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Productivity and Real Wages: Is There a Puzzle?

IN RECENT PUBLIC DISCUSSION of labor income in the United States, considerable concern has been voiced that real wages are not keeping up with productivity growth (or are declining), that sharply rising fringe benefit costs are undermining gains in take-home pay, and that workers in other countries are enjoying better pay increases than U.S. workers. Two frequently cited measures published by the Bureau of Labor Statistics (BLS), which are shown in figure 1, highlight some of these concerns.[1]

The first measure—the growth in real hourly compensation in the nonfarm business sector—has slowed to 0.4 percent a year from 2.4 percent a year over the 1960–73 period. Meanwhile, hourly output per worker has grown at 0.9 percent a year—noticeably faster than hourly compensation, although down considerably from its 1960–73 annual growth rate of 2.5 percent. In an economy where real wage growth has paralleled the rise in productivity over the long run, this apparent divergence implies that the benefits of increased productivity have not been distributed in the expected way over the past two decades.

The second BLS measure—real hourly earnings of nonsupervisory employees—excludes employer payments for pension, health care, employment taxes, and other nonwage costs that are counted in real hourly

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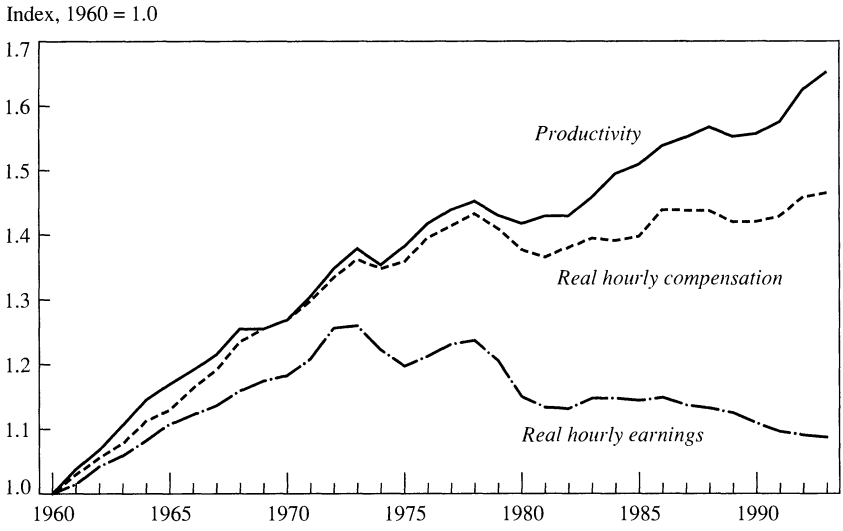
1. U.S. Bureau of Labor Statistics (1993, 1994).

Figure 1. Productivity and Real Hourly Wages, 1960–93[a]



Source: Authors' calculations based on U.S. Bureau of Labor Statistics (1994) and U.S. Bureau of Labor Statistics, consumer price index.

a. Productivity is output per worker-hour for nonfarm business deflated by the output deflator for that sector. Real hourly compensation for nonfarm business and real hourly earnings for private nonagricultural production workers and nonsupervisory workers are deflated using the CPI for urban workers.

compensation. This measure has actually declined by a startling 15 percent since 1973. This difference between real hourly compensation and real hourly earnings is often attributed either to the rising costs of wage supplements, particularly medical insurance, or to a widening gap between the wage rates of nonsupervisory versus supervisory workers.

These two measures of labor earnings, and the comparisons between them and productivity, are often flawed, however, by inconsistencies in how the data are presented, biases in the survey of hourly earnings, and differences among the price indexes used to adjust for inflation. In what follows, we isolate some of these factors to arrive at a more meaningful assessment of U.S. real wage growth and its relation to productivity. In the final section of the paper, we also compare U.S. wage growth with that in other industrial countries.

Trends in U.S. Productivity Growth and Real Compensation

The divergence since 1973 between real wage growth and productivity growth in the published data greatly overstates the departure from

Table 1. Productivity and Real Wages in the Nonfarm Business Sector, 1960–93
Percent per year

Indicator[a]	*1960–73*	*1973–93*	*1973–83*	*1983–93*
Hourly compensation (CPI)	2.4	0.4	0.2	0.5
Productivity (NFGDP)	2.5	0.9	0.6	1.2
Hourly compensation (NFGDP)	2.5	0.8	0.5	1.0
Hourly compensation (PCE)	2.4	0.6	0.9	0.3
Hourly fringe benefits (PCE)	6.0	1.9	3.8	0.6
Hourly wage (PCE)	2.0	0.4	0.4	0.3
Alternative deflators				
PCE implicit	3.1	5.8	7.7	4.0
NFGDP	3.1	5.6	8.1	3.3
CPI-U (urban consumers)	3.2	6.1	8.4	3.8
CPI-W (urban workers)	3.1	6.0	8.4	3.6
CPI-U-X (adjusted)	3.0	5.8	7.8	3.8
PCE (fixed-weight)	2.5	5.7	7.3	4.0

Source: Authors' calculations based on U.S. Bureau of Labor Statistics (1994); U.S. Bureau of Labor Statistics, consumer price index; and the National Income and Product Accounts (NIPA).

a. Computed using the consumer price index (CPI), the personal consumption expenditures (PCE) deflator, or the output price deflator for nonfarm business (NFGDP) as indicated in parentheses.

the way productivity gains have been distributed historically. This can be seen by decomposing the divergence in those data into two parts—a sharp fall in labor's terms of trade, meaning that the prices workers pay for goods have been rising faster than the prices of the goods they produce, and a small decline in real compensation relative to productivity when both are deflated using a common price index.

These points are quantified in table 1. The first two lines report the growth of real hourly compensation and productivity in the private nonfarm business sector as reported by BLS.[2] They show that productivity growth fell sharply off its historical rate after 1973, accounting for most of the slowdown in real wage growth. The published measure of real hourly compensation slowed even more than productivity after 1973, mainly because the consumer price index (CPI) used to deflate compensation grew faster than the output deflator used to deflate productivity.

The third line of table 1 shows hourly compensation deflated by the output deflator (NFGDP) instead of the CPI. Since 1973, this measure of

2. The index of productivity is most commonly computed using a concept of hours paid for all persons, which includes an estimate for the self-employed. A comparable measure of wages is obtained by imputing a wage rate to the self-employed that equals that of employees in specific industries. For nonfarm business, there is no significant difference between changes in the wage rate of employees and all persons.

real compensation, which is often referred to as the real product wage, has grown about 0.1 percent a year more slowly than labor productivity. This small difference is the extent of the genuine departure from average historical experience.

