the indexes help people adjust for inflation when they choose how much to save, spend, and work. Government officials, as well as voters, use price indexes to evaluate economic policies. In addition, both private contracts and government programs often use a particular price index to adjust payments for inflation.

EXAMPLES OF EARLY USES

One of the first uses of a price index in the United States arose from the substantial inflation of the Revolutionary War period. In order to maintain the real, or inflation-adjusted, pay of soldiers, officials in Massachusetts tracked the price of acquiring a market basket of the following goods: 5 bushels of corn, 68 4/7 pounds of beef, 10 pounds of wool, and 16 pounds of leather. The basic idea was simple: the percentage increase in the price of the market basket would have to be matched by the same percentage increase in soldiers' wages to compensate for inflation.[1]

The federal government began collecting national price statistics in the late nineteenth century to evaluate the effects of tariffs. A particularly notable achievement was the production of a 50-year historical series of wholesale prices by the federal Bureau of Labor. In 1902 the Bureau began to regularly publish a Wholesale Price Index that could be used to track recent data. That price index was the forerunner of the current Producer Price Index (PPI); the agency is now known as the Bureau of Labor Statistics (BLS) and remains the primary source for aggregate price data in the United States.

During World War I the BLS collected data on the pattern of consumer expenditures and retail prices. The data were used in adjusting wages of workers for wartime inflation. After the war, the "cost-of-living" index was regularly published;[2] by one account, more than half the settlements in wage disputes in 1923 were based on that index. That index was the predecessor of the Consumer Price Index (CPI).

In short, the subject of price indexes was of great interest even before the sustained inflation of the last half century. That prolonged period of inflation has in turn stimulated more interest in the subject of price indexes. And that additional interest has in turn led to the use of economic and statistical theory to make the indexes more accurate and more relevant.

THE MAJOR INDEXES

Consumer Price Index

The CPI is the most widely used barometer of the average price level. The index is watched closely by workers, retirees, participants in financial markets, and government officials. The CPI's prominence as an inflation measure is reflected in its widespread use as an escalator for wages and benefit payments. Many collective bargaining agreements, other private contracts, social security benefits, and federal and state assistance programs allow for increases in wages and transfer payments tied to increases in the CPI. Elements of the federal income tax structure, including tax brackets and personal exemptions, are also adjusted to reflect movements in the CPI. In addition, the CPI is used to adjust other economic statistics, including hourly and weekly earnings and median family income, for price changes.

The CPI is expressed as the ratio of average prices currently paid by consumers to the average prices paid in a reference, or base, period. Since items vary in importance in personal budgets, both the numerator and denominator of the ratio are *weighted averages*. For example, since most people spend more

[1] This and many other early uses are described in W. Erwin Diewert, "The Early History of Price Index Research," National Bureau of Economic Research Working Paper No. 2713, 1988.

[2] It was not a valid cost-of-living index, however, as economists define the term. A cost-of-living index should measure the least expenditure necessary for an individual to achieve a certain level of satisfaction from consumption, with other important factors such as real after-tax income and wealth held constant.

on housing than on socks, the price of housing has a larger weight in the index than the price of socks. More precisely, the CPI is an estimate of the ratio of the current price of a fixed market basket of consumer goods and services of constant quality to the price of that market basket in a specific base period. (See the appendix for algebraic formulas for the CPI and other price indexes discussed in this article; in addition, numerical examples are also presented.) This market basket is designed to represent the average expenditures of a certain segment of the population at a certain time. The CPI is expressed as an index number. In 1993 the value of the CPI was 144.5, which means that the market basket cost 44.5 percent more in 1993 that it did in 1982-84, the base period.

Two versions of the CPI are published monthly by the BLS. They are published with a lag of about two weeks following the end of the month covered by the index. One is the *CPI for Urban Wage Earners and Clerical Workers (CPI-W)*, which is based on expenditures by consumers who represent about 32 percent of the U.S. population. The other is the *CPI for All Urban Consumers (CPI-U)*, which represents the spending habits of 80 percent of the U.S. population. The CPI-U, introduced in 1978, extended coverage to self-employed, professional, managerial and technical workers as well as to the unemployed, retirees, and others not in the labor force. People who live in rural areas are the largest population group whose expenditures are not explicitly represented in the CPI-U. In practice, the CPI-U and CPI-W data are similar. For example, the compounded annual inflation rate over the period 1972 through 1986 was measured by the CPI-U to be 7.12 percent, whereas the CPI-W rose 7.01 percent.

The quality of the CPI as a measure of price change can be affected by the representativeness of the market basket that is priced each month. A *Consumer Expenditure Survey* is used to identify and specify quantities of the goods and services that will make up the market basket of the CPI. It consists of two separate surveys of about 6,000 households, an Interview Survey and a Diary Survey, that have been conducted continuously since 1979. The survey conducted by the Census Bureau from 1982 through 1984 was used to modify expenditure weights in the CPI beginning in 1987.

The weights in the CPI remain unchanged for relatively long periods; the CPI is therefore often referred to as a *fixed-weight* price index. Strictly speaking, however, the entire record is a set of several time series of fixed-weight indexes that are spliced together. Since one set of expenditure weights is not used to calculate the CPI for every date, it is possible that a user viewing different dates will use index numbers based on different market baskets. Calculating inflation from 1980 to 1990, for example, the 1980 index would be based on the 1972-73 Consumer Expenditure Survey and the 1990 index would be based on the 1982-84 survey.

