

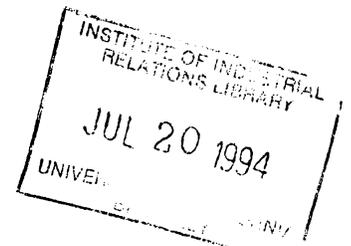
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STATISTICAL METHODOLOGY MAY BE DISTORTING  
KEY ECONOMIC RELATIONSHIPS:  
ANALYSIS OF THE WAGE-PRODUCTIVITY LINKAGE  
AND THE JOBLESS RECOVERY

by

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LOS ANGELES

**Statistical Methodology May Be Distorting  
Key Economic Relationships:  
Analysis of the Wage-Productivity Linkage  
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During recent years, increasing attention has been paid to labor-market issues such as increased income inequality, slippage in job opportunities for individuals without college educations, increased use of contingent workers, and general real wage stagnation. The last topic, for example, is noted in the recent "Dunlop Commission" report, and is the initial subject of this paper.<sup>1</sup> But another background theme is the reliability (or possible lack thereof) of the official data used to chart such trends.

Labor-market analysts will recall, for example, the unfortunate episode in which, in the midst of the 1990-91 recession, the widely-watched series on payroll employment from the establishment survey took a remarkable dive. The Bureau of Labor Statistics (BLS) first confirmed that the dive was real, not a fluke, although no clear explanation could be offered for the sudden drop. A few months later, BLS reported that the drop was a methodological aberration, i.e., that it was not real.<sup>2</sup> In states such as California, where the dive was particularly marked, the fact that other data - such as taxable sales - also dived at the same time, however, have left lingering doubt about the explanations offered. Similarly, on-again, off-again discrepancies between the household and payroll employment series in California have made it harder to analyze the state's depressed economic situation. Nationally, a well-intentioned, but poorly implemented, shift in the underlying data collection methods of the household survey (Current Population Survey) in 1994, have made interpretation of the unemployment rate more difficult.<sup>3</sup> Given such episodes of dubious administration of economic statistics, it is necessary for analysts to be cautious about passing judgment on seeming changes in major economic relationships.

In this paper, therefore, we note what appears to be a structural break in the relation between real wage trends - of the type which concerned the Dunlop Commission - and productivity trends may be - at least in part - a statistical peculiarity. However, the break raises larger concerns about the interpretation of recent national output, productivity, and real wage trends, all key variables in economic forecasting. As an example, the very existence of the so-called "jobless recovery" in the early 1990s can be called into question by reasonable data adjustments. The recovery may have been less vigorous than officially depicted. If so, the lack of job creation would not be especially remarkable.

## **I. Productivity and Real Wages**

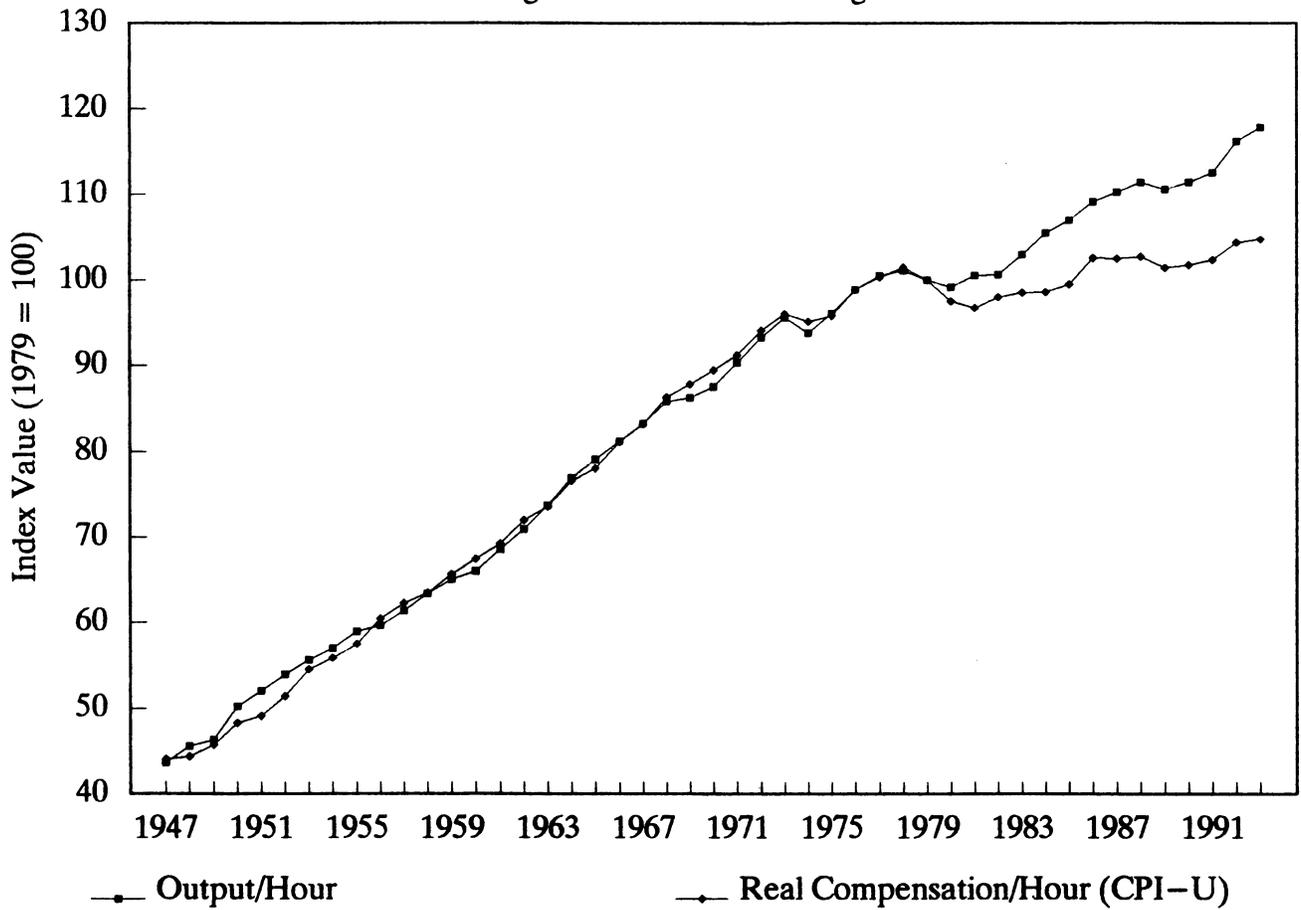
It is almost a truism in economics that real wages are determined by productivity and that the two indexes should move together over long periods. The slippage in growth of the former after 1973 is often linked to the latter, as in the 1994 Economic Report of the President.<sup>4</sup> Figure 1 shows that both productivity growth (output/labor hour) and real wage growth (deflated total compensation per hour, including employee benefits and payroll taxes) in the business sector slowed together after 1973. But in the 1980s and early 1990s, the two series - as officially measured - stopped moving in tandem. Productivity appeared to grow faster than real wages.

In fact, although the productivity-real wage linkage may seem based on

Figure 1

# Productivity and Real Wage Trends

Using CPI-U to Deflate Wage Index



rwcpiv.cgm  
realwage.wk3

some sort of Puritan work ethic, it is actually founded on assumptions about unchanged distribution across labor and non-labor income. Specifically, if "labor's share", the percent of income or product going to labor, is constant in the long run, there will be a corresponding long-term equivalence of growth in real wages and productivity. But, this equivalence assumes consistent data are used to measure both real wages and productivity.<sup>5</sup> To understand this identity, let  $s = \text{labor's share} = WH/PQ$ , where  $W$  is the hourly wage,  $H$  is the number of labor hours,  $P$  is a price index for output, and  $Q$  is the quantity of output.

$WH$  is the total amount of labor compensation and  $PQ$  is the value of income or product. A simple rearrangement of the terms produces the identity  $W/P = s(Q/H)$ .  $W/P$  is a measure of the real wage and  $Q/H$  is productivity (output/hour). So if  $s$  is constant,  $W/P$  must grow in line with  $Q/H$ , i.e., real wages will rise with productivity. Therefore, it would appear from Figure 1 that labor's share must have fallen after 1979 since real wages rose more slowly than productivity in that period.<sup>6</sup>

Figure 2 provides a plot of labor's share in the business sector (the same sector covered in Figure 1). Clearly, labor's share is not a constant. On the other hand, note that most of the observations fall within the narrow range of 52-54%. There is a cyclical motion of labor's share, usually viewed as the result of some sluggishness in layoffs in recessions (labor hoarding) and the fact that profit is a residual (revenue - costs). Profits may be squeezed as booms peter out and become recessions. They may also be squeezed in periods of marked labor shortages (such as the late 1960s).

Apart from the cyclical effects, however, there does not seem to be a dramatic drop in labor's share from the late 1970s to the late 1980s or to 1993 (the latest year available). In 1978, the year before the late 1970s boom ended, the share was 53.1%. In 1989, an equivalent year for the late 1980s boom, the share was 52.6%. And in 1993, it was 52.5%.

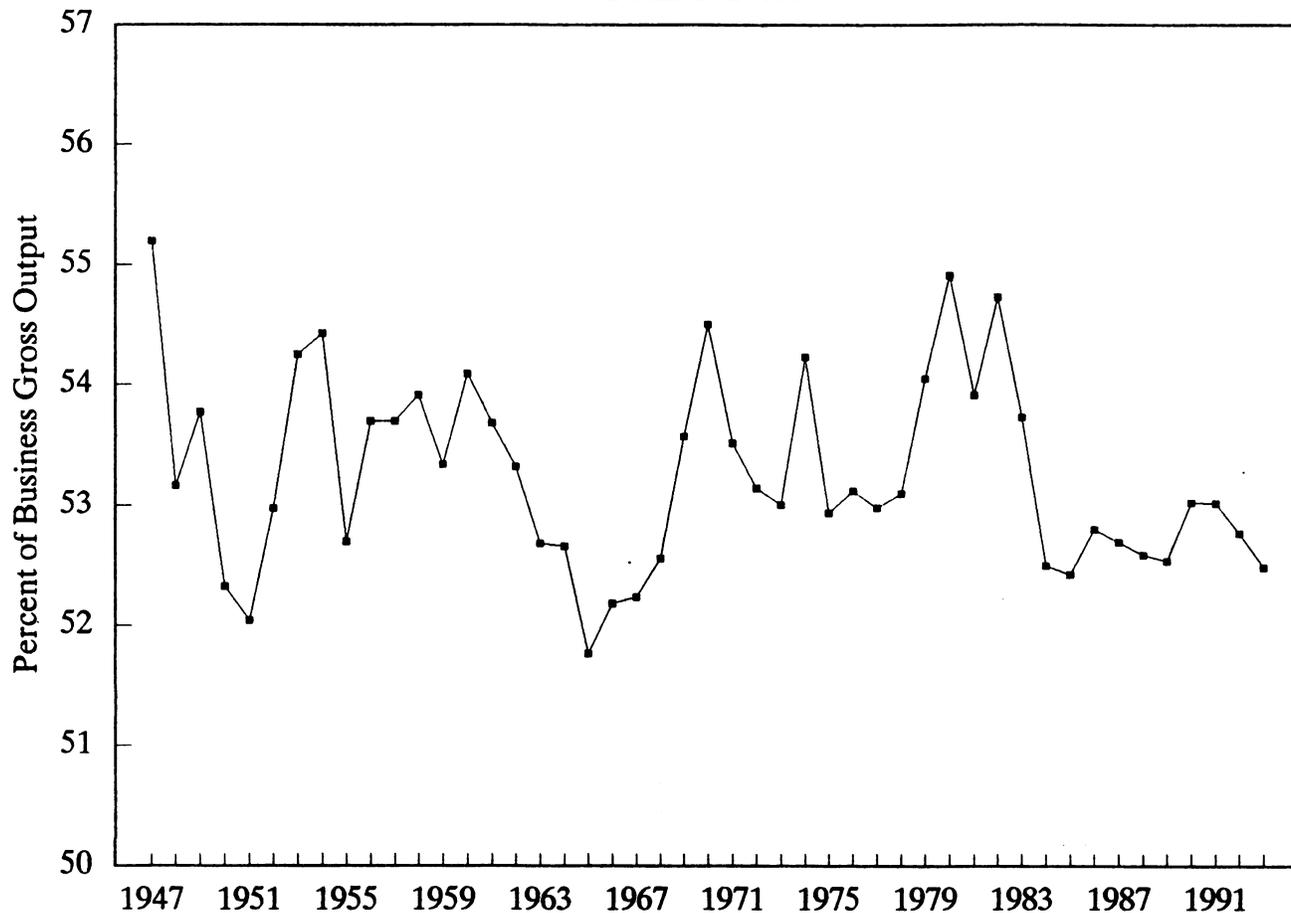
On their faces, therefore, Figures 1 and 2 appear to be in contradiction. However, the root cause of the seeming conflict is that the price index used to determine "real wages" in the official data is the Consumer Price Index for All Urban Consumers (CPI-U) whereas the price deflator for business output - the output measure used in the productivity index - is the implicit price deflator for business output. In economists' terminology, there is a discrepancy between the "product wage" (the wage deflated by the price of what labor produces) and the real wage (the wage deflated by the price of what labor consumes). The share analysis above used the same  $P$  for both production and consumption. But if there is a divergence between output and consumption prices, the linkage between real wages and productivity can fall apart. That is what happened after 1979.