Differences between the growth of productivity and the growth of the real product wage reflect variations in labor's share of total nonfarm income. Labor's share of nonfarm income, which has averaged 65.7 percent over the postwar period and which is slightly procyclical, peaked at 67.8 percent in 1980 and 1982 and declined to 65 percent by 1993. The near constancy of labor's share of nonfarm income in the long run has been used by economists to justify the use of the Cobb-Douglas production function in modeling the long-run behavior of pricing, production, and factor use. The small decline in labor's share since 1982, which was preceded by a small rise, does not call into question this long-run characteristic.

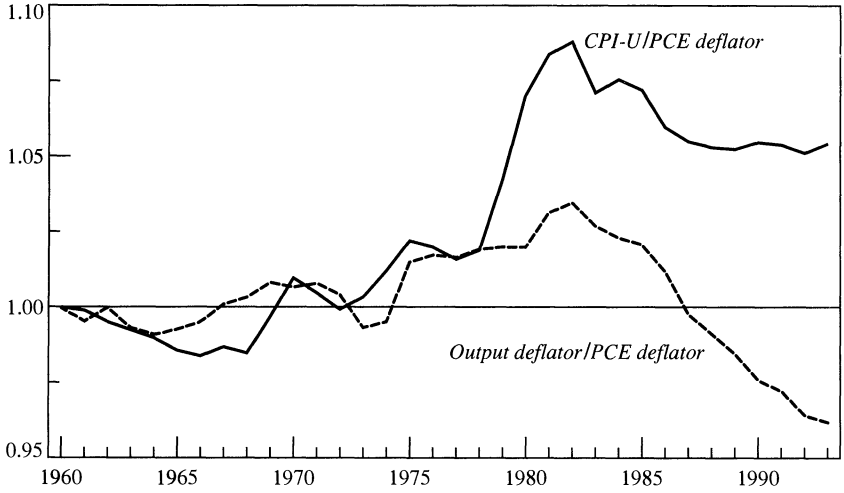
Measuring Price Changes

We now look more closely at alternative price indexes used to adjust for inflation.

CPI versus PCE Deflator

The Bureau of Labor Statistics uses the CPI for urban households (CPI-U) to adjust hourly compensation and uses the CPI for urban workers (CPI-W) to adjust hourly earnings. Both indexes, however, have experienced a major change in their construction that severely distorts the historical trend. Prior to 1983, all versions of the CPI measured homeownership costs by assigning a large weight to changes in mortgage interest rates, even though such changes would affect only a small number of households. Starting in 1983 for the CPI-U and in 1985 for the CPI-W, the BLS changed the housing component of the index to a concept of rental equivalency, in which the costs to homeowners change in line with the rental rates for comparable housing. Because the changeover occurred at a cyclical peak in mortgage interest rates, the CPI, when compared with alternative indexes, increases much more during the period of rising nominal interest rates (the 1970s and early 1980s) and

Figure 2. Relationships among Various Price Series, 1960–93[a]
Index, 1960 = 1.0



Source: Authors' calculations based on U.S. Bureau of Labor Statistics (1994); U.S. Bureau of Labor Statistics, consumer price index; and the National Income and Product Accounts (NIPA).

a. The CPI-U is the consumer price index for urban consumers. The output deflator is for nonfarm business. The PCE deflator is the personal consumption expenditures deflator.

and does not decline during the subsequent period when interest rates fell. As a result of the changed methodology, the CPI greatly overstates the rise in the price level and understates real wage gains since the late 1970s.

For this reason, we choose to use another deflator, the personal consumption expenditures implicit deflator (PCE deflator) from the national accounts, to measure consumer price changes; it is conceptually equivalent to the output deflator used to measure productivity, and it provides a historically consistent measure of price changes. In addition to their treatments of housing costs, the CPI and PCE deflator also differ in the weights attached to specific consumption items. For example, the CPI only reflects out-of-pocket costs for health care, whereas the PCE deflator treats employer and government payments as income transfers to households and reflects the full cost of health care as consumption. Also, the individual expenditure weights used to construct the CPI are adjusted infrequently, whereas the PCE deflator is constructed to reflect shifts in the composition of spending among major expenditure categories. As shown in figure 2, the discrepancy between the CPI-U and

PCE deflator increased throughout the 1970s, peaked at 9 percent in 1982, and still amounted to about 5 percent in 1993.

Changes in Labor's Terms of Trade

Yet, even when measured by the PCE deflator, the prices that workers pay as consumers have been rising significantly more rapidly than the prices of the products they produce. This important change in relative prices, what we call labor's terms of trade, is shown by the change in the ratio of the nonfarm output deflator to the PCE deflator in figure 2. It indicates that while the terms of trade improved by 3 percent over the 1973–83 period—generating real wage gains in excess of productivity growth—this has been followed by a dramatic 6 percent decline in labor's terms of trade over the past decade. Thus, real hourly compensation, using the PCE deflator, has grown at only one-quarter the rate of labor productivity since 1983—0.3 percent a year compared with 1.2 percent a year.

The size of the change in workers' terms of trade is surprising and unprecedented in the historical data. Because consumption constitutes such a large part of total output, the two indexes normally move closely together. Moreover, two likely sources for the divergence can be ruled out. First, the external terms of trade with other countries played no significant role in the relative price movements within the United States. The relative price of imports did rise and fall with changes in oil prices, but there has been little net change since 1980, despite the variations in the dollar's exchange rate. Second, there has been no significant change in the relative price of farm products.

Instead, two other developments help explain the change in relative prices: the decline in the prices of computers, which are produced in the nonfarm business sector but are a very small part of consumption; and the sharp rise after 1982 in the cost of owner-occupied housing, which is a large element in consumption but is largely excluded from nonfarm business output.[3] Price indexes that exclude both computers and housing costs show that these two items indeed account for almost half of the rise in the relative price of consumption products since 1982. Of the total 7 percentage point difference between the growth in consumption prices and the growth in nonfarm output prices between 1982 and 1993, com-

3. Lawrence and Slaughter (1993).

puters account for 1.8 percentage points and rent accounts for another 1.4 percentage points.