Once the expenditure weights are determined, the computation of the CPI for each month requires data on the current prices of items in the market basket. To obtain the price data, the BLS sends agents to many retail establishments in different parts of the country to obtain prices for about 100,000 items each month. The BLS then uses the individual prices to calculate CPI statistics at the local, regional, and national levels. (CPIs for each state are not produced, however.) In addition to the index for all items, the BLS calculates price indexes for selected components of the market basket such as food or entertainment.

Chart 1 graphs the CPI over its first 32 years. One can see the impact of three major events, the wartime inflation in the two world wars and the beginning of the Great Depression. Otherwise there is no clear trend; only the level is affected by various events. That is also the case when looking farther back. Using one estimate of the producer price index before 1890[3] and the official index thereafter, the level of that index only increased by about 10 percent from 1785 to 1913.

The picture shown in Chart 2 is somewhat different. Due to substantial inflation from 1945 to 1993, with the CPI increasing eightfold, this chart contains *percentage changes* in the CPI rather than the levels shown in Chart 1. At first, high rates of inflation were associated with wars; during the 1970s, however, sustained high rates of inflation occurred during peacetime. Unlike the prewar period, there was no tendency for inflationary periods to be offset by deflation at other times.

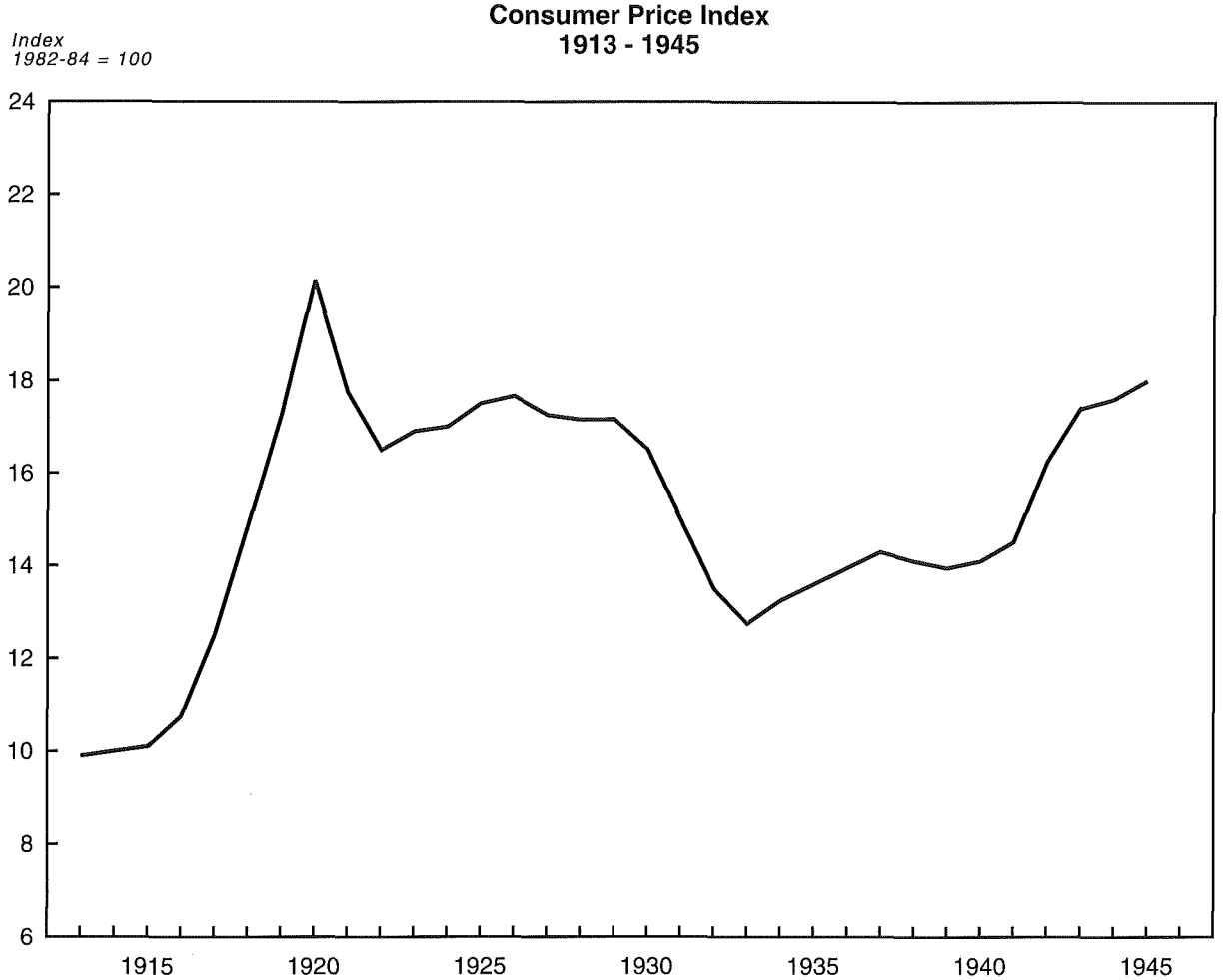
The Producer Price Indexes

The PPIs are used to estimate prices received by domestic producers of goods at various levels of processing. The classification by stage of processing

[3] The series was estimated by G. F. Warren and F. A. Pearson and is reprinted in U.S. Bureau of the Census, *Historical Statistics of the United States: Colonial Times to 1970, Part 1*, Washington, D.C., 1975, 200-201.

Chart 1

Consumer Price Index
1913 - 1945



divides goods into three main categories: *crude, intermediate,* and *finished goods.* Crude goods are items that are entering the market for the first time, that have not been manufactured or fabricated, and that are not sold directly to consumers. They include items like grains, livestock, cotton, and crude oil. Items like lumber, fertilizer, machine belts, and yarn are intermediate goods. They have been processed but may require further processing, or may be complete but will be used by businesses as material inputs. Finished goods will not undergo further processing; that category includes consumer goods as well as capital equipment.

