Measuring Economic Activity and Economic Welfare:

What Are We Missing?

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Abstract

    Major U.S. economic data, most notably GDP and Industrial
Production, are undergoing major changes. Proposals have been
made for significant alterations in the CPI. The revision
process has helped to spur debate on such topics as the proper
method of accounting for high technology's role in the economy,
the reported sluggishness of productivity growth in many service
industries, and the overstatement of price increases for numerous
products. This paper attempts to assess the potential impact of
some of these problems on our understanding of basic trends in
the economy. It is found that with even fairly generous
assumptions as to the time path of errors in price data, the
fundamentals of the economy's broad movements do not change:
productivity and real earnings growth were likely still
substantially slower in the first half of the 1990s than before
1973.

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Major U.S. economic data are undergoing fundamental changes.
The construction of the two major indicators of aggregate
economic activity--Gross Domestic Product (GDP) and Industrial
Production (IP)--have been substantially revised. The best-known
forecasting gauge--the Composite Index of Leading Indicators
(CLI)--has also undergone a significant revision. Finally, as
has been well-reported, proposals have been made for significant
alterations in our major inflation index--the Consumer Price
Index (CPI).

This paper starts with a brief overview of the data
revisions. The revision process has helped to spur debate on
such topics as the proper method of accounting for high
technology's role in the economy, the reported sluggishness of
productivity growth in many service industries, and the
overstatement of price increases for numerous products. The
latter part of the paper attempts an assessment of the potential
impact of some of these problems on our understanding of basic

trends in the economy. Essentially, it is found that with even
fairly generous assumptions as to the time path of errors in
price data, our fundamental view on the economy's broad movements
does not change: productivity growth was likely still
substantially slower in the first half of the 1990s than it was
before 1973. When we narrow our definition of output to a
concept more likely to be directly tied to household welfare the
evidence is also strong that the post-1973 slowdown in real
earnings growth is continuing. A general implication of this
analysis is that the possible discovery and correction of many
sectoral biases in the inflation, output and productivity data in
many industries is more likely to pay off in the form of a
greater understanding of the sources of economic growth rather
than in finding a radically different path for the growth of
aggregate activity and economic well-being. A further
implication is that the hunt for "missing" real output in the
aggregate data could well be more fruitful if directed at
understatements of nominal output rather than overstatements of
inflation.

<u>Revisions in the Indexes</u>

Traditionally, incoming readings of the major U.S. output
series--Gross Domestic Product and Industrial Production were
produced using the fixed-base year Laspeyres technique. The
aggregate series were constructed by weighting indexes of output
in individual components by prices in some past base year. In

cases where the contemporaneous price structure was quite different than that of the base year, this procedure had the effect of giving undue importance to components whose relative prices had fallen since the base year. Note that "undue" is meant with both a positive and normative inference--according to basic economic theory, the current relative price structure should reflect the scarcity value of different products. It is fallacious to assign a relative importance to a product higher than the market does.

The positive, practical problem with the Laspeyres technique was the tendency for initial estimates of aggregate output to be revised down as base years were moved forward. The positive bias in the initial estimates arose from the natural tendency of output to rise most rapidly in sectors whose relative prices are falling. The Laspeyres technique assigned weights in the computation of aggregate growth to these rapidly-growing areas proportional to their higher relative prices in the far-off base year; when the base year was moved forward the weights on the rapidly-growing sectors fell and overall output growth was reduced.

The problems with the Laspeyres method were well-understood. They gained greater urgency, though, because of the spectacular rise in output, and fall in prices, in the computer industry. In the late 1980s, as the base years for GDP and IP computations were moved from 1982 to 1987 the reductions in aggregate growth

estimates were quite noticeable.

The obvious solution to this problem was continually moving forward the base year, and constructing the output aggregates as "linked" or "chained" indexes tied to some base year and backed out from the computed annual growth rates (this was already done on a five-year basis for IP, but the long time interval meant for an awkward transition around the base years). This change was made in 1995-97 for both GDP and IP; in the course of the transition the decision was also made to drop the Laspeyrses technique for computing aggregate growth in favor of the Fisher Ideal method.[1] The Fisher Ideal method combines (using the geometric average) aggregate growth computed by the Laspeyres technique with that computed by the Paasche procedure (which involves assigning current prices to sectors to calculated aggregate growth). Research has established the theoretical attractiveness of this long-proposed method of computing aggregate output and price indexes (Diewert, 1976, 1983a, 1983b, 1987).