What accounts for the remaining 3.8 percentage points? They appear to reflect a pervasive pattern in which the prices of a wide range of investment goods and government purchases from the private sector declined relative to consumption prices. In addition, within total consumption, the prices of services have risen relative to the prices of goods. To try to identify in greater detail which other consumption categories contributed to the divergence, we regressed the price indexes of detailed consumer expenditure components on the private nonfarm deflator and a trend for the 1960–82 period and examined the forecast errors over the 1983–93 period for atypical increases. Although the resulting errors were generally small, they were consistent with the observed divergence between the aggregate PCE and output deflators when cumulated over all components.[4]

Other Price Measures

Some other price indexes are occasionally used to construct measures of real wage changes. Their behavior over the past two decades is summarized in the lower part of table 1. First, the Bureau of Labor Statistics estimates a CPI based on a historically consistent methodology for measuring homeownership costs (CPI-U-X) but does not use it in its published measures of real wage growth. This index has actually risen slightly less rapidly than the PCE deflator from 1960 to 1993. Second, the strong similarity between changes in the CPI-U and the CPI-W indicates a minor role for their different expenditure weights. Finally, as mentioned previously, changes in the price deflators in the national accounts reflect changes in the composition of gross domestic product as well as price changes. The effect of these changes in composition is excluded from the fixed-weight PCE deflator in the national accounts, which rises more slowly than the PCE deflator up to the base period of 1987 and rises faster thereafter.[5]

4. The prices of medical care were not a significant source of change in the relationship between consumption prices and the output deflator. They have been rising more rapidly than other prices for a long time.

5. This result is unsurprising since, compared with the dating of weights used in the fixed-weight deflator, the output weights used to construct the PCE (implicit) deflator are earlier in the years before 1987 and later thereafter. The difference is less in the CPI-U-X because the weights are periodically revised and the resulting indexes are spliced together. In addition, the CPI measures a slightly different basket of products.

The main point remains that using the CPI (either the U or W version) to measure real wage changes results in a dramatic understatement of real wage growth from 1973 to 1982 and an overstatement thereafter. Since most of the difference arises from a known inconsistency in the historical CPI, the emphasis on this index in the published statistics is unfortunate. The PCE deflator provides a more consistent measure of the price inflation affecting consumers, particularly for the purpose of comparing real wages and labor productivity.

Measuring Wages

This section looks at the main alternative measures of wage change in the United States and explains some of the factors responsible for the differences among them.

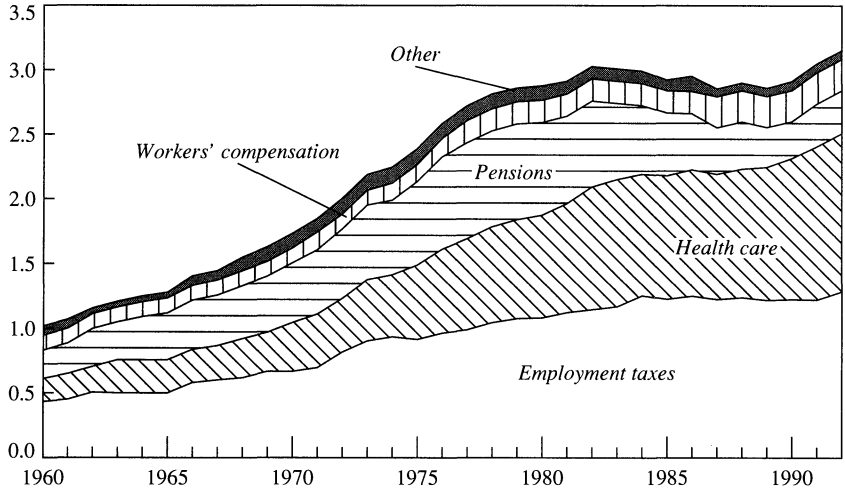
Role of Fringe Benefits

Wages differ from compensation in that they do not include employer contributions for social insurance, pension contributions, and employer payments for health insurance and other fringe benefits. The growth of all these payments is widely blamed for the divergence between measures of total compensation and take-home pay. Yet, as shown in figure 3, their role is smaller than commonly supposed because not all these wage supplements have grown. For example, employment taxes, which rose rapidly in the early 1970s, were quite stable in the 1980s, whereas employer payments for health insurance have been rising swiftly for several decades and now match employment taxes in size. In addition, there has been a less well-known offsetting decline in employer contributions to private pension programs. That slowdown reflects the decline in pension costs during the 1980s, when rising returns on pension portfolios and a shift to defined contribution pensions, primarily 401(k) plans, allowed employers to cut their contributions. Overall, fringe benefits increased from 8 percent of total compensation in 1960, to 16 percent in 1979, to 17 percent by 1993.

Although BLS does not normally publish a measure of the hourly wage excluding supplements in its report on productivity and compensation in the nonfarm business sector, it is easy to construct the series from

Figure 3. Wage Supplements, 1960–92

1992 dollars per hour



Source: Authors' calculations based on the National Income and Product Accounts (NIPA).

information published in the national accounts. The major advantage of this measure is that it is fully comparable, in terms of data sources and definitions, with hourly compensation.

The change in the index of the hourly wage rate (excluding benefits), using the PCE deflator to adjust for inflation, is shown in the sixth row of table 1. Over the 1960–73 period, hourly wages grew at an annual rate of 2.0 percent, compared with 2.4 percent for hourly compensation. The differential widened slightly in the following decade when both measures slowed, but since 1983 it has disappeared, with hourly wages and hourly compensation both growing by 0.3 percent annually.

Other Wage Indexes

There are two other major sources of information about aggregate wage rate trends, both from the Bureau of Labor Statistics. One is the long-published measure of hourly earnings of nonsupervisory employees, which is part of its monthly survey of business establishments and which was shown in figure 1. This measure is constructed in a fashion similar to the wage rate from the national accounts—the wage bill di-

Table 2. Alternative Measures of Real Hourly Wages, 1976–93[a]

Percent per year

Sector and measure	*1976–93*	*1976–83*	*1983–93*
Private industry worker			
Hourly compensation, national accounts[b]	0.5	0.5[c]	0.4
Hourly compensation, ECI	0.5	1.2[c]	0.2
Hourly wages, national accounts[b]	0.3	0.4	0.3
Hourly wages, ECI	−0.1	0.0	−0.3
Production and nonsupervisory workers			
Hourly earnings (published, CPI)[b]	−0.6	−0.8	−0.5
Hourly earnings (PCE)	−0.6	−0.1	−0.9
Hourly wages, ECI	−0.1	0.2	−0.4

Source: Authors' calculations based on U.S. Bureau of Labor Statistics (1994); U.S. Bureau of Labor Statistics, employment cost index; and U.S. Bureau of Labor Statistics, consumer price index.

a. All series are deflated by the PCE deflator except for hourly earnings (published, CPI), which is deflated by the consumer price index for urban workers (CPI-W).

b. The figures are as published by the BLS for the nonfarm business sector.

c. Data begin in 1980.

vided by total hours paid. The other source is the employment cost index (ECI), which reports measures of hourly compensation since 1980 and wage rates since 1975. The major advantage of the ECI is that it is a fixed-weight Laspeyres index, with a June 1989 base period, that corrects for the effects of shifts in employment between high-wage and low-wage jobs. As an index, it is therefore conceptually close to the CPI.