Figures 3, 4, and 5 and Table 1 present recalculations of the real wage trend using three alternatives to CPI-U. Figure 3 uses the implicit deflator for personal consumption from the national income accounts. Figure 4 uses the fixed-weight (1987) personal consumption deflator. Finally, Figure 5 uses CPI-U-X1, a revision of CPI-U designed to correct a past methodological flaw in the computation of the housing component. The flawed methodology is no

Figure 2

# Labor's Share: Compensation/Value of Output

Business Sector

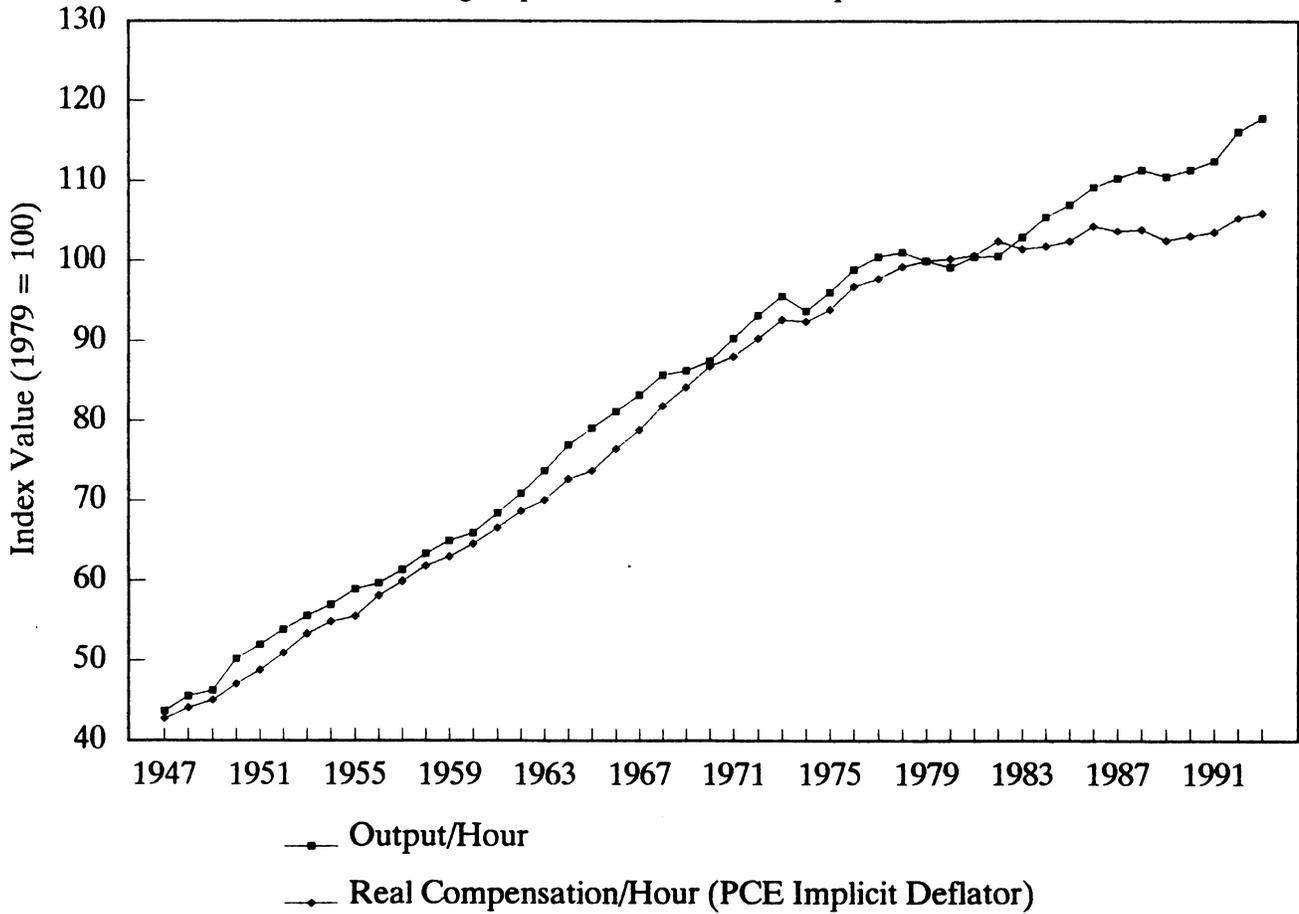


labrsh.cgm  
realwage.wk3

Figure 3

# Productivity and Real Wage Trends

Using Implicit Personal Consumption Deflator

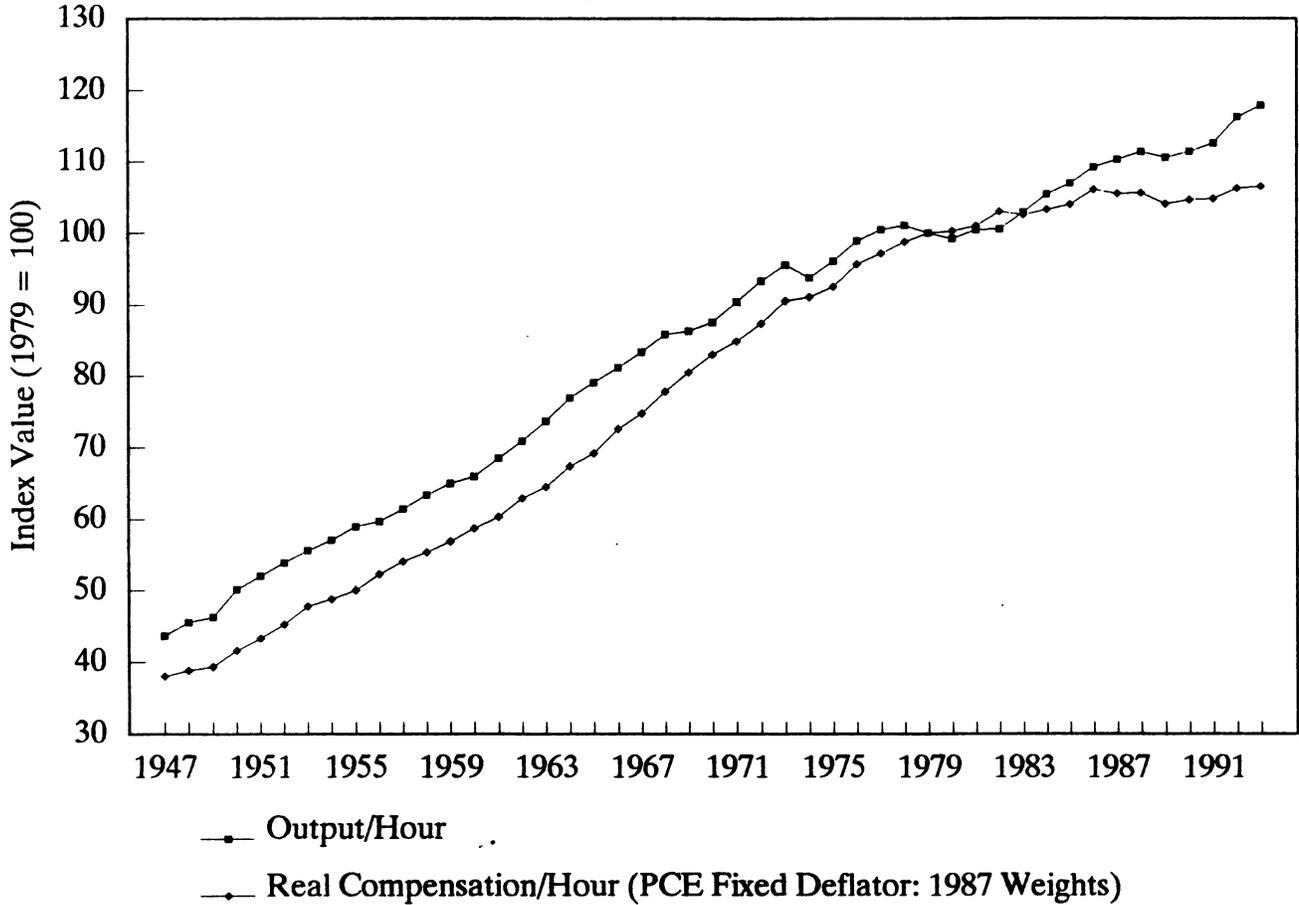


rwpceim.cgm  
realwage.wk3

Figure 4

# Productivity and Real Wage Trends

Using Fixed Weight Personal Consumption Deflator

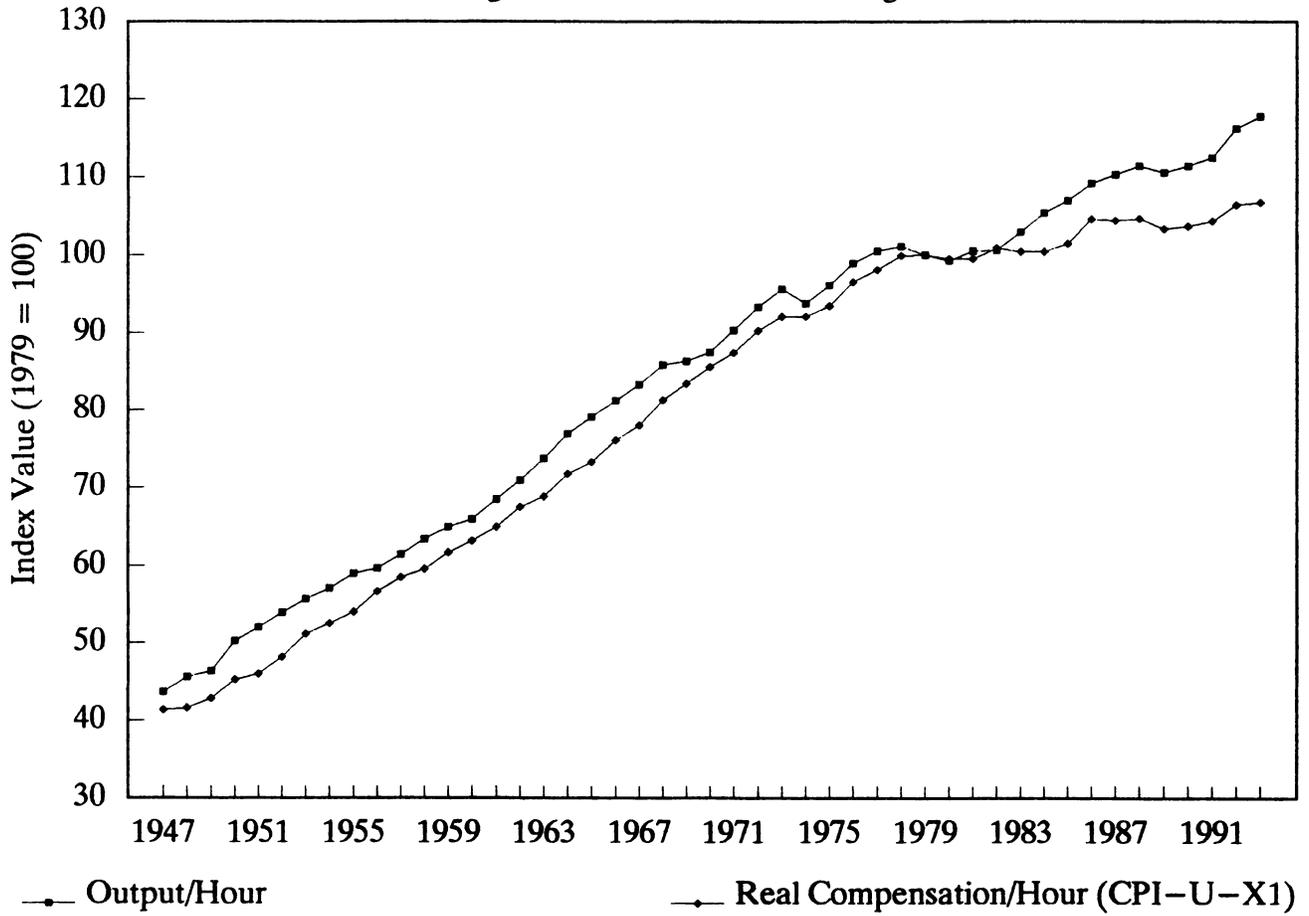


rwpce87.cgm  
realwage.wk3

Figure 5

# Productivity and Real Wage Trends

Using CPI-U-X1 to Deflate Wage Index



rwcpixl.cgm  
realwage.wk3

Table 1

**Trends in Officially-Measured Output/Hour  
and Alternative Real Compensation/Hour Indexes**

(Annualized Percentage Rates of Change)

	1947- 1973- 1973 1993	1947- 1979- 1979 1993	1973- 1979- 1990- 1979 1990 1993
Output/ Hour (official)	3.1 1.1	2.6 1.1	.8 1.0 1.9
-----			
Real Wage:			
Official (CPI-U)	3.0 .4	2.6 .3	.7 .2 1.0
Based on:			
PCE-Implicit	2.9 1.0	2.7 .4	1.1 .8 1.6
PCE-Fixed	3.4 .8	3.1 .5	1.7 .4 .6
CPI-U-X1	3.1 .7	2.8 .4	1.4 .3 1.0
Business- Implicit	2.9 1.0	2.6 1.0	1.1 .8 1.6
-----			
Price Index:			
CPI-U	2.7 6.1	3.8 5.0	8.5 5.5 3.4
PCE-Implicit	2.7 5.8	3.7 4.9	7.9 5.4 3.4
PCE-Fixed	2.3 5.7	3.3 4.9	7.5 5.2 3.8
CPI-U-X1	2.6 5.8	3.5 4.9	7.8 5.3 3.4
Business- Implicit	2.8 5.5	3.8 4.4	8.1 4.8 2.8

Note: CPI-U = Consumer Price Index for All Urban Consumers  
PCE-Implicit = Implicit Deflator for Personal Consumption Expenditures  
PCE-Fixed = Fixed Weight Deflator for Personal Consumption Expenditures (1987)  
CPI-U-X1 = Consumer Price Index adjusted to current methodology for CPI-U  
Business Implicit = Implicit Deflator for business output  
Real Wage = Deflated compensation per hour

longer in place in CPI-U, but it was used to compute the index until the early 1980s. This flaw, which involved treatment of mortgage interest rates, tended to exaggerate inflation in the late 1970s. In effect, CPI-U-X1 is designed to duplicate what the current methodology for CPI-U would have produced over the entire period.<sup>7</sup>