The revisions of the aggregates brought into sharp focus the apparent failure of trend output and productivity to improve in the 1990s, despite the extraordinary growth in spending on high-

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[1] For overviews of the switch in GDP, see Young, 1989; Triplett, 1992; Motley, 1992; Landefeld, 1995;, Landefeld and Parker, 1995; and Steindel, 1995; for the IP change see Corrado, Gilbert, and Raddock, 1997.

technology items.[2] Debate began to focus on potential problems

with price indexes. If inflation is overstated, real output and

productivity growth are being understated. In support of the

argument that there may be significant problems with the price

data in the service sector, in particular, has been the

observation that the published productivity data for much of the

service sector of the economy continues to be very

disappointing.[3] Observation has also been made of the rather

limited coverage the existing industrial classification system

gives to the service sector--in the sense that there are fewer

classifications at a disaggregated level--of rapidly growing

tertiary services in such areas as health care, finance, and

business services. There appears to be a presumption that

improvements in the data collection system might result in upward

revisions of real growth for the service sector and overall GDP,

perhaps because of improvements in the construction of price

indexes (Baily and Gordon, 1988).

The growing importance of the service sector to the economy-

-or, at least, the relative decline in importance of goods

[2] See Business Week, 1995; Farrell, 1995; and Spiers, 1995, for criticisms of the revisions. McNamee, 1997, discusses the continuing puzzle of low productivity growth.

[3] Slifman and Corrado (1996) note the oddly slow growth of the noncorporate sector of the economy. While there are many services in this sector it is by no means synonymous with services as a whole, nor is it clear that all the data problems are on the price side.

production--has been underscored by changes in the Composite

Index of Leading Indicators (CLI). In the recent revision of the

index, long-standing components that were presumably most closely

related to the manufacturing sector--commodity prices and

unfilled orders for manufactured goods--were dropped (Conference

Board, 1996). One of the new components placed in the index was

the spread between the yield on the 10-year Treasury Bond and the

Federal funds rate, in line with recent studies suggesting its

value as a generalized forecasting variable (Estrella and

Mishkin, 1996). An alternative, non-exclusive view, is that this

variable may also foretell expansion in the very large financial

sector of the economy. Of course, these changes in the index

were prompted by the statistical need to maintain a good

forecasting tool, rather than by a priori notions about tying

individual components to individual sectors. Still, it is

reasonable to think there should be some rough correspondence

between the composition of such an index and that of the economy.

What are We Missing?

There is then a fairly widespread impression that the

published data could be missing significant movements in the

economy--possibly because of underestimation of the effect of

high technology in the service sector (Business Week, 1995;

Farrell, 1995; Spiers, 1995; and Quinn and Baily, 1994; discuss

the impact of high technology on the service sector; Baily and

Gordon, 1988; and Gordon, 1995, discuss low reported service

sector growth). At one extreme, it has been argued that
aggregate productivity growth might be as high or higher today
than in the 1950s and 1960s (Nakamura, 1997). This section
attempts to quantify the amount that aggregate real growth may be
higher than we observe due to understatements of service sector
activity resulting from overstatements of service sector
inflation, examining a number of sets of data: real GDP, real
productivity growth, and a measure of average real earnings
growth.

Although discussions of understatements of overall growth
often focus upon the oddly low productivity growth rates in many
service industries, it is unreasonable to estimate
understatements of aggregate real growth by simply adding-up
understatements of productivity growth and sectoral output, at
least in any simple fashion (Baily and Gordon, 1988; and Gordon,
1995). The problem is that in the U.S. data, industry output is
measured as value-added, not sales. If an industry's output
growth is understated, it is possible that the output growth of
some supplier or customer industry is overstated; getting a fix
on the understatement in aggregate output would then involve
working through industry linkages in an input-output framework.