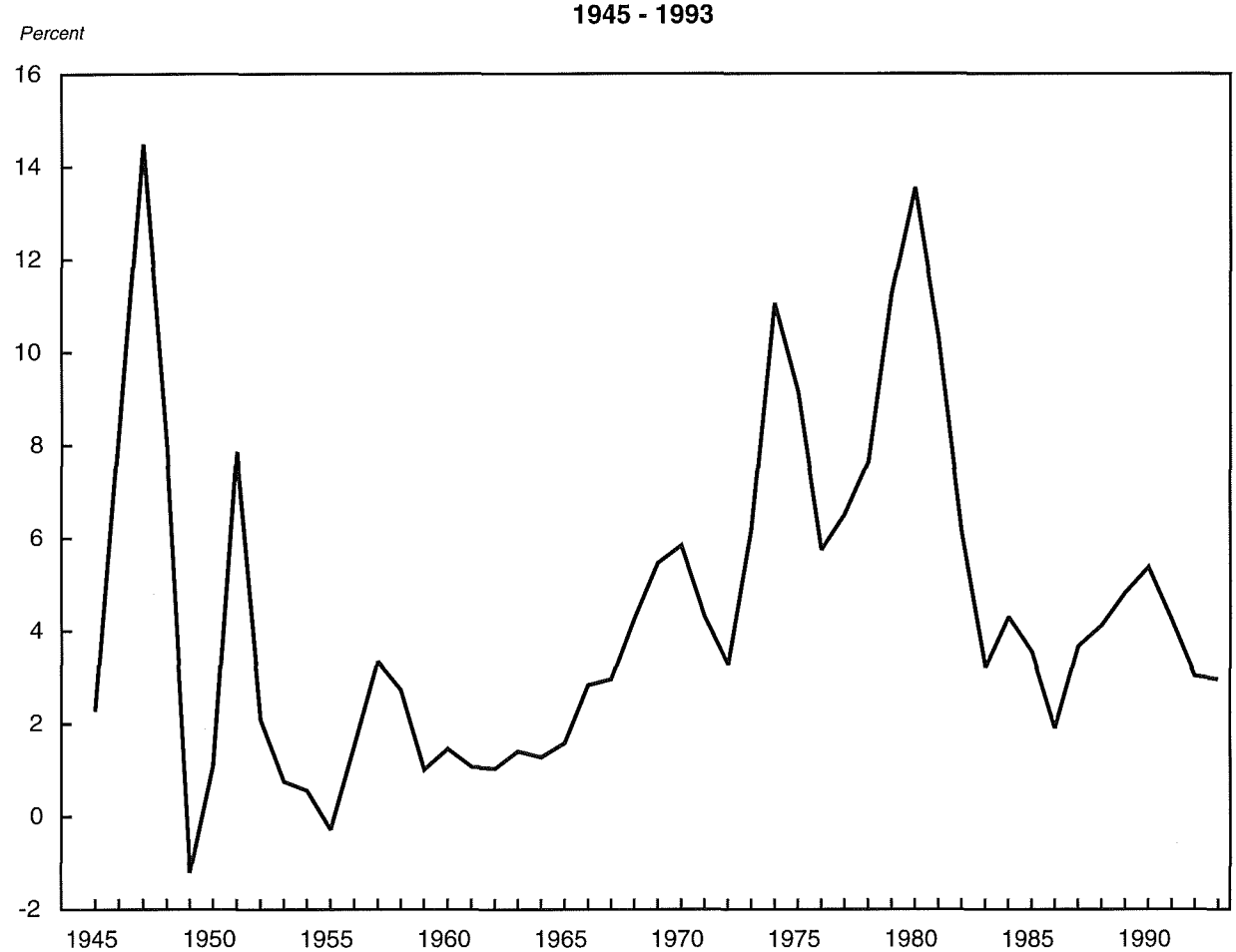
Indexes are also calculated for special commodity groupings, organized by similarity of end-use or material composition. Examples include the PPIs for industrial commodities and for farm products. Also, there are producer price indexes for the net output of different industries and their products. The entire system of PPIs consists of over 10,000 indexes.

The widely followed PPIs cover prices of physical commodities in manufacturing, mining, agriculture, and to a small extent electric power production. Coverage of physical products is comprehensive and detailed. Coverage of services, which now account for the bulk of total economic activity, is at best partial. Recently, PPIs for some service industries have been constructed, but are not included in the indexes of final, intermediate, and crude goods. Certain transportation, utility, and medical prices are reported at the industry level, while prices in other service industries such as banking and insurance are not yet covered.

The PPIs are calculated from a large number of individual prices. Like the CPI, they are constructed

Chart 2

Consumer Price Index Changes
1945 - 1993



using fixed weights for a number of years. The weight for each individual component is the relative value of shipments of that item. Periodically, the Bureau of the Census conducts industry surveys that the BLS uses to update the value weights. Among the most important surveys are the Census of Manufactures, the Census of Agriculture, and the Census of Minerals, which includes oil and gas production. The latest update of the PPIs uses surveys that were conducted in 1987 and have been incorporated in the PPI as of 1992.

The PPI for finished goods in 1993 was 124.7. That is a concise way of saying that prices producers received in primary markets for finished goods had increased 24.7 percent since 1982, with the prices of those items weighted by the relative values of 1987 shipments.