All of the alternatives to CPI-U paint a broadly similar picture and still suggest there was a structural break after 1979. In all cases, real wages grew at or above the growth rate in productivity as officially measured before 1979 and slower than productivity thereafter. Mechanically, this is because the alternative price indexes rose more rapidly after 1979 than the implicit deflator for business output. This tendency is depicted on Figures 6 and 7, utilizing the implicit personal consumption deflator. (Figure 7 also includes the GDP implicit deflator for comparison.) The divergence probably results mainly from the adjustment for quality in the price indexes for the computer output component.

Real output of computers in the national income accounts is calculated by deflating the nominal value of output by a hedonic price index which takes account of the large gains in memory, speed, and other desirable attributes associated with advancing computer technology. These gains produce such remarkable price drops in the computer sector that estimate of real GDP was notably boosted when the new price index was introduced. Indeed, the Commerce Department does not normally publish the fixed weight GDP deflator before 1982 because, using 1987 weights, it reports falling prices for the overall economy (not just computers) over 1959-87!<sup>8</sup> The same non-publication policy applies to price indexes for investment, exports, and imports. Implicit deflators for these sectors are published but they are affected disproportionately by computer pricing methodology nonetheless. This issue arises for the implicit business deflator since it differs from the GDP deflator mainly due to the inclusion of government wages in the latter.

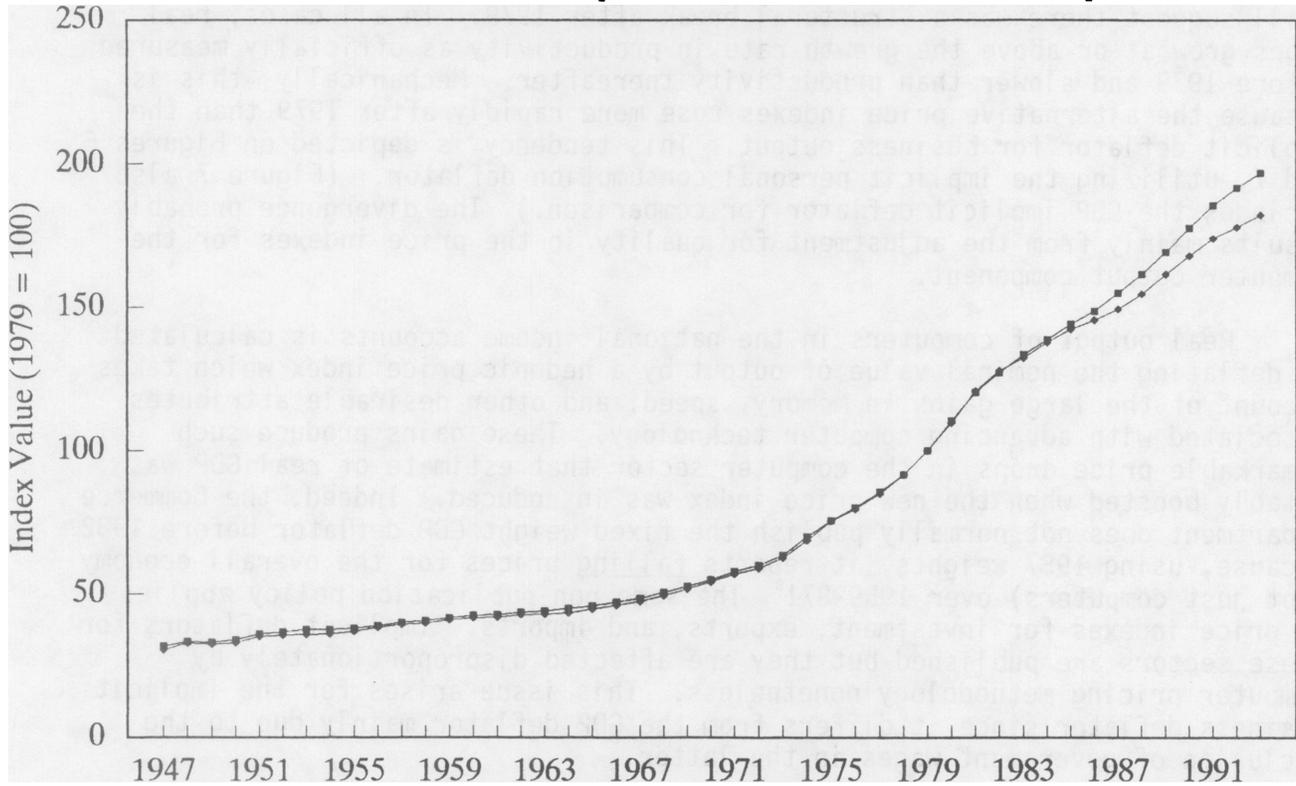
In 1987, the year of the most recent benchmark input-output table and the current base year for the national income accounts, a total of \$56 billion of computer and office equipment (including \$17 billion of imports) was sold for final demand purposes. Of this total, 59% went to gross private fixed investment (about 5% of all such investment) but only about 6% went into personal consumption (about 0.1% of such consumption).<sup>9</sup> Hence, the computer quality adjustment influence is relatively slight in price deflators for personal consumption. The weight of "information processing equipment" in CPI-U during its base period for weighting purposes (1982-84) was only 0.2%.<sup>10</sup> Thus, computer pricing trends affected the implicit business deflator but had negligible effects on CPI-U and CPI-U-X1.<sup>11</sup>

Figure 8 illustrates the impact of substituting the implicit business deflator (which includes the computer pricing effect) for the other price indexes in calculating real wages. In effect, the real wage index becomes a product wage which is entirely consistent with the productivity measure. With that substitution, real wages and productivity do move together. As Table 1 shows, output/hour and the product wage both rose at 2.6%/year during 1947-79; during 1979-93 the former rose at 1.1%/year and the latter at 1.0%.