A much simpler way to compute possible output growth
understatement is to use estimates of individual price
overstatements to adjust the real expenditure data. In the
exercises below, this procedure will be followed. The working

assumption is that the price overstatement issue is of particular

importance in services. This is not to deny that there may well

be overstatements in the prices of goods or structures--indeed,

in the Boskin commission report (Boskin, et al, 1996), most of

the hard data in support of inflation overstatement came from

studies of goods prices. However, there is little reason to

believe that problems with the overstatement of goods price

inflation have increased as time has passed, while the dramatic

changes in the nature of many services gives us some reason to

think that biases may have grown over time.[4]

Table 1 gives the basics on the composition of aggregate

spending. A bit over half of GDP consists of spending on

services. About 20% of the spending on services consists of

government compensation of employees plus depreciation of

government capital, and more than 10% consists of the imputed

services provided by the housing stock. Thus, only two-thirds of

total spending on services--about one-third of GDP, but a higher

share of nonfarm business output--consists of actual purchases of

services from the private sector. Another significant portion of

services consists of those whose prices are probably measured

fairly well, or, at least probably no worse than in the past--

items such as utilities and transportation. This leaves only

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[4] The issue fundamentally involves adjusting posted price
increases for quality improvements. Hulten, 1997; and Moulten
and Moses, 1997; discuss the theory and practice of quality
adjustments in the CPI.

about 40% of spending on services--about 20% of GDP--in
categories where there are significant questions about pricing--
areas such as financial and business services, medical care, and
educational and charitable expenses. (Griliches, 1994, notes the
rising importance of "hard-to-measure" products, though his list
is somewhat larger than the one used here.) Note that spending
on these services enters directly into GDP when it is made by
households or governments or is a part of foreign trade.

Assuming that the national accounts correctly measure
current-dollar spending in these service categories, we can
readily compute the effect on real growth of alternative, reduced
estimates of inflation in these hard to measure sectors. Table 2
presents such estimates. They are made under two assumptions: 1.
Inflation in these sectors is uniformly overestimated by 2
percentage points a year. 2. Inflation in these sectors is
reduced to equal that in the rest of the economy. Alternative
measures are presented of overall GDP growth and nonfarm business
productivity growth. The periods to which these alternatives
apply is 1. 1960 and thereafter. 2. 1974 and thereafter. 3.
1983 and thereafter. 4. 1992 and thereafter.

In general, reducing the rate of inflation in the rapidly-
growing "hard-to-measure" service categories does raise recent
growth rates. GDP growth over the last generation would have
averaged .3 percentage point higher, and nonfarm business
productivity growth about .4 percentage point higher, if the

inflation numbers in these categories had been lower along the lines of the alternatives.[5] However, the more interesting implication is what these adjustments would have meant to the long-term dynamics of the economy. The answer is, not too much: comparing the growth rates shown for the later periods in the alternative lines with the published numbers for the period before 1973 indicates that real GDP growth and real productivity growth would still have been significantly lower in recent years than in the 1960-1973 period **even if the overstatement to inflation in these categories is assumed to have started in recent years** (if the inflation overstatement began earlier the conclusion is even more valid). One cannot meaningfully assume that reduced measured aggregate output and productivity growth is an artifact of problems in pricing certain types of services unless one believes that the problems are very large indeed relative to those of the past (There could, of course, be large persistent overstatements of price changes throughout the economy, but the point at issue here is whether the comparison of growth today with the past changes much if the inflation overstatements in certain sectors have grown over time).

Another set of issues involving misstatement of prices

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[5] The productivity adjustment is almost surely exaggerated, since it was made assuming that *all* outlays in the hard-measure-categories were produced in the nonfarm business sector. Many medical, educational, and religious and welfare services are produced directly in the nonprofit sector of the economy.

involves the growth of real income. How much of the reported

post-1973 decline in growth of average real income may be due to

problems in deflating nominal income? The answer to this

question involves recomputing the growth of the cost of living.

A natural way to do this is to apply the above alternatives to

the consumer portion of hard-to-price services and recompute the

growth of the chain-weight deflator for personal consumption.

This procedure was done, with the partial modifications that 1.

spending on personal business services was removed from

consumption, on the grounds that these expenditures do not

directly add to household well-being; and 2. spending on consumer

durables--which is a form of asset accumulation--was removed from

consumption and replaced by estimates of the gross imputed rent

from the existing stock of durables (here measured as

depreciation[6] plus a 3 percent additional rate of return).