Price Measures from the National Income and Product Accounts

In the process of estimating GDP and its components, the Bureau of Economic Analysis (BEA) also estimates corresponding price measures, including fixed-weight price indexes, *implicit price deflators,* and *chain price indexes.*

To calculate GDP and its components, the BEA estimates the dollar value of spending for current production. It then calculates what that spending would have been if current quantities had not been valued at current prices but rather at prices paid during a reference (base) period. The ratio of the two spending totals, current dollar spending divided by constant dollar spending, is an implicit price deflator. Implicit price deflators are computed for GDP, for broad expenditure categories such as

consumer spending, and for more narrow categories such as consumer spending for stationery and writing supplies.

In the appendix it is shown that an implicit deflator is unlike the indexes discussed above in two important respects. First, instead of using historic weights, a deflator uses current quantities as weights. Second, an implicit deflator is not a pure price index, since changes in the index may reflect factors other than changes in prices. In fact, when two periods are compared (neither being the base period), the calculated change in the deflator depends on both the price change and on any change in the relative quantities exchanged.

An implicit deflator can therefore behave differently from a fixed-weight index. For example, if people spend their money for different products, that by itself does not immediately affect the CPI or PPI, which are not affected unless individual prices change. The implicit deflators, however, can be very much affected when relative quantities change. To provide users with better data on price movements, the BEA also publishes fixed-weight price indexes for GDP and many of its components. The weights are the amounts produced in a particular base period, which at present is 1987.

Since the National Income and Product Accounts are used to study the economy over long periods of time, there is also a disadvantage to the fixed-weight price indexes; the farther from the base period, the less representative will be the base-period weights. In fact, the BEA has stopped publishing the fixed-weight price index for GDP and several of its components before 1982 because using the 1987 weight for computers can make the fixed-weight price index behave strangely.

The BEA therefore provides two additional alternatives.[4] A chain-type annual-weighted price index is calculated for a particular year as the geometric average (that is, the square root of the product) of two price indexes: one uses the previous year as the base period, and the other uses the particular year as the base period. The resulting values can then be "chained" to form a time series that in effect uses weights that change each year. A similar procedure is followed for the other alternative, a benchmark-years weighted price index. Instead of weights changing annually, however, they change every five years. (Detailed information from economic censuses is available at five-year intervals.)

Although the differing measures of price levels may seem confusing, they usually tell similar stories over time. For example, between 1982 and 1993 the GDP fixed-weight price index, the implicit price deflator for GDP, and the GDP annual-weighted chain-type price index each grew at a 3.6 percent annual rate. Quarterly changes in the statistics, however, can diverge substantially; when they do, it is best to discount extreme movements in the implicit price deflator, which can result from changes in relative quantities produced between two particular quarters.

Chart 3 shows the GDP annual-weighted chain-type price index and the implicit price deflator. Note that they both reveal rising inflation in the late 1960s and 1970s and lower inflation in the 1980s and 1990s. On a quarterly basis, however, the implicit deflator is more volatile.

CAUTIONS

Price indexes are invaluable tools; however, no single index gives unambiguous answers to all questions. Some important cautions should be kept in mind.

Quality Change

Ideally, one can use price indexes for different dates to measure the average price change of goods and services of constant quality. Therefore, if a price increase of an item is due solely to quality improvement, then that price increase should not affect the index.

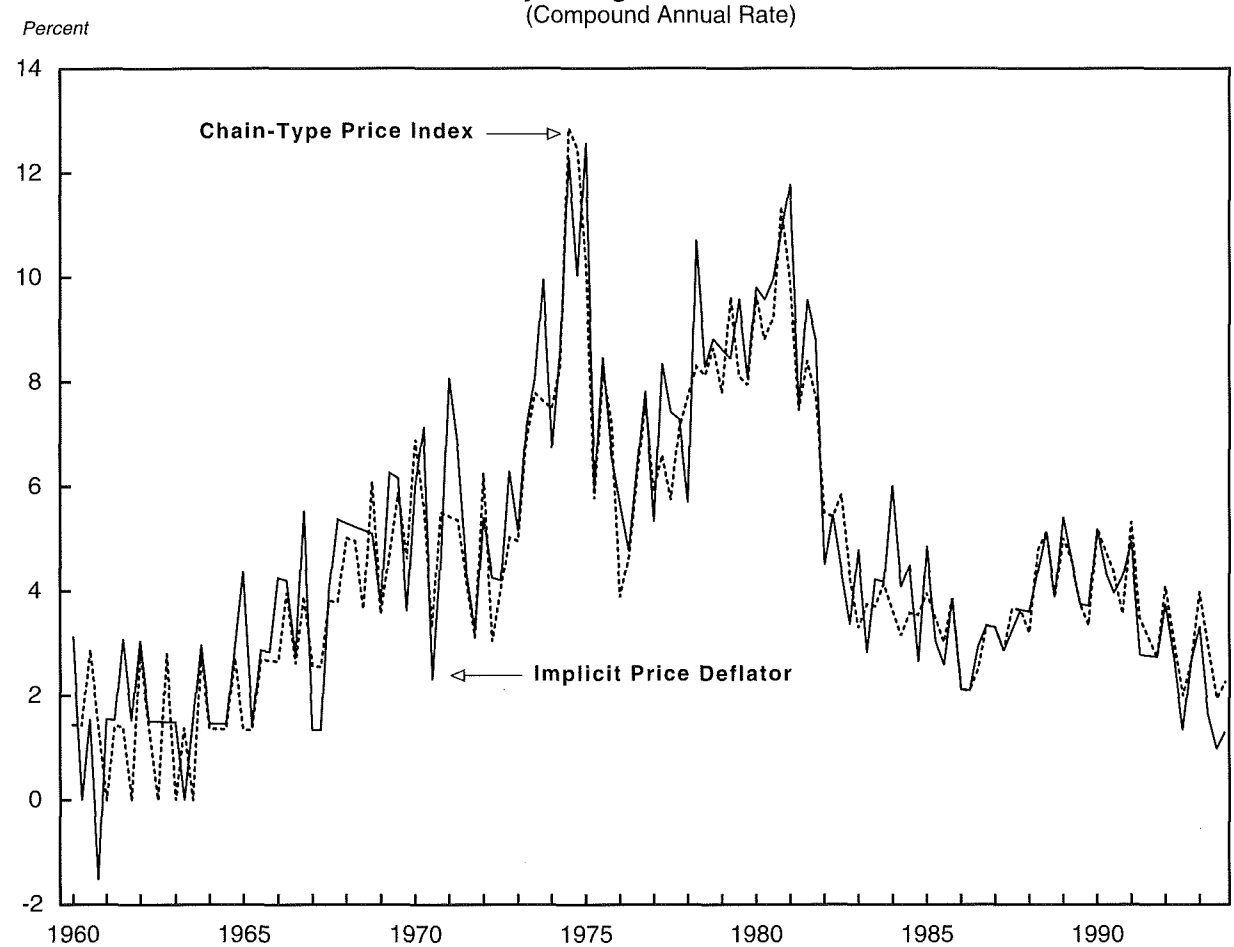
In many cases statisticians do not make any adjustment for quality changes. Banking, for example, has become much more convenient over time as extended hours, automated teller machines, and credit cards have eased banking transactions. None of the major price indexes adjusts for that quality change.