Figure 6

# Alternative Price Indexes

Business Deflator vs. Implicit Deflator for Personal Consumption



—■— Business Implicit Deflator

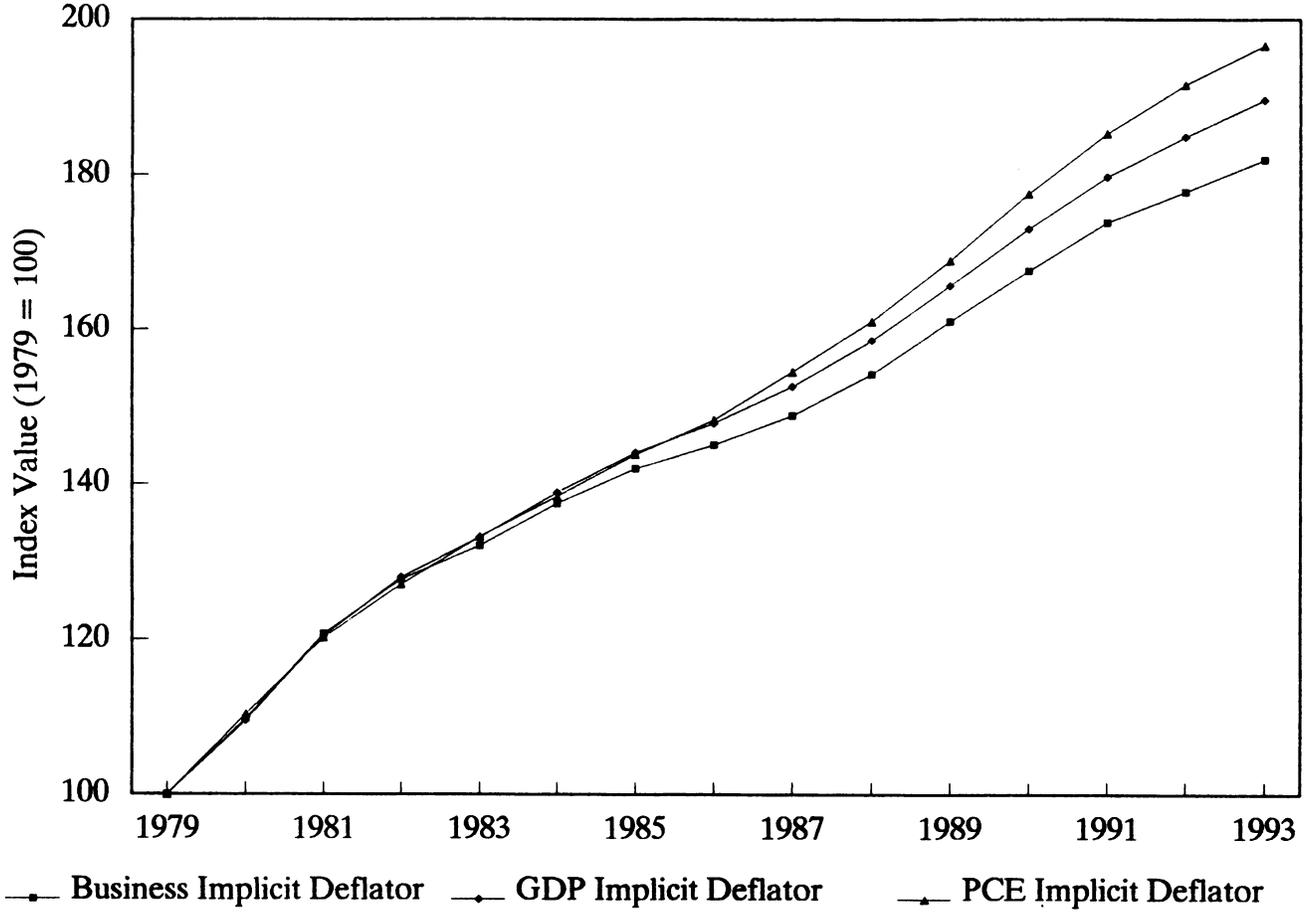
—◆— Implicit Deflator for Personal Consumption

altpl.cgm  
realwage.wk3

Figure 7

# Alternative Price Indexes

1979 = 100

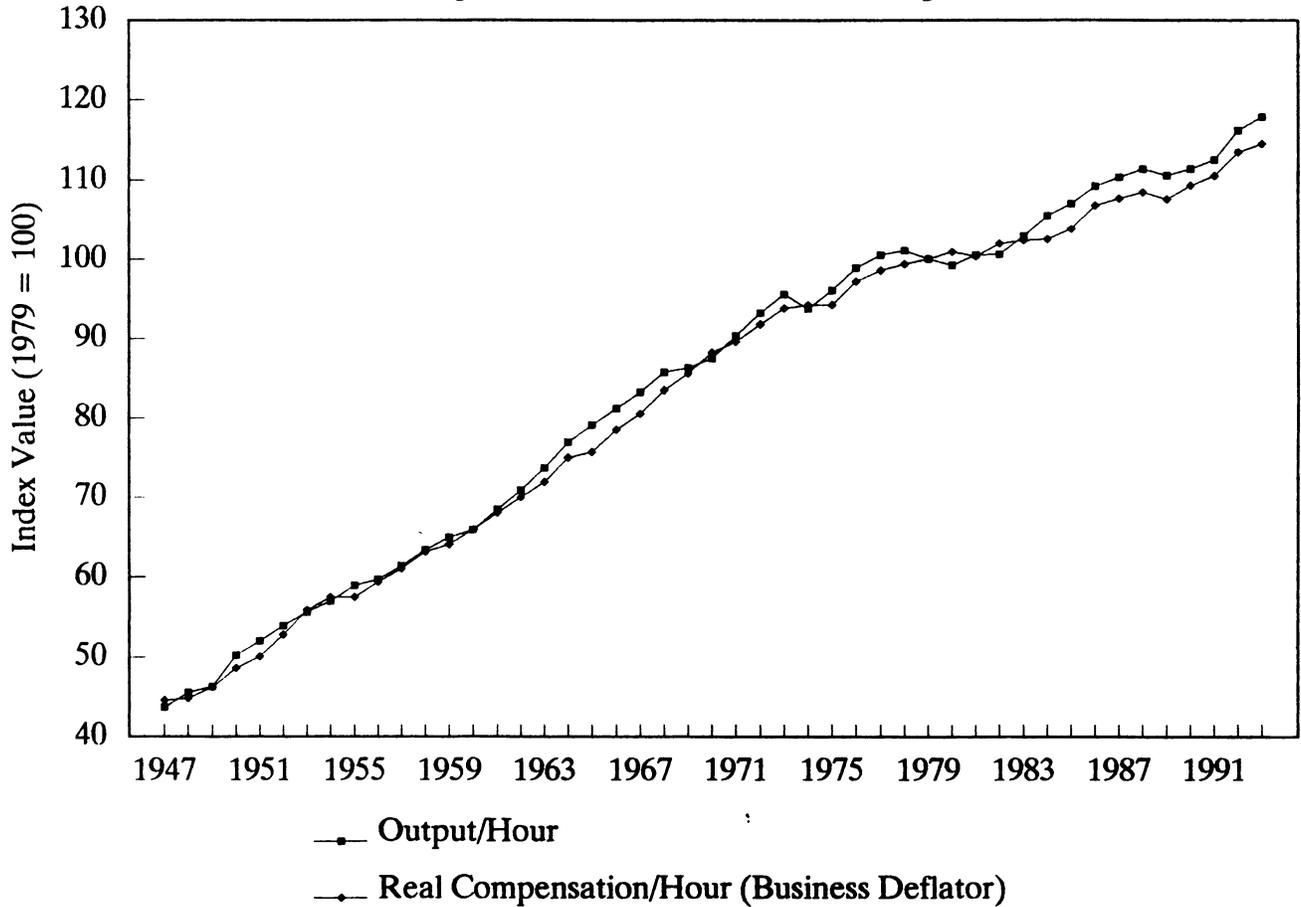


deflator. cgm  
real wage. wt3

Figure 8

## Productivity and Real Wage Trends

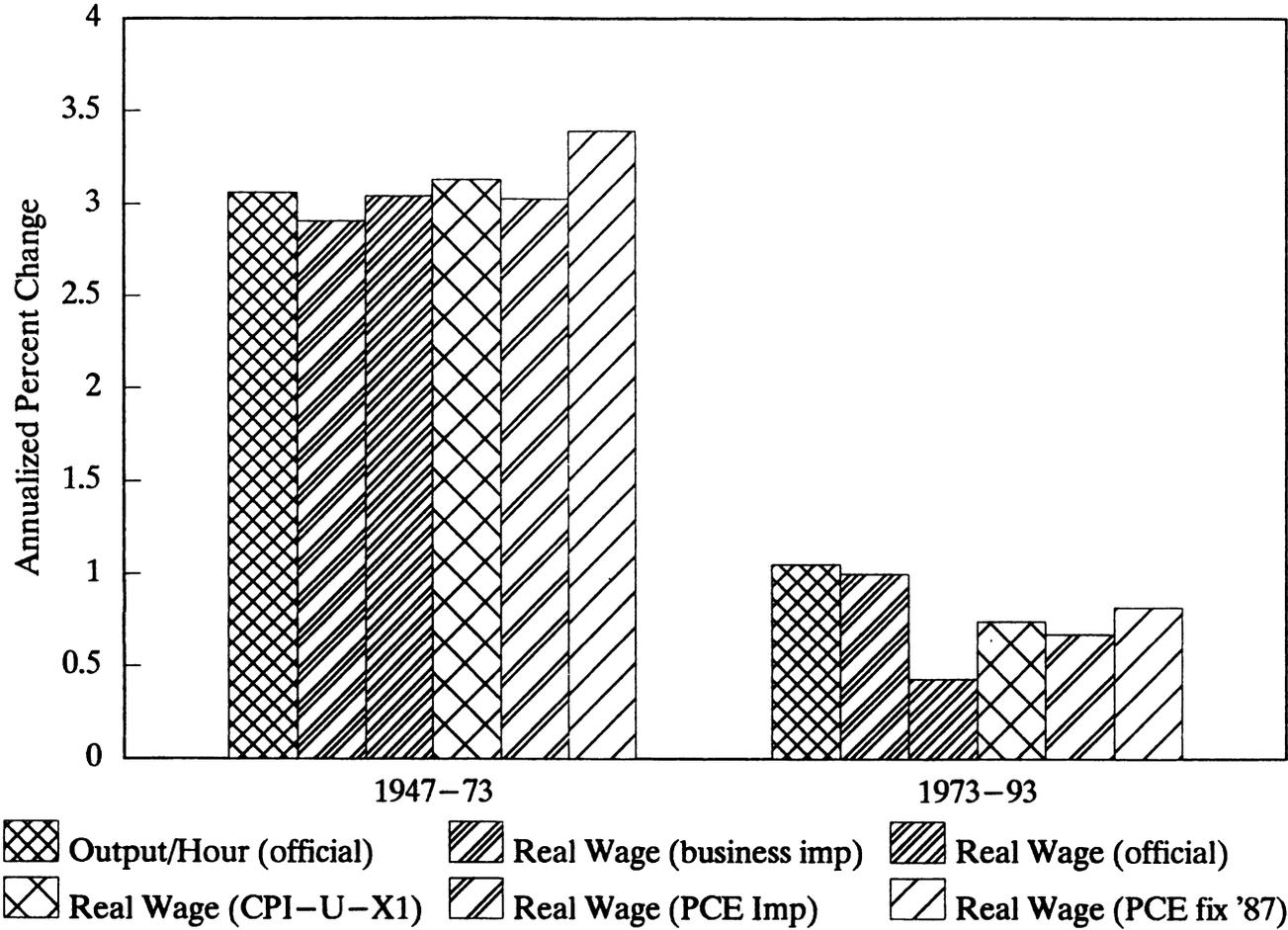
Using Business Deflator to Deflate Wage Index