Table 3 presents alternative estimates of the growth of

average real income, with nominal income being compensation per

full time equivalent worker in private nonfarm business. As was

the case for real output and productivity, alternative estimates

are presented on the basis of inflation for "hard-to-measure"

services being equal to that for the rest of consumption, and 2

percentage points lower than published, for various time periods

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[6]Current-dollar data on the depreciation of durables are
available in the flow-of-funds tables. It was assumed that the
deflator for depreciation was the same as that for the stock of
durables.

since 1960. The top lines of the two parts of the table present the real income growth data for the conventional measure of consumer inflation and that for the restated measure, which removes spending on personal business activity and restates durables.

The results of this exercise are much the same as those for GDP and productivity: reducing inflation rates in selected service categories does markedly raise estimates of real income growth over the last few years--from roughly .5% to 1% or more over the last decade. However, **at best**, all we can conclude is that if either of these alternatives are correct--and only correct for recent years, not for the whole period since 1960-- real income per employee is now growing about half as fast as it was in the 1960s. While this is more favorable than the more conventional calculations that real income per worker is growing much less that half as fast as in the pre-1973 era, it hardly changes the observation that real income growth remains well below its earlier standards.

Conclusion

These exercises suggest that one is unlikely to explain away continued historically slow growth of output, productivity, and real incomes through faulty pricing of various hard-to-price services,[7] unless the pricing problems have widened to such a

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[7] Sichel, 1997a and 1997b, reaches a similar conclusion.

magnitude that there has been, in reality, outright deflation for a wide variety of products in these and other categories.

One implication of these exercises is that the payoff from reengineering the statistical system toward services, with emphasis on improved pricing, may not involve a radically different picture for aggregate growth, unless we think that recent growth of nominal output will be raised, along with reductions in published inflation. One way a redesign of the statistical system may produce higher nominal output growth is a through a redefinition of capital to include more intangible items, such as software and some measure of accumulated R&D knowledge. Even this change, though, will not necessarily increase recent growth relative to the distant past (conceivably, the "stock" of, and the output generated by, R&D capital grew even more rapidly in the 1960s than today).

The real payoff from an improved statistical system could well be a greater understanding of the industrial sources of U.S. growth. Such an improvement could well guide policymaking and possibly improve longer-term forecasting. It seems much less likely that we would see a major revamping of the stylized facts suggested by the existing data.

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Table 2

Alternative Estimates of GDP and Productivity Growth

	1960-1996	1960-1973	1974-1996	1983-1996	1992-1996
GDP Growth					
Published	3.2	4.2	2.5	3.0	2.7
Alternative 1:[8]	3.4	4.3	2.8	3.3	2.8
Alternative 2:[9]	3.4	4.4	2.8	3.2	2.9
Productivity Growth					
Published	1.7	2.9	1.0	1.2	1.0
Alternative 1:[1]	2.1	3.1	1.4	1.6	1.2
Alternative 2:[2]	2.1	3.2	1.4	1.5	1.3

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[8] Prices of hard-to-price services grow at same rate as other products.

[9] Prices of hard-to-price services grow at 2 percent less than published.

Table 3

Alternative Estimates of Real Income Growth

	1960-1996	1960-1973	1974-1996	1983-1996	1992-1996
Published	1.1	2.5	.5	.3	.4
Restated	1.3	2.5	.5	.5	.4
Alternative 1	1.6	2.7	.9	.9	.9
Alternative 2	1.6	2.6	.9	.9	.9

Published: Growth of compensation per full-time equivalent employee, divided by personal consumption deflator.

Restated: Deflator restated to eliminate personal business expenditures and durables spending replaced by estimate of service flow.

Alternative 1: Prices of medical, educational, and religious and welfare spending assumed to grow at same pace as other items.

Alternative 2: Prices of medical, educational, and religious and welfare spending assumed to grow 2 percent a year less than published.

Table 1

1996 Composition of GDP

	Billions of Dollars	Percent
Total	**7636.0**	**100.0**
Goods	**2785.2**	**36.5**
Structures	**663.6**	**8.7**
Services	**4187.3**	**54.8**
Government Employee Compensation	759.9	10.0
Government Depreciation	125.1	1.6
Space Rent	564.4	7.4
Other	2737.9	35.9
Hard-to-Measure Components	**1774.9**	**23.2**
Consumer	1499.0	19.6
Medical Care	808.1	10.6
Personal Business	421.1	5.5
Educational	119.6	1.6
Religious and Welfare	150.5	2.0
Government	179.0	2.3
Net Exports	96.6	1.3
All Other Services	963.0	12.6