When they do adjust for quality change, statisticians often use a practice known as linking. That procedure estimates a price change for a new product by the price change of a similar product for which quality did not change. In other instances statisticians estimate the amount of quality change by the cost of producing it. For example, car manufacturers routinely provide the BLS with cost data for new

[4] A more complete discussion of this topic is contained in Allan H. Young, "Alternative Measures of Change in Real Output and Prices," *Survey of Current Business,* April 1992, 35-48.

Chart 3

Price Measures for Gross Domestic Product
Quarterly Changes: 1Q 1960 - 4Q 1993
(Compound Annual Rate)



features or additional items that were once optional before becoming standard equipment. Thus, if a new audio system added 1 percent to a car's cost of production and the new car price rose 3 percent, the quality-adjusted price increase would be 2 percent.

While those adjustments are clearly better than no adjustment for quality change, many observers believe they do not go far enough. As Robert J. Gordon has put it:

> The typical product, whether automobiles in the 1920s, TV sets in the 1950s or electronic calculators in the 1970s, experiences after its invention an initial period of declining price, as its manufacturers spread the fixed cost of development over more and more units sold. Then, as the product becomes mature, there is less opportunity for efficiency gains to cancel out increased wages and other costs, so prices begin to rise. Three aspects of the CPI cause it to understate quality improvements and to overstate price movements. First, the use of obsolete weights from decade-old expenditure surveys tends to place too little weight on modern products where price increases are relatively slow. Second, new models and products are typically introduced in the index much later than the date when their sales volume becomes important. And finally, the linking procedure, by far the most common quality-adjustment technique used by the BLS, tends both to treat new products as if they were mature products and to ignore performance improvements.[5]

For example, consider the difficulty in measuring the price of computers. For many years computer price changes were not included in the PPI or in the CPI's market basket or in the national income and product accounts; the price change was simply assumed to be zero. Over the last few decades,

[5] Robert J. Gordon, "The Consumer Price Index: Measuring Inflation and Causing It," *The Public Interest* (Spring 1981), 129-30.

however, the price of computing has fallen substantially; the price indexes therefore overstated the average inflation rate. Recently, the BEA revised the national income and product accounts back to 1970 to account for computer prices, which they now estimate have been falling by 15 percent per year. In contrast, the CPI is not revised once it is published;[6] it will therefore never be revised to account for the price declines found by the BEA for personal computers.

Other durable goods also may have higher quality levels that are not accurately reflected in price indexes. For example, Gordon has calculated that producers' durable equipment prices grew by 66 percent from 1947 to 1983; in contrast, the BEA's official deflator for that category grew by 383 percent.[7] The huge difference is accounted for by Gordon's detailed quality adjustments for many items using sources other than the BLS or BEA. In some cases his estimates were based on conventional methods such as linking; in other cases, however, he went beyond usual methods when new models performed much better than old ones.

Problems in measuring quality change are especially severe for services, which account for a large fraction of economic activity. (Employment in service-producing industries recently accounted for three-fourths of private nonfarm employment.) Traditional methods to correct for quality improvement are difficult to apply since the product of a service industry can have attributes such as convenience that are difficult to measure. The chapter on price indexes for medical care provides details that illustrate the difficulty of constructing a price index for a service with substantial quality change.

Due to technical progress and increasing knowledge, many observers believe that the average quality of goods and services has risen over time, and that unmeasured quality change has caused inflation in the United States to be overstated by most price indexes.[8] That belief, however, is extremely difficult to quantify. The examples above certainly indicate that the problem of measuring quality change is important and should be studied. Unfortunately, they do not provide the final word on the magnitude of unmeasured quality changes in the major indexes.

Homeownership

The CPI increased sharply in the late 1970s and early 1980s, with its annual rate of increase peaking at 15 percent in 1980. Flaws in the measurement of the cost of homeownership in the CPI contributed to its sharp increase.[9] At that time the CPI's cost of homeownership contained two main components, the house purchase price and the mortgage interest cost, as well as other expenses such as taxes, maintenance, and insurance. That method overweighted the cost of homeownership for two reasons. First, it treated the investment in a house much like the purchase of a nondurable good. Second, it confused the purchase price with the method of financing. That method therefore tended to overstate the CPI in the late 1970s as house prices and mortgage rates increased sharply.