rwbsdefl.cgm  
realwage.wk3

Figure 10

Output Per Hour and Alternative Real Wage Indexes  
Business Sector

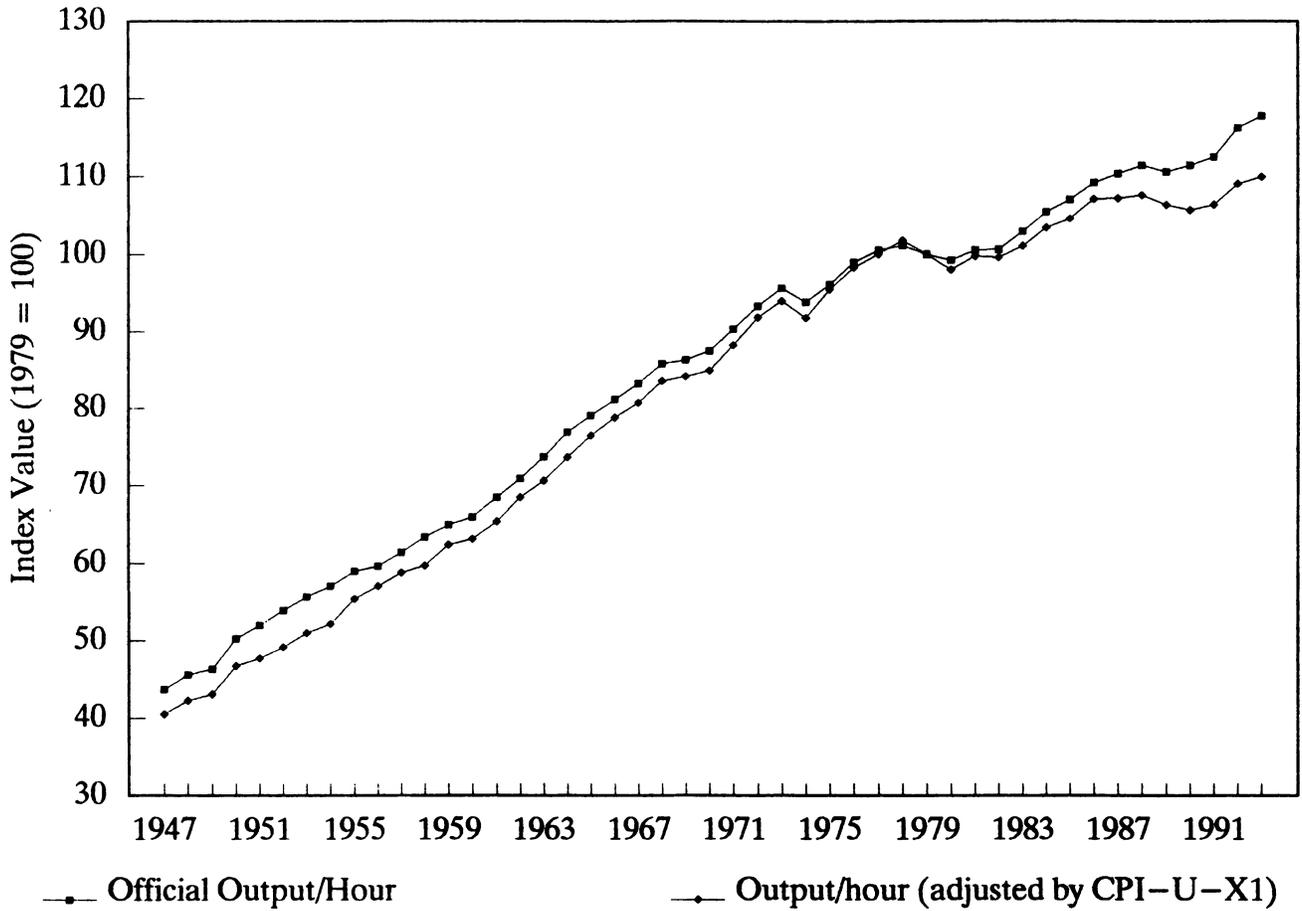


altreal2.cgm  
realwage.wk3

Figure 11

# Alternative Productivity Indexes

Business Sector



alt prod 2. eqm  
real wage. wk3

counterpart before 1979 and slower than the official index thereafter. Similar results are found on Figure 12 which uses the implicit deflator for personal consumption expenditures to create an alternative productivity measure.

A change in the deflator can produce a different history of subperiod productivity trends. As can be seen on Table 2 and Figure 13, productivity slowed markedly after 1973 by either measure, official or CPI-U-X1 deflated. But the official measure stages a modest comeback during the 1980s while the alternative slows even more. Both measures show acceleration in the early 1990s but the official index rises at a notably higher rate than the alternative. Indeed, the rate of growth of the alternative index during 1990-93 is only marginally higher than the rate which characterized 1973-79.

Again, an important factor in the difference between the two measures is computer pricing estimates which must be regarded as subject to challenge. As shown elsewhere, the acceleration in productivity based on official business output data is not mirrored in data based on detailed industry output statistics.<sup>14</sup>

Figure 14 depicts the two productivity measures (official and CPI-U-X1 deflated) during 1977-93. Both show the procyclical effects of the recessions of the early 1980s and early 1990s. However, the recovery in the early 1990s was popularly termed the "jobless recovery" because labor input did not rise as expected despite increased output. Indeed, Table 2 and Figure 15 show that labor hours actually fell from cyclical peak 1990 to 1993. Put another way, the recovery was dubbed "jobless" because productivity rose so seemingly fast that fewer hours were needed.

The official productivity index peaks in 1978 before the cyclical downturn and again in 1988. On Figure 16, a peak-to-peak trend line is added to the graph of Figure 14 for official productivity. As can be seen, productivity in 1992-93 rises above the trend line, an indication of a jobless recovery (less labor input than the old trend would have suggested). But when the same technique is applied to the alternative productivity index deflated by CPI-U-X1, no such above-trend results are apparent; 1992 and 1993 are, in fact, below the trend line. If labor hours creation was not occurring, the alternative suggests, it was because there wasn't an especially robust surge in output. Moreover, the result is not unique to use of CPI-U-X1 as a deflator in estimating productivity; as Figure 17 shows, the same results obtain when the implicit deflator for personal consumption expenditures is used instead.

Ultimately, what appeared at first as a real wage vs. productivity puzzle has implications for output and the general perception of economic growth. Figure 18 compare official real business output with business output estimated using CPI-U-X1 as a deflator. The alternative shows somewhat faster growth before 1979 than the official index and somewhat slower growth thereafter. Indeed, as Figure 19 illustrates, the gap between the official and alternative indexes has steadily widened. The alternative output index, which can be seen on Table 2 and Figure 20, tells a story of a decline in business output growth from 3.9%/year during 1947-73 to only 1.1%/year from

Table 2

**Trends in Officially-Measured Output/Hour and Output  
and Alternative Indexes of Output/Hour and Output  
Deflated by CPI-U-X1**

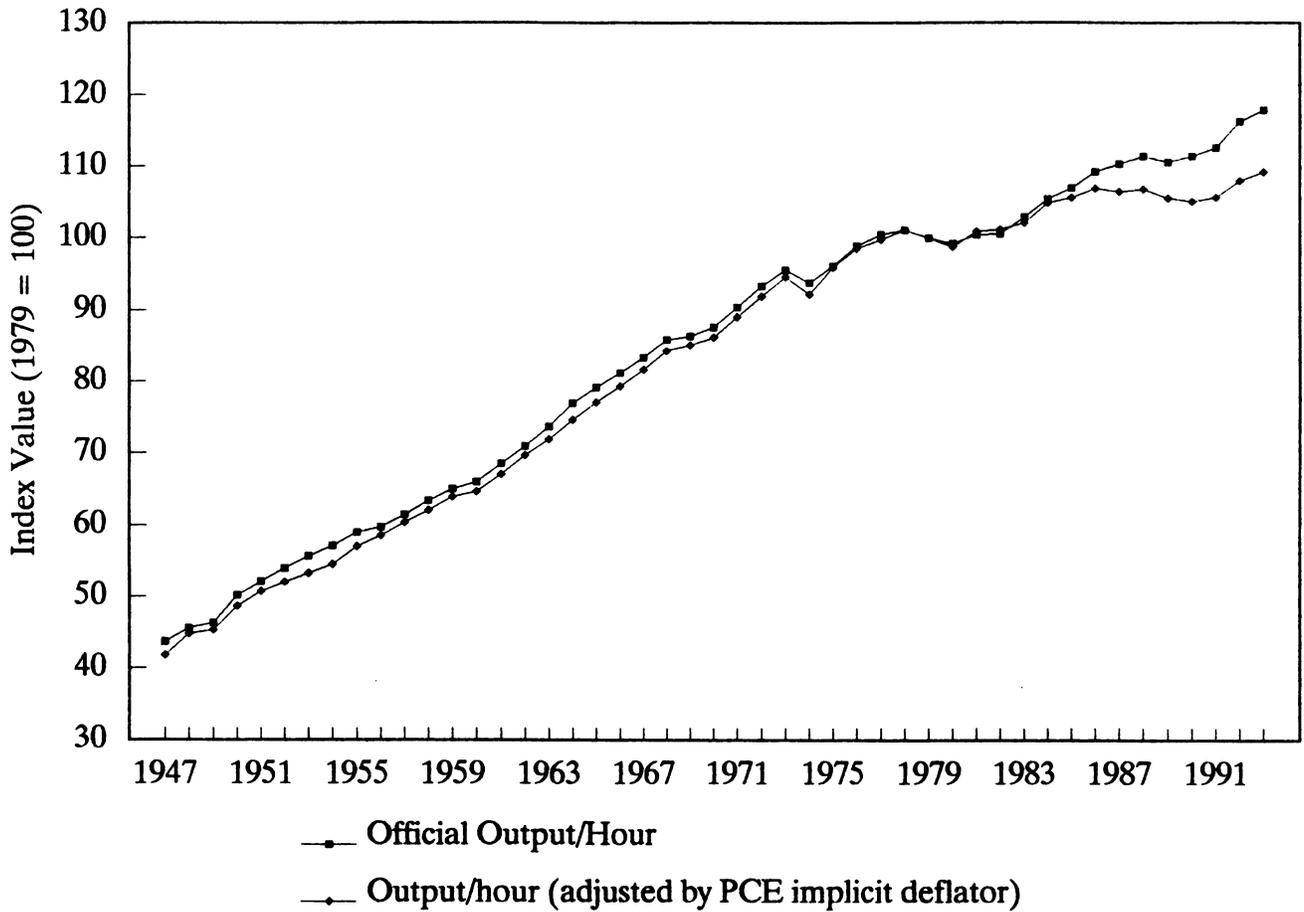
(Annualized Percentage Rates of Change)

	1947- 1973- 1973 1993	1947- 1979- 1979 1993	1973- 1979- 1990- 1979 1990 1993
Output/ Hour (official)	3.1 1.1	2.6 1.1	.8 1.0 1.9
Output/ Hour (using CPI-U-X1)	3.3 .8	2.9 .7	1.1 .5 1.3
-----	-----	-----	-----
Output (official)	3.7 2.4	3.5 2.3	2.5 2.5 1.7
Output (using CPI-U-X1)	3.9 2.1	3.7 1.8	2.8 2.0 1.1
-----	-----	-----	-----
Note: Hours	.6 1.3	.8 1.1	1.7 1.5 -.2