Another difference is that the ECI is an index of wages per hours worked, whereas the other measures are based on hours paid—a difference that shifts some payments from wages to benefits in the ECI. For example, increases in vacation time and overtime premiums are reported as gains in benefits, not wages, in the ECI. Also, compensation costs in the ECI refer only to costs associated with current employees, excluding such items as retiree health costs. Table 2 summarizes these measures of real wage and compensation trends, together with others described above, all deflated by the PCE deflator.

Between its inception in 1980 and 1993, the ECI has registered a change in hourly compensation that is similar to the change in hourly compensation recorded in the national accounts. However, there are significant differences over shorter periods. Some of the discrepancies can be traced to different methodologies; some to shifts in the mix of high-wage and low-wage jobs in the economy, which is known to have significant effects on average compensation; and some to the greater

weight placed on fringe benefit costs in the ECI than in the national accounts, which again may reflect a shifting of employment toward workers with lower fringe benefit costs. The result is a larger discrepancy between the two wage measures when fringe benefits are excluded.[6] The wage rate derived from the national accounts data also poses a problem in that the estimates of aggregate wages and hours come from different data sources. This is probably an important source of the short-run volatility in those data.

Among the alternative indexes in table 2, hourly earnings is the outlier. We rule out several potential explanations for the weakness in this index, which, as published, shows a 10.3 percent decline in real wages between 1976 and 1993 (or a 9.3 percent decline using the PCE deflator). First, because all the wage measures are deflated by consumer prices—the CPI-W for the published hourly earnings index and the PCE deflator for all the rest—labor's terms of trade are not a source of the differences between hourly earnings and the other measures in the table. Second, although the hourly earnings index includes only production and nonsupervisory employees, the differences between it and the other measures cannot be traced to higher wage increases for the excluded workers, who represent only 19 percent of the total work force. The decline in the ECI with the same coverage as the earnings index is 2.7 percent, which is identical to the change in the full ECI.[7] Third, we cannot plausibly attribute the weakness in hourly earnings to changes in the mix of high- and low-wage jobs, since the real wage measure derived from the national accounts, which is also affected by changes in the mix, increased 5.6 percent between 1976 and 1993.

The employment and earnings data used to construct the hourly earnings index are benchmarked to the unemployment insurance tax data, which are also used in compiling the national accounts' estimate of total wage payments. The national accounts data also agree closely with the BLS data on the reported number of employees. Thus, the differences in the measured wage rate must arise from a different treatment of the

6. Data on the composition of benefits are available only since 1987. From that information, it would appear that the difference between the two wage series cannot be explained by differences in annual leave and supplemental pay. Furthermore, there has been no major change in the ratio of hours worked to hours paid over the period in question.

7. U.S. Bureau of Labor Statistics, employment cost index, 1993. This result is more surprising because the earnings measure includes overtime and vacation pay, while the ECI does not.

wage bill in the annual benchmark adjustments. While the BLS does benchmark its employment data on an annual basis, it does not do the same for the hours and wage data. Since the monthly survey does not have a probability-based design for the inclusion of firms, it is very likely to develop persistent biases in its measures of hours and earnings, which presently go uncorrected. Furthermore, the continued focus on nonsupervisory employees is difficult to respond to for many firms, and it would be preferable if the survey focused on the average wage of all workers. The result appears to be an increasing underestimation of wage growth.

What Should One Believe?

We can draw several conclusions about prices and wages from the various measures available. First, real wages have stagnated over the past two decades, but claims of a large decline in the average real wage are exaggerated. Second, some widely used series are clearly deficient for some purposes. For example, because of the change in how the CPI treats housing costs after 1982, it is a distorted measure of consumer prices over any period spanning this change and, many would argue, for the period leading up to that change, when mortgage costs were rising sharply. Deflators for personal consumption expenditure from the national accounts do not have this problem. Since 1982, the differences between the the CPI and PCE deflator have diminished but are still significant.

Among measures of wages and compensation, the hourly earnings index should be dismissed because it is based on sampling techniques that are not properly benchmarked, although in its favor it is available promptly each month. But if it is going to be published, the methodology should be improved to make it a useful measure of developments over long periods.

The ECI, by contrast, is a well-designed index of wages and compensation that adjusts for changes in the industrial and occupational mix of employment. This makes it a good measure of the changing wage costs confronting employers. For the same reason, however, it misses the effect of changing job opportunities; by design, if the ratio of high-paying jobs to low-paying jobs rose, the ECI would not reflect it. Wage and

compensation data based on the national accounts offer the opposite advantages and disadvantages. As measures of wage costs to employers, they suffer from mix effects, but changes in the mix of high- and low-paying jobs are relevant to evaluating wage trends from the perspective of workers. And they can be used to measure changes in labor's share of output.

On two final points, it would be helpful if the report on nonfarm productivity and hourly compensation were expanded to include separate measures of wages and wage supplements. Furthermore, the statistical agencies could do more to reconcile the differing measures of wage change.

International Comparisons

Growth in U.S. real compensation has been low relative to that in other industrial economies, and the difference cannot be explained away by the kinds of corrections to the U.S. statistics that have been made thus far. Although the data needed to make a detailed analysis are not available, the broad picture is clear. Table 3 compares U.S. performance with that of six other industrial nations: Canada, Great Britain, France, Italy, Germany, and Japan.[8] For 1979–92, and the subperiods 1979–85 and 1985–92, real compensation per worker in the private sector rose more slowly in the United States than in any of the other six economies using either the PCE deflator or the GDP (output) deflator to adjust nominal compensation.

