In Brief
Economic Capsules

An Overview of Inflation Measurement

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The measurement of inflation—the rate of change in the aggregate price level—requires the construction of price indexes. In this article we survey a variety of indexes compiled and published by the government. We identify differences in the construction and coverage of these measures and touch on some of the issues affecting the measurement of prices for a broad range of goods and services. A companion article by Eugene Kroch in this issue of the *Quarterly Review* focuses more directly on the problems of measuring inflation in the service sector.

Inflation measurement would be a trivial matter if the prices of all goods and services increased proportionally. In fact, however, relative prices are continually shifting. For this reason, any real-world inflation index (a weighted average of the rate of increase or decrease in the prices of various goods and services) is imperfect.

With any price index, one wishes to compare the prices of *identical* goods and services over time. Difficulties can arise when the exact nature of a product changes—for example, as a result of improvements in the product's quality. The quality issue is probably deeper for many categories of service spending, such as health care, than for goods.[1] Quality corrections are less common in services than in goods, leading to the suspicion that service inflation rates may be overstated.

The most commonly used type of price index is a Laspeyres, or fixed-weight, index, which measures the current cost of purchasing the initial (base) period basket of goods and services. Such an index fails to account for those shifts in spending patterns due to changes in relative prices. Consequently, Laspeyres indexes like the consumer price index (CPI), producer price index (PPI), and the fixed-weight index for gross national product (GNP) are usually believed to overestimate the rise in the "cost of living"—that is, the loss in "utility" or well-being resulting from an increase in the price level.

Any fixed-weight index will lose some of its accuracy as the interval between the base and current period increases and the weights used become outdated. In addition, because a fixed-weight index only includes commodities that appear, and can be priced, in every period, information about both new products and those that have become obsolete is lost.

Alternatively, a Paasche index measures the cost of purchasing the *current* period's basket of goods and services at base period prices. This type of index, exemplified by the implicit GNP deflator, is not a pure price index, because it encompasses the interaction between price and quantity changes. A Paasche index can usually be said to understate inflation, since it will be reduced when consumers shift their spending patterns in response to rapid increases in the prices of some items.

Specific inflation measures

The consumer price index[2]

The CPI, the most widely used measure of inflation, was

[1] See Eugene Kroch, "Tracking Inflation in the Service Sector," in this issue of the *Quarterly Review*

[2] Much of the information in this section and the next is based on U S Department of Labor, Bureau of Labor Statistics, *BLS Handbook of Methods*, Bulletin no 2285, April 1988 Some of the sample sizes cited in this publication have been subsequently changed

first introduced during World War I to calculate cost-of-living adjustments for wages. Today, in addition to the escalation clauses in collective bargaining agreements, provisions to adjust future payments based on changes in the CPI can be found in Social Security and other federal programs, rental contracts, insurance policies, and royalties, as well as alimony and child support payments. In 1985, to prevent inflation-induced "bracket creep," the federal income tax structure was indexed to the CPI.

The CPI, which is compiled and published by the Bureau of Labor Statistics, measures the average change in prices of a fixed market basket of goods and services purchased by urban consumers. The market basket covers seven major categories of expenditures: food, housing, apparel, transportation, medical care, entertainment, and other goods and services. Prices are collected in eighty-five urban areas from about 19,000 retail establishments and approximately 35,000 tenant-occupied and 27,000 owner-occupied housing units. Prices for food, energy items, rent, and a small number of other goods and services are compiled monthly in all eighty-five locations. Prices of most other items are gathered every month in the five most populous geographic areas. In the other urban areas they are gathered every other month. Overall, about 95,000 prices are collected each month. In addition, information on rents is collected each month from one-sixth of the rental units and one-twelfth of the owner-occupied housing units in the sample. Most price data are obtained directly through visits or telephone calls by trained representatives of the Bureau of Labor Statistics.[3] Some secondary sources (that is, government agencies and trade publications) are consulted for items such as used cars, electricity and natural gas, local telephone charges, airline fares, and intercity bus and train fares.

The composition of the market basket of consumer goods and services is derived from expenditure data collected by the ongoing Consumer Expenditure Survey. The data reflect people's buying habits: what type of goods and services consumers are buying and how much they are spending on each item. Expenditure patterns are estimated from the survey data for a base period. The base period spending patterns constitute the fixed market basket of goods and services whose average price change the CPI is designed to measure. The current index base period is 1982-84. Approximately once every ten years, the base period is revised to bring the consumer spending pattern in the index closer to the changing reality.