Figure 12

# Alternative Productivity Indexes

Business Sector

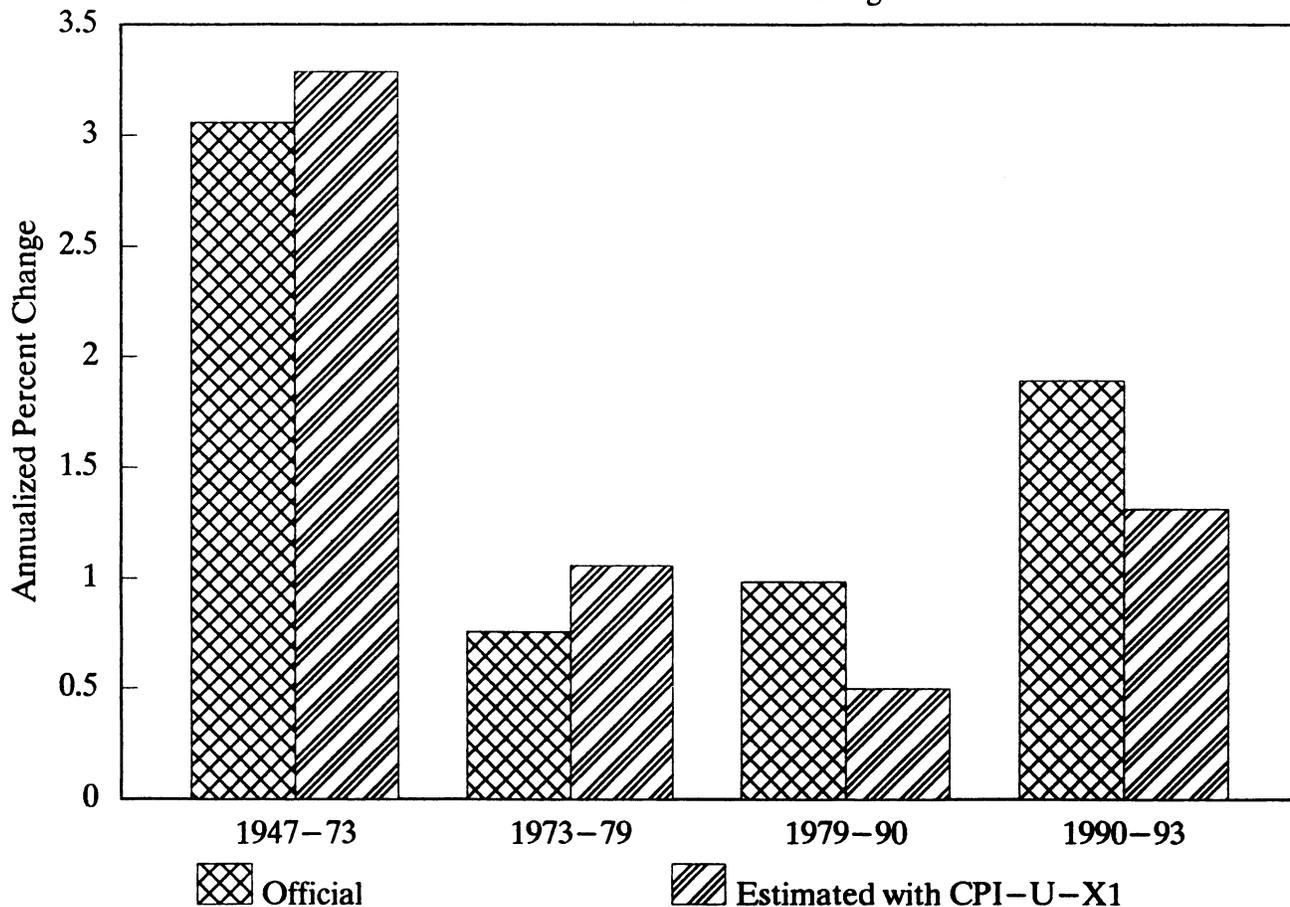


alt prod. cgm  
real wage. wk3

Figure 13

# Alternative Business Output/Hour Indexes

Annualized Percent Change

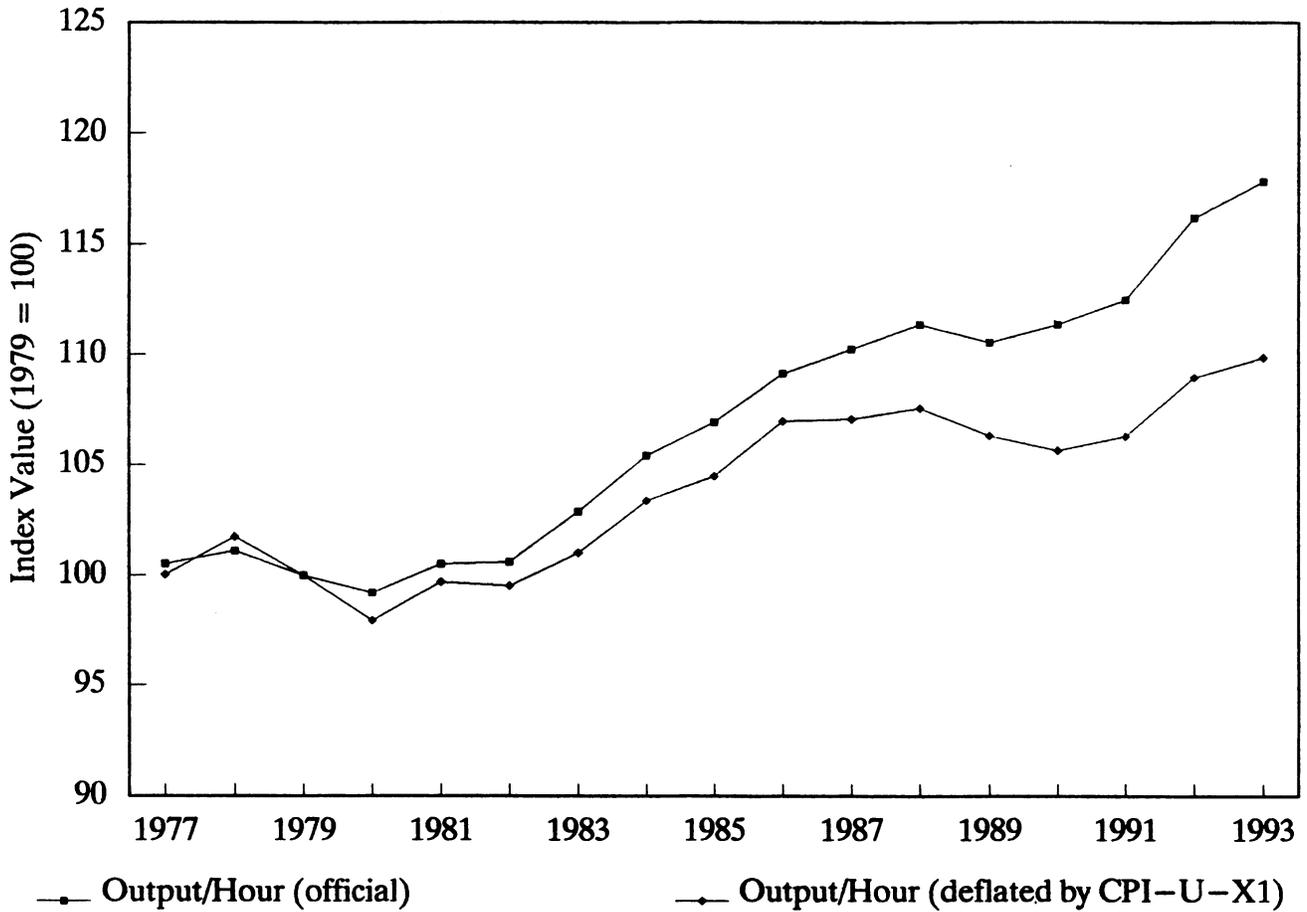


per prod. cgm  
real wage, wk3

Figure 14

# Alternative Productivity Indexes

Business Sector

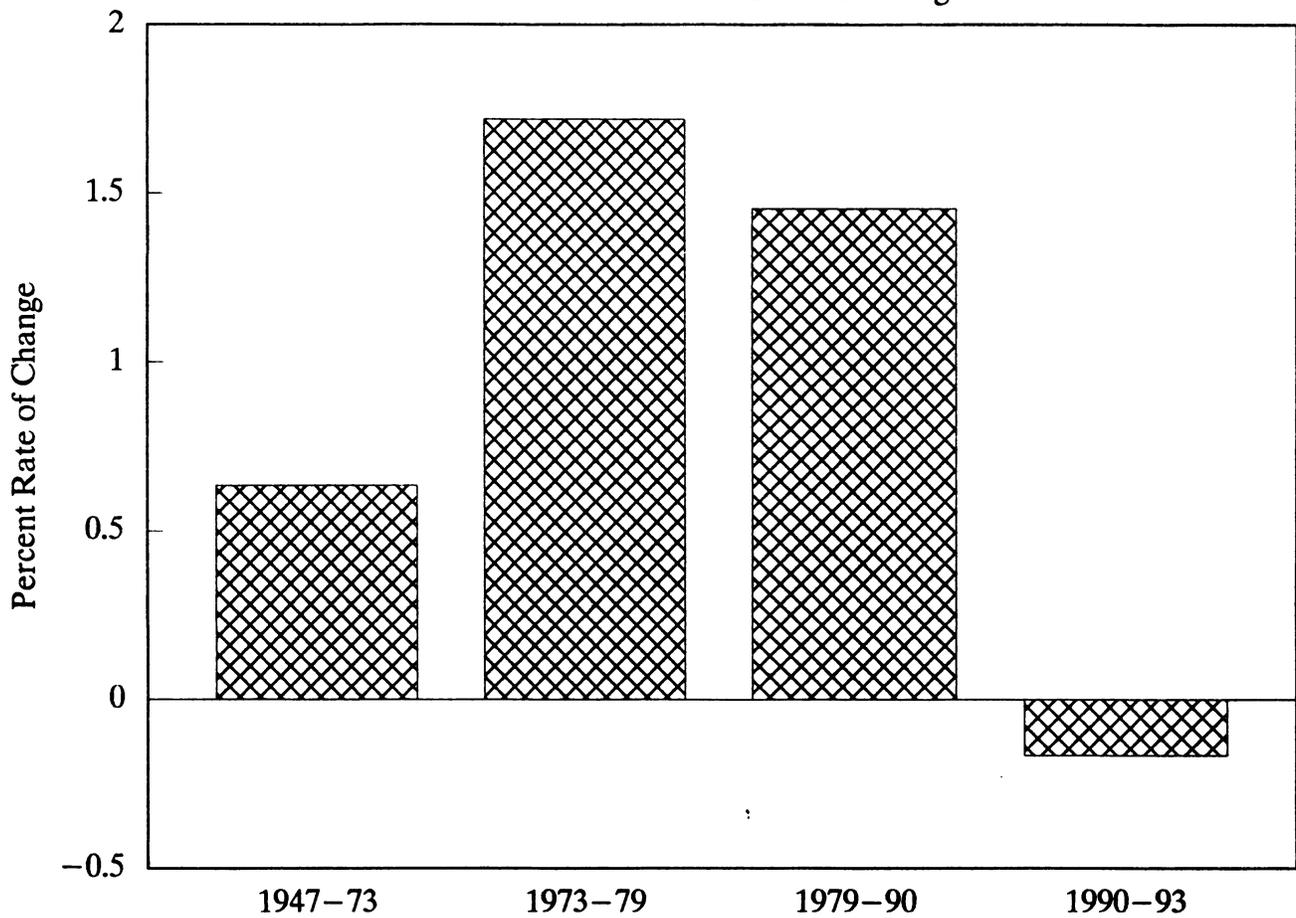


altprod3. cgm  
realwage. wk3

Figure 15