Although exchange rate movements do not explain the divergence between consumption and producer prices within the United States, comparing the data in table 3 across the two subperiods strongly suggests that exchange rate movements were important in other countries. Over the 1979–85 period, when the dollar appreciated dramatically against other currencies, U.S. real compensation trailed that in other countries by less when the PCE deflators were used than when the GDP deflators were used. The reverse is true over the 1985–92 period, when the dollar depreciated just as dramatically.

Using the PCE deflators, annual rates of increase in real compensa-

8. For comparability with other countries, the U.S. output data in this section refer to the total economy, rather than the nonfarm business sector as before.

Table 3. International Comparisons of Real Compensation, 1979–92

Percent per year

Sector and period	*Indicator*[a]	*United States*	*Canada*	*Great Britain*	*France*	*Italy*	*Germany*	*Japan*	*Mean (excluding U.S.)*	*U.S. minus mean*
Private sector										
1979–92	Real compensation per worker (PCE)	0.14	0.81	2.18	1.22	1.29	1.14	1.60	1.38	−1.24
	Real compensation per worker (GDP)	0.41	1.38	1.86	1.30	0.95	0.96	2.00	1.41	−1.00
	Output per worker	0.76	0.99	1.65	1.94	1.72	1.46	2.57	1.72	−0.97
1979–85	Real compensation per worker (PCE)	0.11	0.54	1.89	0.86	0.60	0.45	0.92	0.88	−0.77
	Real compensation per worker (GDP)	0.08	1.24	1.56	1.39	0.53	1.01	1.92	1.27	−1.19
	Output per worker	0.64	1.35	1.90	1.72	1.46	1.16	2.72	1.72	−1.08
1985–92	Real compensation per worker (PCE)	0.16	1.05	2.43	1.53	1.89	1.75	2.18	1.81	−1.65
	Real compensation per worker (GDP)	0.69	1.51	2.12	1.23	1.31	0.92	2.08	1.53	−0.84
	Output per worker	0.86	0.68	1.43	2.12	1.94	1.71	2.45	1.72	−0.87
Manufacturing										
1979–92	Real hourly compensation (GDP)	0.57	1.58	2.88	1.82	1.08	2.35	2.74	2.08	−1.51
	Real compensation per worker (GDP)	0.75	1.54	2.54	1.35	1.31	1.56	2.21	1.75	−1.00
	Output per hour	2.44	1.53	4.43	2.90	3.97	2.00	3.74	3.10	−0.66
1979–85	Real hourly compensation (GDP)	0.61	1.77	3.02	2.93	1.25	2.36	2.10	2.24	−1.63
	Real compensation per worker (GDP)	0.81	1.72	2.54	1.80	1.10	1.60	2.16	1.82	−1.01
	Output per hour	1.97	2.42	4.39	3.10	5.03	2.05	3.94	3.49	−1.52
1985–92	Real hourly compensation (GDP)	0.54	1.42	2.76	0.88	0.92	2.35	3.30	1.94	−1.40
	Real compensation per worker (GDP)	0.70	1.39	2.54	0.97	1.49	1.52	2.24	1.69	−0.99
	Output per hour	2.84	0.77	4.47	2.74	3.08	1.95	3.57	2.76	0.08

Source: Authors' calculations based on U.S. Bureau of Labor Statistics (1993) and *OECD Economic Outlook*, various issues.

a. Real compensation is computed using either the personal consumption expenditure (PCE) deflator or GDP deflator as indicated in parentheses.

tion were noticeably faster in the second period in all countries except the United States. But using the GDP deflators, the evidence of a speedup in real compensation is mixed across countries, amounting to 0.6 percentage point in the United States and averaging only 0.3 percentage point elsewhere.

We regard the GDP deflator as the most appropriate measure for deflating labor compensation when comparing it across countries. It shows the annual rise in U.S. real compensation per employee (the real product wage) to be 1.2 percentage points slower than the average of the other countries over the 1979–85 period and 0.8 percentage point slower over the 1985–92 period.

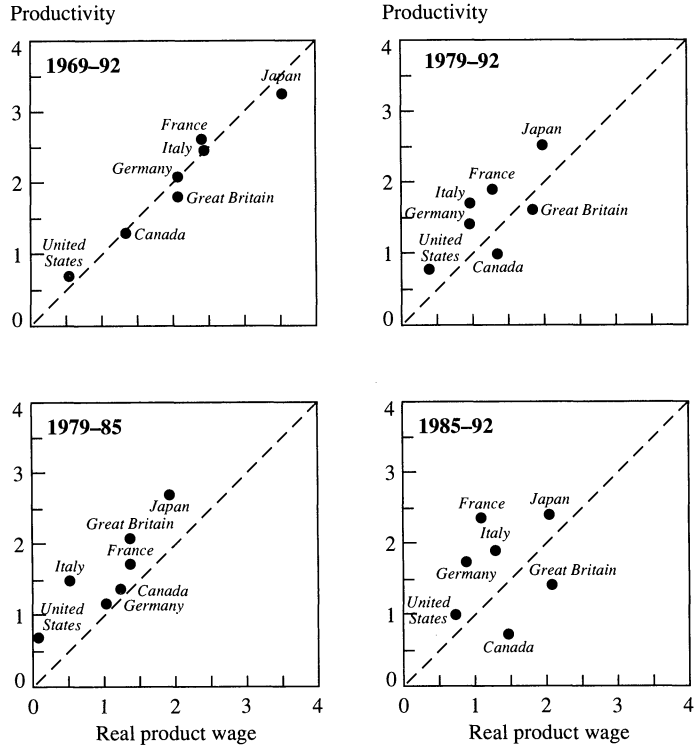
Differences in productivity growth account for the differences in the growth of real product wages between the United States and the average of the other countries shown in table 3. In comparisons between the United States and individual countries, only in the U.S.-Canada comparison does productivity not account for all or most of the differential in real product wage growth. Over a long interval, such as the 1969–92 period shown in the top left panel of figure 4, there is little difference between the growth rates of productivity and real product wages in any country, indicating no trend in the labor share of output. But in the 1979–92 period, there are notable departures from this tendency (and, implicitly, offsetting departures in the previous decade). In Canada and, by a small margin, Great Britain, compensation grew faster than productivity, while the opposite is true in the other countries. These developments do not seem to be related to unemployment rates, which rose everywhere between 1979 and 1985, a development usually associated with a constant or rising labor share.