Economists usually consider the purchase of a house to be an investment and the use of a house to be consumption. The CPI, as a measure of the cost of consuming a bundle of goods and services, should therefore incorporate only the change in the current cost of housing services. One estimate of the current cost of using owner-occupied housing is the amount it would cost to rent a similar property. Starting in 1983 with the CPI-U and in 1985 with the CPI-W, the BLS adopted a *rental equivalence* approach to measure the cost of housing services. Rental equivalence approximates the change in the cost of services of homeownership with an index of the rental value of owner-occupied housing.

The rental equivalence approach was already used in the National Income and Product Accounts and its personal consumption expenditure fixed-weight price index. Chart 4 shows the period in which the different measures diverged substantially; from 1978 to 1982, the CPI rose 10.7 percent whereas the fixed-weight price index for consumer spending rose 8.9 percent. The most important difference in the two statistics is their different methods of estimating prices for housing. Since the BLS does not revise CPI data once they are published, users

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[6] Since the CPI is used frequently to adjust contractual payments and government benefits, revising historical values could lead to complex revisions of liabilities and payments. The not-seasonally adjusted version of the index is not revised after publication, while the seasonally adjusted version is only revised to the extent that seasonal factors are revised.

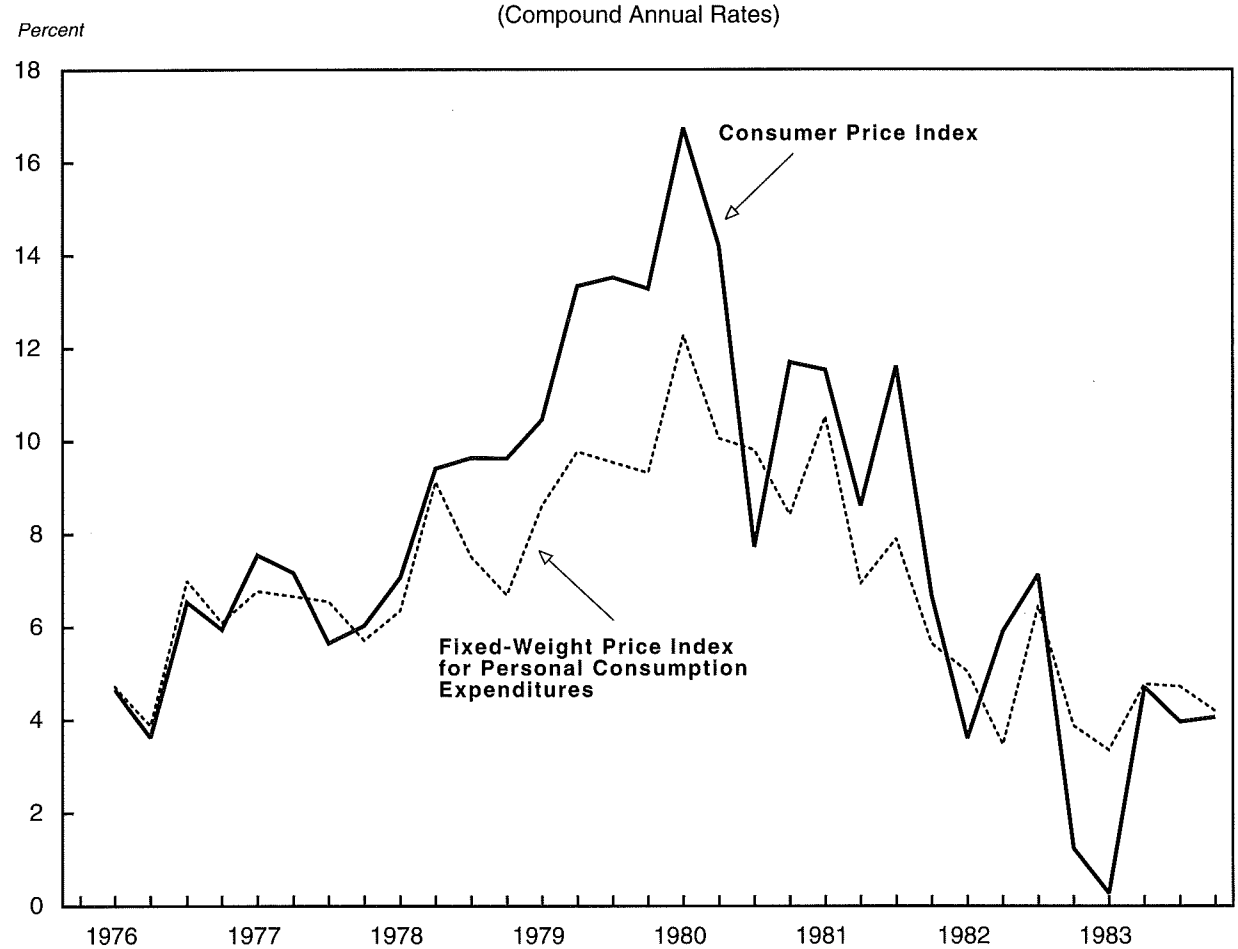
[7] Robert J. Gordon, *The Measurement of Durable Goods Prices*, University of Chicago Press for the National Bureau of Economic Research, 1990.

[8] There are, of course, counterexamples that would illustrate quality declining, such as decreasing legroom in coach seats on airplanes.