# Change in Labor Hours

Annualized Percent Rate of Change

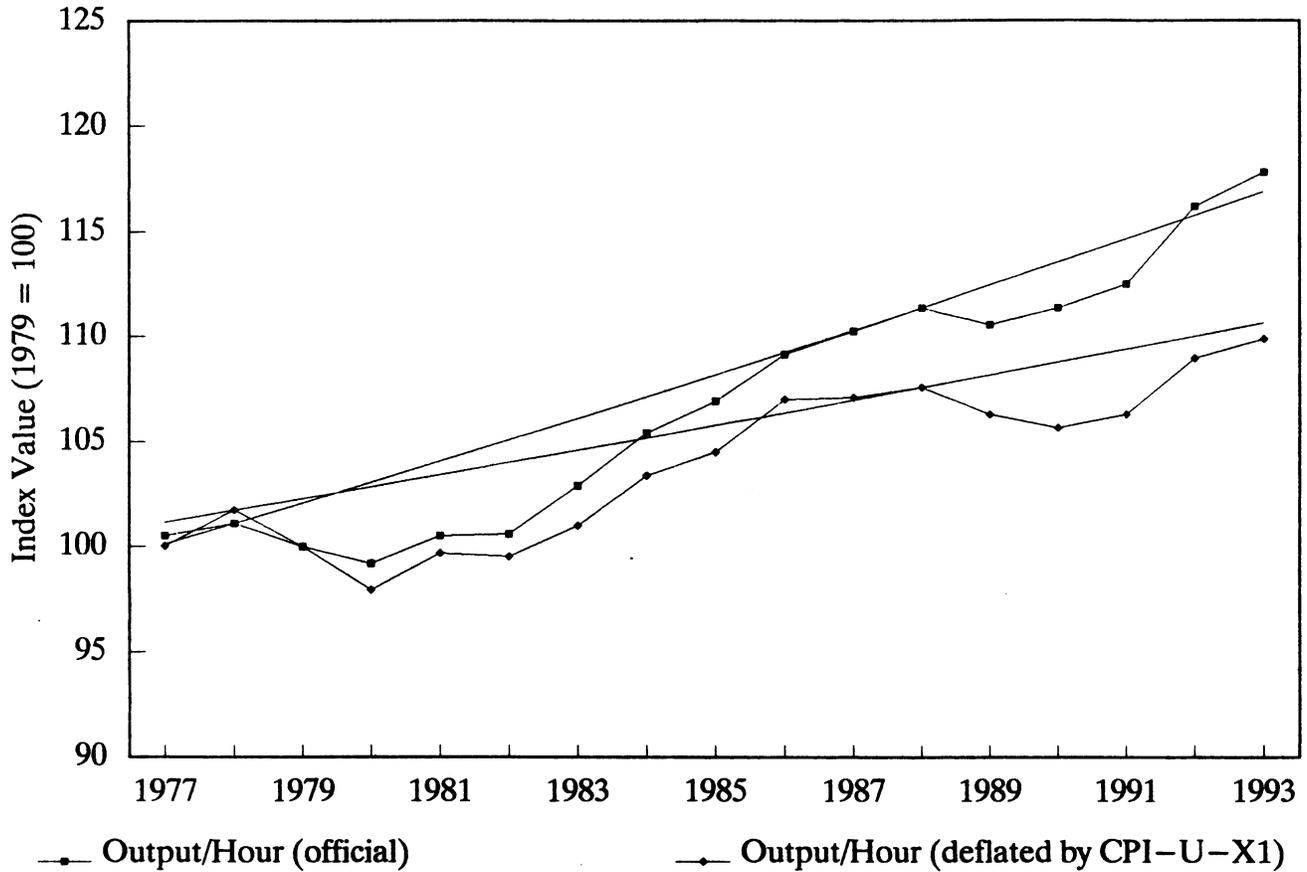


hours.cgm  
realwage.wk3

Figure 16

## Alternative Productivity Indexes

Business Sector



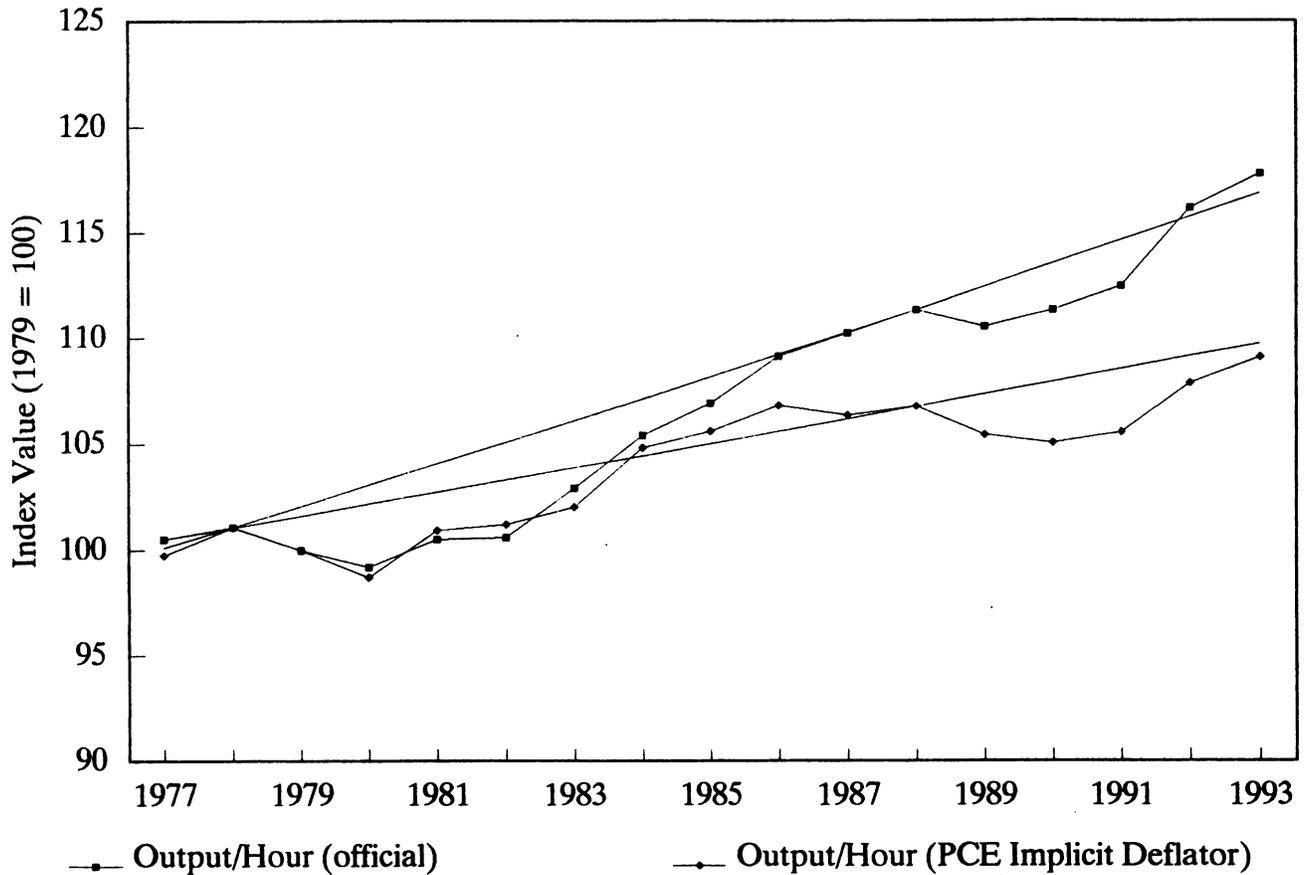
Note: Trend lines based on 1978 and 1988 peaks.

alt prod 4. cgm  
real wage. wk3

Figure 17

# Alternative Productivity Indexes

Business Sector



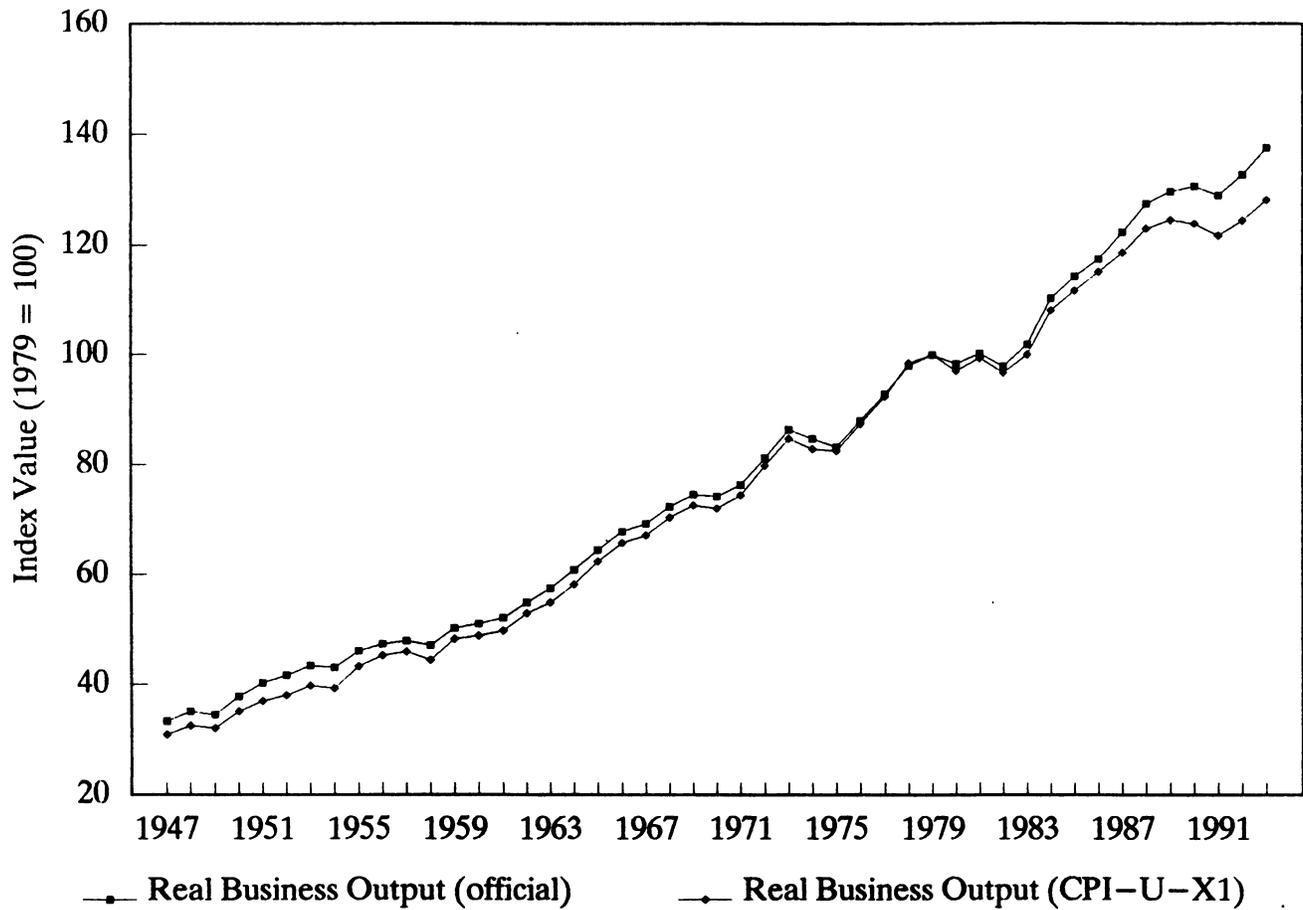
Note: Trend lines based on 1978 and 1988 peaks.