[3]For a good description of some of the procedures used by these representatives, see "How Reliable is the Consumer Price Index?" *Business Week*, April 29, 1991

Besides the periodic revisions of expenditures for the fixed market basket of goods and services, various forms of improvements and changes have been introduced in the construction of the index over time. The most significant conceptual revision involved the treatment of home ownership costs. Before 1983, the index implicitly measured the cost of owning a house rather than the cost of consuming housing services. Under this approach, home purchase prices and mortgage interest rates figured importantly in the housing component. In fact, movements in this component were often dominated by movements in mortgage rates and, therefore, by movements in long-term interest rates in general.

Since the CPI is a measure of the "cost of living," the more appropriate concept is the cost of consuming housing services. For this purpose, rental cost (explicitly, or, in the case of homeowners, implicitly) is the relevant "price." Thus, the revised approach involves estimating the cost of renting a house. The assumption is that homeowners incur an opportunity cost by living in, rather than renting out, their houses. This revision has had the effect of substantially reducing the weight of homeowners' costs in the CPI.

While the treatment of homeowners' costs has been improved, other problems with the CPI relating to item substitution and quality adjustments remain. The difficulties of isolating price changes caused by quality differences and of pricing a new substitution often complicate price assessments for components such as apparel and medical care.[4] To address quality changes and other problems, special procedures are used to compile price information for new cars, used cars, automobile finance charges, health insurance, quantity discounts, and bottle deposits. In addition, adjustments are made for pricing practices such as bonus merchandise, utility refunds, manufacturers' rebates, and cents-off coupons so that the index measures actual out-of-pocket spending by consumers. These special procedures cannot correct for all problems, however.

Some critics also question whether taxes are treated appropriately in the CPI. The coverage of taxes in the CPI is fairly broad but not fully comprehensive. The CPI measures actual prices paid by consumers, prices that may include sales, excise, utility, or gasoline taxes. Real estate taxes are not explicitly included as part of the cost of housing services in the CPI. They are indirectly taken into consideration, however, through their effect on residential rents, both for renters and as part of "owner's equivalent rent." Income taxes, which are independent of consumer spending on goods and services, do not in any way enter into the CPI.

[4]See Kroch, "Tracking Inflation"

In recent years the rate of inflation based on the CPI for all items has fluctuated around an average of about 5 percent. This rate is somewhat greater than the inflation rate of around 3 to 4 percent between 1983 and 1986 but substantially lower than the rate before the 1982 recession. As Chart 1 illustrates, the rate of inflation in the CPI for all items is quite volatile from quarter to quarter This is largely due to the inclusion of food and energy in the CPI. The "core rate" of inflation, which excludes those two items, has been quite stable at around 4 to 5 percent since 1983, although it showed a slight upward trend in the last two years before turning down in the spring of this year

The producer price index

The PPI is an index measuring prices paid to domestic goods producers, excluding indirect taxes. The PPI is classified by stage of processing, with separate measures for finished goods, intermediate goods, and crude materials. Finished goods are defined as those ready for sale to a final user (household or business). Crude materials are those entering the market for the first time. Any good that meets neither of these definitions is classified as an intermediate good.[5] In addition, the PPI is reported for a large number of specific products or groups of products. The most closely watched measures are the PPI for all finished goods and the PPI for finished goods excluding the volatile food and energy components. The PPI for crude materials has received some attention as a long-lead indicator of inflation.

The PPI is a fixed-weight index, with weights based on the value of shipments reported in the 1982 censuses of manufacturing, agriculture, and minerals. The 1982 weights were incorporated beginning in January 1987. Data are collected through a survey of business establishments, with participation voluntary. Reported figures are subject to revision four months following initial publication, although in practice these revisions are usually minor. Seasonally adjusted figures are revised each January.

The PPI as it is currently calculated has several problems. Because it covers only domestically produced goods and excludes both services and imported goods, its usefulness as a leading indicator of consumer price inflation is limited. As a fixed-weight index, it fails to account for changing expenditure patterns

[5]It is possible for some items to be counted more than once at the intermediate stage