[9] For a more detailed account, see Alan S. Blinder, "The Consumer Price Index and the Measurement of Recent Inflation," *Brookings Papers on Economic Activity* 2:1980, 539-73.

Chart 4

Changes in Consumer Price Measures
1Q 1976 - 4Q 1983
(Compound Annual Rates)



of old CPI data should realize that the CPI-U data before 1983 (and the CPI-W before 1985) still use the old measurement of housing cost and thus overstate the actual price increases. Similarly, other statistics that are adjusted for inflation by using the CPI are biased downward for that period, including real hourly earnings and real family incomes.

Outlet Substitution Bias

When preparing the CPI, the BLS considers an item purchased at a discount store and the same item purchased at a traditional retailer to be different goods, presumably reflecting a lower quality of service by the discounter. Thus, the post-World War II shift in purchases toward discounters is not reflected in the indexes, and the CPI overstates the change in the average price paid for many items. In the 1980s, for example, the CPI for an average of many food items grew at a 2.1 percent higher rate than the corresponding average prices consumers actually paid.[10] To the extent that price differences among stores do not represent quality differences, the failure of the CPI to incorporate the effect of discounters would bias it upward.

Changing Quantities

People shift their buying habits over time due to changes in relative prices, real incomes, demographic characteristics, and tastes. The CPI, however, is based on a market basket that is fixed for long intervals. Table 1 provides a contrast between the

[10] Marshall Reinsdorf, "The Effect of Outlet Price Differentials on the CPI," in Murray Foss, Marilyn Manser, and Allan Young, *Price Measurements and Their Uses*, University of Chicago Press, 1993.

Table 1

Composition of Consumer Spending

Expenditure Group	Consumer Expenditure Survey 1972-73	1982-84
Food and Beverages	18.7	18.1
Food away from home	3.8	4.9
Housing	28.0	30.7
Apparel and Services	7.8	5.4
Transportation	18.7	19.7
Gasoline and motor oil	4.3	5.6
Medical Care	4.6	4.4
Other	22.2	21.7

Note: Figures represent the relative importance of items, stated as percentages of annual expenditure.

Source: *Monthly Labor Review*, June 1986, p. 17.

major expenditure shares based on the 1972-73 and the 1982-84 Consumer Expenditure Surveys.

The CPI's fixed expenditure weights become less representative over time as consumption patterns change. For example, consumers normally reduce consumption of items for which price increases are relatively large. This problem is often referred to as substitution bias. It is inherent in any price index whose weights are fixed, and it becomes more serious when price movements are widely dispersed. In practice, substitution bias may not be very large. One recent study found substitution bias for the CPI from 1959 to 1985 was only about 0.18 percent per year.[11]

Lack of Good Data on Individual Prices

The BEA uses prices of individual items that were first collected for the CPI and PPI to estimate over 90 percent of the private sector prices in the National Income and Product Accounts. Since the accounts attempt to cover all current production, whereas the CPI and PPI cover limited areas, prices of some items remain to be estimated by the BEA. They may not have usable data for some of those remaining items, such as commercial construction or financial services, where both price and quantity may be difficult to define. In those cases the BEA may use the cost of production to estimate a product's price; the quantity produced is then estimated as total spending divided by that estimated price. If there are substantial productivity gains in those industries, however, then that procedure will overstate price change and correspondingly underestimate real output growth.

International Comparisons

As should now be apparent, compiling a price index involves many choices among imperfect alternatives. Not surprisingly, statistical agencies of different nations have made different choices. Thus, one cannot assume that the price indexes of different nations are exactly comparable even if they have the same title.

CONCLUSION

These caveats indicate that price indexes do not answer all questions as well as we might wish. Despite their imperfections, however, the existing price indexes are invaluable. As Irving Fisher put it:

> But, although in the science of optics we learn that a perfect lens is theoretically impossible, nevertheless, for all practical purposes lenses may be constructed so nearly perfect that it is well worth while to study and construct them. So, also, while it seems theoretically impossible to devise an index number, P, which shall satisfy all of the tests we should like to impose, it is, nevertheless, possible to construct index numbers which satisfy these tests so well for practical purposes that we may profitably devote serious attention to the study and construction of index numbers.[12]

SUGGESTIONS FOR FURTHER READING

The Bureau of Labor Statistics is the primary source for the CPI and the PPI and publications explaining their construction. The monthly publications *CPI Detailed Report* and *The Producer Price Indexes* present the actual data and contain brief introductions to the construction of the CPI and the PPI; they also announce and explain periodic revisions in the series. The *BLS Handbook of Methods* describes in more detail the construction of the CPI and the PPI. The *Monthly Labor Review* contains recent data as well as articles on topics related to the CPI and PPI.

The implicit PCE and GDP deflators are explained in most macroeconomic textbook discussions of the National Income and Product Accounts. The *Survey of Current Business*, published monthly by the Commerce Department, presents the data and regularly provides brief explanations of the deflators and price indexes.

[11] Marilyn E. Manser and Richard J. McDonald, "An Analysis of Substitution Bias in Measuring Inflation, 1959-85," *Econometrica* (July 1988), 909-30.

[12] *The Purchasing Power of Money* (1911; reprint, New York: Augustus M. Kelley, 1963), p. 212.

Problems of quality adjustment in the price indexes are discussed in Robert J. Gordon's works cited in footnotes above. Other useful critiques of official indexes include the following: Phillip Cagan and Geoffrey H. Moore, *The Consumer Price Index: Issues and Alternatives*, American Enterprise Institute, Washington, 1981; and Council on Wage and Price Stability, *The Wholesale Price Index: Review and Evaluation*, Washington, 1977.