altprod5.cgm  
realwage.wk3

Figure 18

# Alternative Real Output Indexes

Business Sector

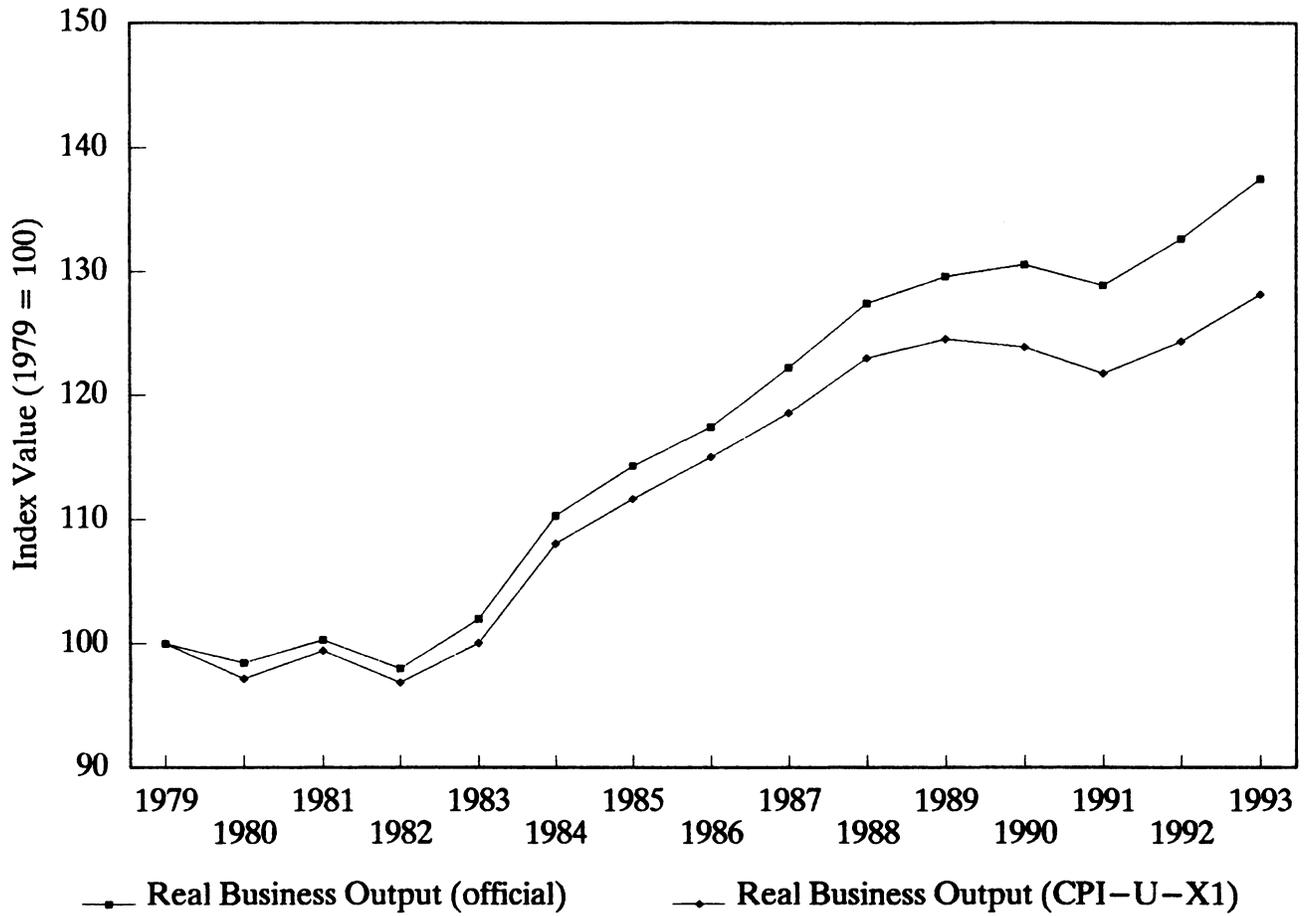


Output 1. cgm  
realwage. wk3

Figure 19

# Alternative Real Output Indexes

Business Sector

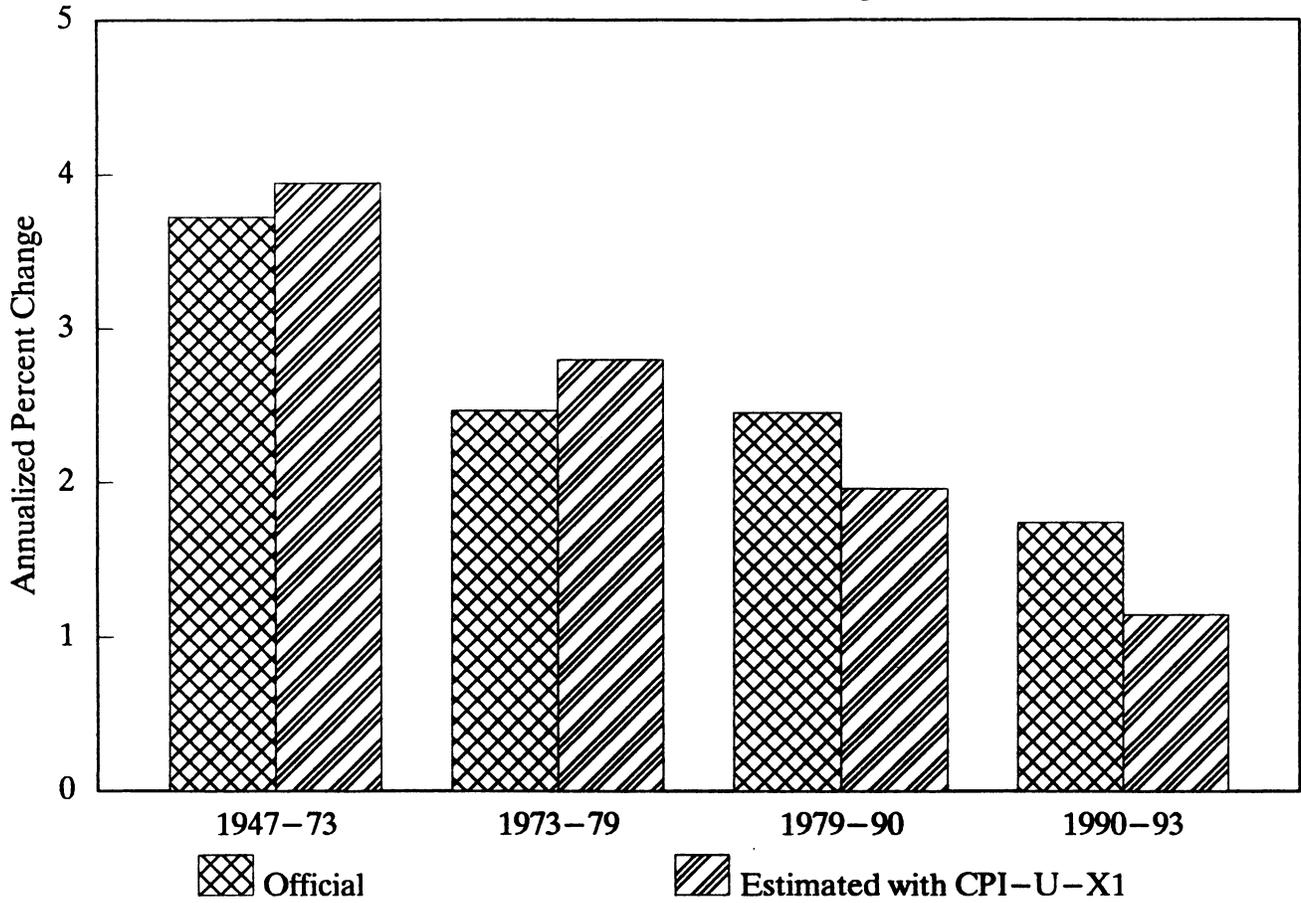


output2.cgm  
realwage.wk3

Figure 20

# Alternative Business Output Indexes

Annualized Percent Change



perout.cgm  
realwage.wk3

business cycle peak 1990 to 1993. It is hardly surprising that slow growth of 1.1%/year did not produce jobs.

#### **IV. Concluding Thoughts on the Provision of Economic Statistics**

These results do not answer the question of whether the computer quality adjustment, which seems to be an important element in the difference between the different price indexes and the official business deflator, is "correct." They do suggest that the quality adjustment has important implications for economic forecasters. It can change perceptions of economic growth and create seeming breakdowns of historic economic regularities such as the productivity - real wage linkage or the relation between output and labor input.

Many economic statistics are useful mainly for time series interpretation. The gatherers of the nation's economic data need to be mindful that theoretical "improvements" in statistical methodology, such as the introduction of hedonic price indexes, are likely to create structural breaks in important variables and relationships. Examples are not limited to price data. The change in the Current Population Survey implemented in 1994, ostensibly to make questions less gender biased and increase the efficiency of survey takers, has already been mentioned. It created a break in the unemployment rate and other labor force data just at a time when economists (including those at the Federal Reserve) were debating whether the rate was reaching a level at which inflation would be triggered. Thus, short-term economic policy making was disrupted. And long-term analyses of what are thought to be structural changes in the labor market will also be impeded.

In short, statistical agencies need to be mindful of their clientele, the data users. To put the matter in hedonic terms, data customers may put a much heavier value on continuity of reporting than is appreciated by those making policy about statistical methodology. Can it be that economic statistics are too important to be left to the (official) statisticians?

## Footnotes

1. U.S. Commission on the Future of Worker-Management Relations, Fact Finding Report, May 1994 (Washington: GPO, 1994), p. 16.
2. U.S. Bureau of Labor Statistics, "Research Results: March 1991 Benchmark Revisions to Payroll Survey Employment Estimates," January 8, 1993; U.S. Bureau of Labor Statistics, "Revisions of Payroll Survey Employment Estimates to March 1991 Benchmarks," June 3, 1992.
3. The changes involved both a shift in questions asked and the use of computerized data collection. An attempt to provide a bridge between the old methodology and the new reportedly failed. See "BLS Finds Difficulties in Returning to Old Way of Conducting Jobs Survey," Daily Labor Report, June 22, 1994, pp. A9-A10.
4. U.S. President, Economic Report of the President, February 1994 (Washington: GPO, 1994), pp. 116-117.
5. Note that in the national income accounts, from which the basic output measures used in calculating productivity are drawn, income is conceptually equal to product.
6. All data used in this paper are as of late June 1994. Subsequent data revisions are not reflected.
7. Daniel J.B. Mitchell, "Should the Consumer Price Index Determine Wages?," California Management Review, vol. 25 (Summer 1983), pp. 78-92.
8. Allen H. Young, "Alternative Measures of Change in Real Output and Prices," Survey of Current Business, vol. 72 (April 1992), p. 39.
9. Survey of Current Business, vol. 74 (April 1994), pp. 113-114.
10. Charles Mason and Clifford Butler, "New Market Basket for the Consumer Price Index," Monthly Labor Review, vol. 110 (January 1987), p. 10.
11. The hedonic methodology is not applied to the computer component of the Consumer Price Index.
12. If  $s$  (from the previous analysis in the text) is constant,  $W/P$  and  $Q/H$  will move together even with an erroneous  $P$ . This result occurs because  $Q$  is estimate as the value of output deflated by  $P$ . Thus, if  $P$  is, say, 1% too high in some period,  $Q$  will be 1% too low as will be  $W/P$ .
13. Edward F. Denison, "Estimates of Productivity Change by Industry: An Evaluation and an Alternative," unpublished manuscript dated August 11, 1988.
14. Daniel J.B. Mitchell, "Prospects for a Jobless Recovery" in The UCLA Business Forecast for the Nation and California: December 1993 (Los Angeles: UCLA Business Forecasting Project, 1993), pp. Nation-2.1-2.2, 2.11.