Employment Gains

While real wage gains of U.S. workers have been modest relative to those of workers in other countries, they tell only part of the story of the relative performance of labor markets. Employment, another gauge of worker welfare, rose faster in the United States than in any of the other countries between 1979 and 1992, and not simply because the working-age population grew faster. Table 4 compares changes in the unemployment rates and changes in the ratios of employment to the working-age population across the seven countries. U.S. performance was substan-

Figure 4. Changes in Productivity and the Real Product Wage, 1969–92[a]

Percent per year



Source: Authors' calculations based on *OECD Economic Outlook*.

a. Productivity is measured as output per employee for the total economy (real GDP). The real product wage is total compensation per employee in the private sector deflated by the GDP deflator.

tially better on both counts than performance in any other country except Japan. If U.S. performance had just matched the European average over this interval, the 1992 U.S. unemployment rate would have been 9.9 percent rather than 7.4 percent, and employment would have been lower by 9.6 million, with more than 6 million fewer workers even looking for jobs. It is extremely doubtful, however, that the much slower job creation in the other economies can be blamed on the faster increase in the real compensation of their workers. As noted earlier, different productivity trends largely explain the differences in real compensation growth across countries.

Table 4. Labor Market Indicators, 1979–92

Percentage points

Indicator	*Period*	*United States*	*Canada*	*Great Britain*	*France*	*Italy*	*Germany*	*Japan*
Change in unemployment rate	1979 to 1985	1.4	3.0	7.1	4.4	2.4	4.8	0.5
	1985 to 1992	0.2	0.8	−1.6	0.1	1.4	−2.2	−0.4
	1979 to 1992	1.6	3.9	5.4	4.5	3.9	2.6	0.1
Mean unemployment rate	1979 to 1985	7.8	9.6	9.2	8.0	9.1	5.9	2.4
	1985 to 1992	6.4	9.2	9.0	9.9	11.5	6.9	2.4
	1979 to 1992	7.0	9.3	8.9	8.9	10.4	6.3	2.4
Change in employment-population ratio[a]	1979 to 1985	0.9	0.4	−4.8	−4.8	−2.0	−4.0	0.3
	1985 to 1992	2.9	1.1	1.4	−0.2	2.0	4.5	3.4
	1979 to 1992	3.8	1.5	−3.3	−5.0	−0.0	0.6	3.6

Source: Authors' calculations based on *OECD Economic Outlook*.

a. Population is defined as working-age population, ages 15–64.

On the other hand, causality in the other direction—from poor job performance to lower take-home pay for workers—almost surely exists. With higher employment-to-population ratios, the costs of programs supporting those without work would be lower and would be spread over more workers. Consequently, the tax burden per employed worker would be lower on both counts, except as the higher costs are financed through larger budget deficits. If U.S. performance had just matched Europe's as described above, and transfer programs were financed through payroll taxes, U.S. payroll taxes per worker would have had to be 11.3 percent higher than they actually were, assuming only the costs of unemployment compensation were affected on the expenditure side. If other income maintenance transfers also rose, the needed increase would be greater. And if part of the lower revenues from income and profits taxes had to be made up, the tax burden on employed workers would be higher still.

Manufacturing Compensation

In manufacturing, shown in table 3, U.S. real compensation over the 1979–92 period grew 1 percentage point more slowly than the average of real compensation across the other countries, the same differential as existed for economywide compensation. That long period of comparison, however, ignores a more recent change. U.S. productivity growth in manufacturing has improved since 1985 and matched the average of the other countries over the 1985–92 period. None of this recent U.S. improvement is reflected in real compensation gains, however. In fact, over the 1985–92 period, real compensation gains in U.S. manufacturing slowed slightly, as they did in the other countries, on average.

Two inferences can be drawn from these patterns. First, manufacturing compensation in the industrial economies was less cyclically sensitive than economywide compensation—the wedge between the two widened everywhere during 1979–85, when unemployment was rising most sharply. Second, the dollar's appreciation and depreciation did not seem to affect the relation between manufacturing compensation and economywide compensation. The wedge between the two widened more in the United States than elsewhere when the dollar was appreciating and widened less when the dollar fell—both contrary to what might

have been expected on the grounds that manufacturing is more sensitive to foreign competition than is total GDP.

Looking Ahead

These broad comparisons across countries, both in manufacturing and the economy as a whole, help illuminate past and expected future differences in their real wage growth. The differences in compensation growth across countries can be traced largely to different rates of productivity growth. However, in recent years the productivity growth differential between the United States and other industrial countries lies largely in the nonmanufacturing sector, as other countries have largely caught up with U.S. productivity in manufacturing. The remaining gaps in the nonmanufacturing sector still leave room for economywide gains in productivity and real wages to be larger abroad than in the United States.

Comments and Discussion

Matthew D. Shapiro: Growth in compensation has slowed dramatically since the productivity slowdown. But in discussions of U.S. economic performance, it is often claimed that real wages have actually fallen substantially over the past two decades. This is surely not the case. Real wages are proportional to productivity, and productivity is definitely higher now than it was in the mid-1970s.

Bosworth and Perry's paper is a reexamination of the data on real wages and compensation. Their careful data analysis will clarify the discussion of real wage growth and the relationship between real wages and productivity.

The claim that real wages are declining arises from the behavior of the Bureau of Labor Statistics's series on real average hourly earnings. From 1972 to 1992, this measure of real wages fell by 13 percent. But this measure understates the growth in the return to an hour's work for several reasons.

The BLS deflates average hourly earnings by the CPI for urban workers (CPI-W). Prior to 1985, the CPI-W had a home purchase component that rose with interest rates and therefore caused the price index to overstate inflation in periods when nominal interest rates were rising. When average hourly earnings are instead deflated by the personal consumption expenditures deflator in the national accounts, real wages fell 10 percent from 1972 to 1992. Thus, three percentage points of the published decline in the BLS's real earnings series arises from the overstatement of inflation by the CPI, especially during the late 1970s.

The average hourly earnings series includes only the wages of production and nonsupervisory workers. The paper also discusses problems with the sampling and benchmarking of the series. Real wages *and* salaries per hour for all workers grew 8 percent from 1972 to 1992, com-

pared with the decline in real (PCE-deflated) average hourly earnings of 10 percent. Finally, fringe benefits have accounted for an increasing share of compensation. Real total compensation per hour grew 15 percent between 1972 and 1992—almost twice as fast as wages and salaries per hour. Hence, going from real average hourly earnings from the BLS to PCE-deflated compensation per hour reverses the claim that the return to an hour's work has fallen for the representative worker during the past two decades.