On the relation of economic theory and index numbers, an accessible account is Peter Hill's "Recent Developments in Index Number Theory and Practice," *OECD Economic Studies #10*, Spring 1988. A classic comparison of many different price indexes is Irving Fisher, *The Making of Index Numbers*, Riverside Press, Cambridge, MA, 1922.

APPENDIX

The CPI, PPI, and GDP fixed-weight price indexes all reflect weighted averages of prices relative to average prices in a base period. Since the weights on specific prices remain fixed for long periods of time, the indexes are often referred to as fixed-weight indexes. In symbols, a fixed-weight index can be represented as in equation (1a) or its possibly more intuitive form, (1b):

$$P_t = \frac{\Sigma p_t q_b}{\Sigma p_b q_b} \qquad (1a)$$

$$= \Sigma \left(\frac{p_t}{p_b} \right) \left(\frac{p_b q_b}{\Sigma p_b q_b} \right) \qquad (1b)$$

where P_t is the price index in period t, the summation signs represent summation over all commodities covered by the index, p_t is the price of a specific item in period t, q_b represents either the quantity of a specific item included in the market basket (CPI) or the quantity produced in the base period (PPI or GDP indexes), and p_b is the price of a specific item in the base period. In words, equation (1b) states that the price index is a weighted average of the relative price changes for specific items (the first term in parentheses), with the weights being the relative importance of the items in the base period (the second term in parentheses).

The deflators used in the National Income and Product Accounts are somewhat different since the weights of individual prices can vary over time. A deflator can be represented as in equation (2):

$$P_t = \frac{\Sigma p_t q_t}{\Sigma p_b q_t} \qquad (2)$$

where P_t is the price index in period t, the summation signs represent summation over all commodities covered by the index, p_t is the price of a specific item in period t, q_t is the current quantity consumed of that specific item, and p_b is the price of a specific item in the base period. In words, equation (2) states that the price index is the ratio of current expenditure to current quantities times base period prices. When compared to the base period, an implicit deflator is a current-weight price index. That is, it is a weighted average of prices, with the weights being current quantities. When two periods other than the base period are compared, however, the change in the deflator is a muddle of price and quantity changes that can be difficult to interpret.

A final type of index considered is the chain-type price index of the national income accounts. In symbols it is

$$P_t = \sqrt{\frac{\Sigma p_t q_{t-1}}{\Sigma p_{t-1} q_{t-1}} \times \frac{\Sigma p_t q_t}{\Sigma p_{t-1} q_t}} \qquad (3)$$

where P_t is the price index in period t, the summation signs represent summation over all commodities covered by the index, p_t is the price of a specific item in period t, and q_t is the current quantity consumed of that specific item. In words, equation (2) states that the price index is the geometric average of two fixed-weight price indexes; one uses last period's quantities as weights, and the other uses the current period's quantities as weights.

A simple example may help clarify the types of indexes. Suppose that one wishes to construct a price index for fruit. There are two types of fruit, apples and oranges. Table 2 shows the prices of apples and oranges in April, May, June, and July and the amounts bought. A fixed-weight Fruit Price Index (FPI) is calculated, using quantities bought in April as the base; as is conventional, the index value in the base period is 100. An Implicit Fruit Deflator (IFD) is also calculated, as is a Chain-Type Price Index (CTPI).

Table 2

Numerical Examples of Price Statistics

		APRIL	MAY	JUNE	JULY
Price per apple		12	20	20	20
Number of apples bought		6	3	2	2
Price per orange		4	4	4	2
Number of oranges bought		7	10	15	30
FPI:	Level	100	148	148	134
	Percentage change		48	0	−9
IFD:	Level	100	132	119	69
	Percentage change		32	−10	−42
CTPI:	Level	100	140	100	66
	Percentage change		40	−29	−34

For example, using equation (1a) to construct the FPI for May,

$$\text{FPI} = \frac{(20 \times 6) + (4 \times 7)}{(12 \times 6) + (4 \times 7)} = \frac{120 + 28}{72 + 28} = 148.$$

Similarly, using equation (2) to construct the IFD for June,

$$\text{IFD} = \frac{(20 \times 2) + (4 \times 15)}{(12 \times 2) + (4 \times 15)} = \frac{40 + 60}{24 + 60} = 119.$$

A few points are worth emphasizing. First, the monthly estimates of price change can differ substantially, depending only on how the index is constructed. The differences in this example are extreme since the relative price changes and quantity changes are also extreme.

Second, the implicit deflator is less than the fixed-weight index. That is often the case in the real world as well, resulting from the tendency to switch consumption toward relatively less expensive goods when relative prices change.

Third, although neither price changed in June, both the implicit deflator and the chain index changed substantially.

Finally, in July there was a substantial decline in the price of oranges. The fixed-weight index put little weight on that decline due to the small relative importance of oranges in the base period, April.

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Thank you for your recent order for *Macroeconomic Data: A User's Guide*. Unfortunately, it contains errors on pages 68 and 69 that are corrected below. Please insert this sheet in your book for future reference, and please accept our apologies for the inconvenience.

1. Equation 3 on page 68 should read:

$$\frac{P_t}{P_{t-1}} = \sqrt{\frac{\sum p_t q_{t-1}}{\sum p_{t-1} q_{t-1}} \times \frac{\sum p_t q_t}{\sum p_{t-1} q_t}} \qquad (3)$$

2. Using that formula, the bottom of Table 2 on page 69 should be:

CTPI: Level	100	140	140	93
Percentage change		40	0	-34

3. In addition, the next to last paragraph on page 69 should read:

Third, although neither price changed in June, the implicit deflator changed substantially.