Chart 1

Comparison of Consumer Price Index Inflation Indicators

Quarterly Percent Change at Seasonally Adjusted Annual Rates

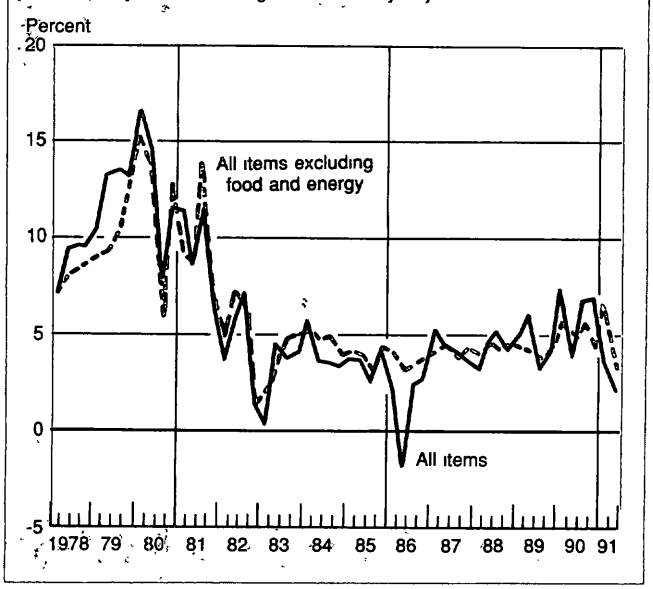
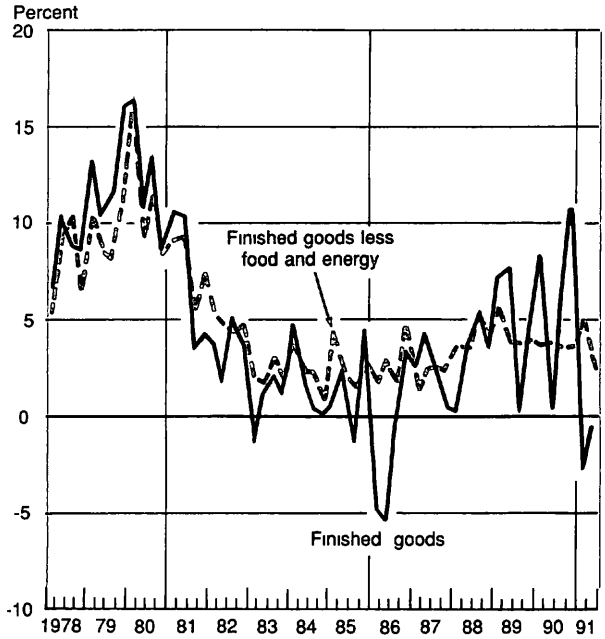


Chart 2

Comparison of Producer Price Index Inflation Indicators

Quarterly Percent Change at Seasonally Adjusted Annual Rates



Note Second-quarter figures are based on data available as of August 9, 1991, and are subject to revision

over time, tends to track obsolete models for too long, and introduces new ones too slowly. In addition, the use of weights obtained from surveys taken in a recession year means that, in the PPI's current form, cyclically-sensitive goods are underrepresented. Respondents are supposed to report actual transaction prices, but some may in fact report only the list price of an item without adjusting for special sales, discounts, or manufacturers' rebates

Recently the rate of inflation in the PPI for finished goods has been very volatile from quarter to quarter (Chart 2). As in the case of the CPI, this volatility is due to the inclusion of food and energy When oil prices rise sharply, as they did in the fourth quarter of 1989 and in the third and fourth quarters of 1990, producer price inflation tends to accelerate dramatically. Likewise, declining oil prices yield a sharp deceleration in PPI inflation (or even a negative rate of inflation, as in 1986 and the first quarter of 1991). Excluding the volatile food and energy components, producer prices of finished goods have risen at an annual rate of about 4 percent over the past few years.

Inflation measures based on the GNP accounts

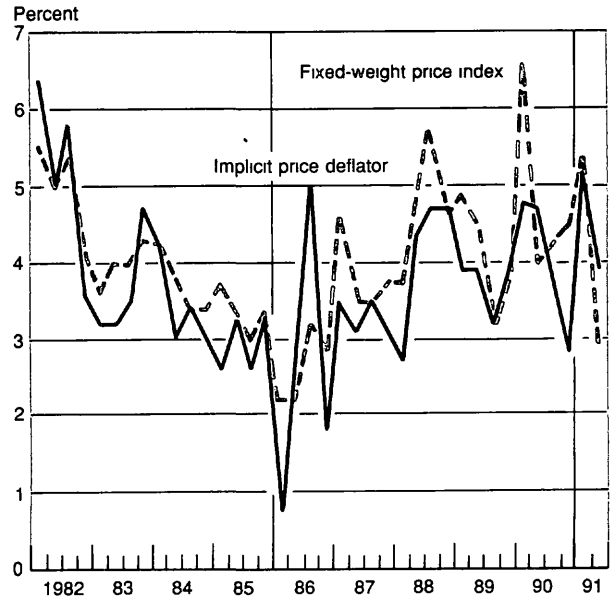
The inflation measures in the National Income and Product Accounts are byproducts of the construction of real GNP.[6] One such measure is the implicit GNP deflator, which is simply the ratio of nominal GNP to real GNP. It is basically a current period weighted average of all price indexes used to estimate the individual components of real GNP For each category, weights reflect current period final demand (as well as inventories) as a fraction of current GNP. The GNP deflator theoretically covers only domestically produced goods and services Import prices, however, are implicitly reflected in the deflators for various components of gross domestic purchases, then explicitly subtracted in calculating the overall deflator.