Yet, the growth of real hourly compensation has been very slow compared with the early postwar period. PCE-deflated compensation per hour grew 2.7 percent annually from 1948 to 1972, but only 0.6 percent a year since then. The decline in compensation growth is a direct consequence of the productivity slowdown. This point is well understood by economists. But the central point of the Bosworth-Perry paper is that the slowdown in PCE-deflated compensation per hour has been even greater than the slowdown in productivity growth. Since 1972, output per hour for nonfarm business has grown 0.9 percent a year—a third faster than PCE-deflated compensation per hour.

The divergence of real compensation growth and productivity growth does not contradict the implication of economic theory that their growth rates should be equal. Rather, as the paper makes quite clear, once compensation is deflated by the price index for output rather than by the price index for consumption, productivity and compensation grow at about the same rates.

The paper has little discussion of the theoretical reasons for the divergence of the consumption wage (hourly compensation deflated by the PCE deflator) from the product wage (hourly compensation deflated by the output price deflator) on the one hand and the coincidence of the product wage and productivity on the other. Before addressing this issue in some detail, it is worth noting some other reasons why wages and productivity, at least as measured in the paper, might grow at different rates.

Productivity is measured in the paper as the average product of labor. Labor earns its marginal product. In the usual balanced-growth model, average and marginal products will grow at the same rate in steady state. But if the economy is converging to the steady state, or if no steady state exists (because of biased technological progress, nonconstant returns, or other reasons), then average and marginal products will diverge. For

the long time series averages that the authors highlight, examining the average product of labor is probably not a problem. But the difference between average and marginal is worth keeping in mind when considering period-by-period wage and productivity movements and for any extensions of this work.

Profit maximization implies that the marginal product of labor should equal the wage. Competition in labor markets implies that the wages of workers across industries—controlling for differences in the attributes of workers and for differences in the amenities of jobs—should be equal in different industries. If not, workers would move across industries until they were equalized.[1] There are, however, huge differences in both the level and growth of output per hour across industries. Differences in capital-labor ratios and in productivity growth are key sources of variation in marginal products across industries.

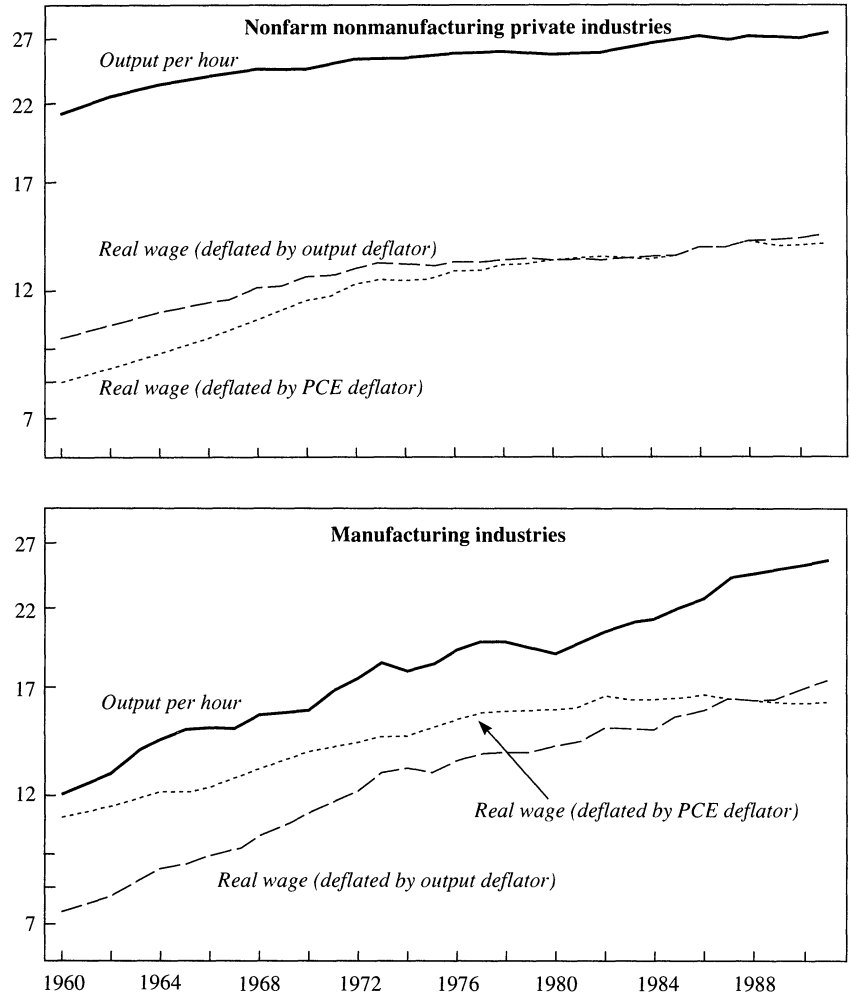
To use a classic general examination question, consider two workers: an airline worker who "parks" planes and a barber. Both might need similar years of vocational training and similar intelligence to do their jobs. The barber's output per hour is roughly fixed, and has been for centuries. The plane parker's output per hour can increase dramatically. Suppose he or she switches from parking 727s to 747s. With the same wave of the flashlight, he or she is able to bring three times as many passengers safely to roost. The worker's productivity has tripled. Should his or her wage triple relative to its old level or relative to the barber's? The answer is no. If it did, many barbers would become plane parkers, until the wages in the salon and on the tarmac equalized. Does this violate the condition that the marginal product equal the wage? Again, the answer is no. It is the product wage that should equal the marginal product of labor. To the extent that there are efficiency gains from parking 747s compared with parking 727s, the technological improvement should depress the price of airline tickets, not raise the wage of airline parkers.

The predictions of this theory hold up quite well when looking across time and sectors. Consider my figure 1. The top panel gives data for the nonfarm nonmanufacturing sector. The bottom panel gives data for manufacturing. The solid lines denote productivity. Manufacturing

1. There is a well-known literature that documents interindustry wage differentials that are not explained by differences in workers' attributes or jobs. These industry effects are fairly stable across time. Since this paper is about the evolution of wages over time, the existence of persistent industry differentials does not affect the analysis.