[6]For a more detailed description of the National Income and Product Accounts (NIPA), see Carol S Carson, "GNP An Overview of Source Data and Estimating Methods," *Survey of Current Business*, July 1987, pp 103-26, "The U S National Income and Product Accounts Revised Estimates," *Survey of Current Business*, July issues, 1988 and subsequent years, NIPA Methodology Papers nos 3,4,5, and 6, and Allan H Young, "Alternative Measures of Real GNP," *Survey of Current Business*, April 1989, pp 27-34

Chart 3

Comparison of Gross National Product Price Measures

Quarterly Percent Change at Seasonally Adjusted Annual Rates

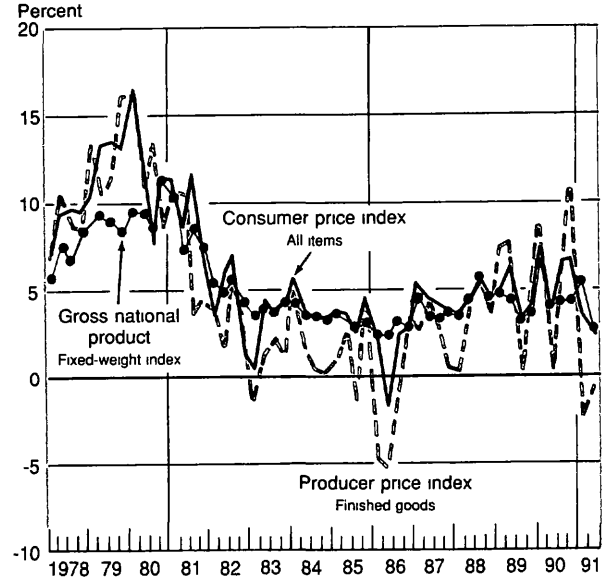


Note Second-quarter figures are based on data available as of July 26, 1991, and are subject to revision

Chart 4

Comparison of Three Major Inflation Indexes

Quarterly Percent Change at Seasonally Adjusted Annual Rates



Note Second-quarter producer price index and gross national product figures are based on data available as of August 9, 1991, and are subject to revision

Since the weights vary from quarter to quarter, changes in the implicit deflators for GNP and its components reflect not only price movements but also changes in the mix of goods and services. The more conventional fixed-weight price index for total GNP and selected components is calculated from the same set of detailed price indexes. Changes in both the fixed-weight price index and the implicit deflator can be seen in Chart 3, which illustrates the effects of different weights on the movement of the two price measures. The fixed-weight indexes are close counterparts of the CPI; the index for personal consumption expenditures covers mostly the same items as the CPI and assigns them similar weights. The currently published fixed-weight GNP price index uses weights based on the 1982 composition of goods and services. The forthcoming comprehensive revision of the accounts, scheduled for this November, will recalculate real GNP using 1987 prices.

The wide variety of individual price indexes used in estimating constant dollar GNP components includes a large number of CPI series, accounting for 82 percent of total personal consumption expenditures in 1982. Other government-published price indexes such as PPI, export and import price indexes, and price series from trade sources are also used in the process of deflating. Several special price indexes for components such as computers and defense purchases are constructed by the Bureau of Economic Analysis. The indexes for computers and peripheral equipment, originally developed by IBM, are adjusted for quality changes based on such characteristics as speed and capacity.

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Chart 4 illustrates the path of three major measures of inflation—the CPI for all items, the PPI for finished goods, and the GNP fixed-weight index—since 1978. On average, the three measures have in recent years yielded similar inflation rates, but the GNP fixed-weight index is much smoother than the others. The PPI is especially volatile because it covers only goods prices, with energy prices playing a prominent role. The CPI is somewhat less volatile since it includes service prices as well as goods prices, but it is still influenced by both energy prices and the value of the dollar.