Figure 1. U.S. Productivity and Real Compensation, 1960–90

1987 dollars per hour, ratio scale



Source: Author's calculations based on data from U.S. Bureau of Labor Statistics (1994); U.S. Bureau of Labor Statistics, consumer price index; and NIPA data.

shows much more rapid growth in output per hour. The dashed lines show the product wage—compensation per hour deflated by the implicit deflator for industry output. In both sectors, the product wage closely parallels productivity. For nonmanufacturing, productivity grows at an annual rate of 0.9 percent and the product wage grows at an annual rate

of 1.0 percent over the 1972–91 period. For manufacturing, productivity grows at a much faster annual rate of 1.9 percent while the product wage grows at a similarly rapid 2.0 percent over the same period. For both industries, the product wage and productivity grew within one-tenth of one percentage point of each other.

In neither sector does the consumption wage grow at close to the rate of productivity growth. On the other hand, growth in the consumption wage is quite similar across industries: 0.6 percent a year in nonmanufacturing versus 0.7 percent in manufacturing. Note that the level of the consumption wage is also similar across industries. (They need not be equal if there are differences in skill requirements and other factors between the sectors.) The message is clear: industry prices move to reflect marginal products, while consumption wages tend to equalize across industries.

One might think, however, that these relative price changes would average out across industries so that the average consumption wage would track productivity. This would be the case only if consumption exhausted output. In particular, if some output is invested and if the relative price of investment and consumption goods is changing, then consumption and output prices will diverge. Indeed, given what is known about productivity growth across industries and about the composition of investment and consumption, one would expect consumption and output prices to diverge.

Investment is relatively goods intensive, and productivity growth in manufacturing has, as the figure shows, far outstripped productivity growth elsewhere in the economy. (The slow growth in productivity in construction works against the price of investment goods, but not enough to offset their advantage, especially given the importance of housing in consumption.) Figure 2 in the Bosworth-Perry paper makes the point quite clearly. Consider two extremes of relative price change. If you are a computer producer and a buyer of health care you are not doing too well. That, in short, is the situation in which the consumer finds himself or herself.[2]

One very interesting finding of this paper is that the relative price of consumption goods does not follow a steady upward trend. According

2. That health care is both produced and consumed does not deflate this example. None of health care is invested (in the NIPA sense), so the changing relative price of health care can affect the relative prices of output and consumption.

to the authors' figure 2, it was flat until the mid-1970s, ticked down until the early 1980s, and has trended up since then. Students of Baumol's disease might have predicted an upward trend over the entire sample. It would therefore be quite interesting to study in greater detail the explanation for and determinants of this pattern.

General Discussion

The paper generated substantial discussion about the availability and quality of data for examining productivity and wages. Lawrence Katz observed that, on a quarterly and annual basis, the Current Population Survey provides an alternative measure of hourly wages. He noted, however, that these data pose a further puzzle, as the CPS measure of hourly earnings rises significantly more slowly than the measures based on the national income accounts data, even after accounting for the absence of fringe benefits in the CPS measure. Barry Bosworth noted that this difference arises in the measurement of hours per person, since the annual figures for earnings and employment are similar in the two sources. Katz also suggested looking further at the differences between the growth rates of hourly compensation in the national income accounts and the employment cost index. The ECI is a fixed-weight measure while the national accounts figure is not but is available disaggregated by industry. By starting with the disaggregated national accounts figures, it would be possible to allocate the aggregate differences between these measures into shifts across sectors and differences within sectors.

Turning to specific biases in standard measures of output and productivity, Robert Gordon observed that fixed-weight output measures that include computers are biased upward after the base year and biased downward before it, reflecting the rapid change in the relative price of computers. To avoid the distortion from the bias that would arise because computers have a much larger weight in the output deflator than in the consumption deflator, he suggested using the Bureau of Economic Analysis's chain-weighted deflators to assess labor's terms of trade. Bosworth reported that he had eliminated this bias more directly, using unpublished data from the BEA to completely remove the computer sector from the national accounts data before computing the relative prices of output and consumption.

Gordon listed two additional sources of upward bias in consumption deflators: the likely failure to adjust adequately for quality change, especially for consumer durables; and outlet substitution bias. As an example of the latter, when consumers shift from buying toothpaste at a corner drug store to buying it at a supermarket, the lower price is not directly reflected in consumption deflators. Martin Baily highlighted biases stemming from quality improvements that result from information technology, many of which are not captured correctly in the standard price measures. For example, the costs of financial intermediation associated with buying a house have dropped substantially in recent years, partly because of the effective application of computers. Gordon also noted that labor's share in national income has risen slightly over the past 20 years, a period during which its share in nonfarm private business output—the measure used in the paper—has fallen slightly. He suggested that reconciling this discrepancy could help elucidate the link between real wages and productivity.

Responding to the general discussion about measurement error, Bosworth observed that, for most purposes, the important question is not whether there is significant bias in the consumer price index, but whether this bias is getting worse over time. In light of the fact that more effort is taken today to adjust for quality, he raised the possibility that unmeasured quality change may not cause more bias in consumption deflators today than 30 years ago.

Katz noted that the measurement difficulties highlighted by the panel could bias international comparisons of productivity and real wages. No one knows how to adjust for quality correctly, and adjustments are not done uniformly across different nations' accounts. In addition, retail outlet substitution bias could be much greater here than abroad, because such substitution has probably been proceeding much faster in the United States than abroad.

Several members of the panel focused on the direction of causality among wages, productivity, and employment. Gordon argued that an important causal link runs from real wage growth to productivity, the opposite of the direction implicitly assumed in the paper. In particular, he suggested that low wages in the United States are an important cause of relatively slow productivity growth. Many people are hired to do things in this country—like bag groceries—who would not be hired in European countries because of labor market institutions that make it

more expensive to hire low-skilled workers. Jeffrey Sachs agreed, noting that minimum wage rules and union wage agreements reduce low-wage employment in Europe and drive up productivity in low-wage sectors. He observed that the retail sector in Germany is very capital intensive, with few people working in retail outlets.

The panel also raised some broader conceptual issues. Robert Hall proposed an alternative welfare-based approach for measuring productivity: because consumption is the key to welfare, treat investment goods as pure intermediate inputs in the national accounts. In this treatment, output would equal the production of consumption goods plus a term to account for the future flow of consumption goods from investment. Productivity would also be calculated with this alternative output measure. In this framework, Hall added, productivity and real wages should be computed using a consumption deflator, rather than the GDP deflator that is appropriate if the output measure is total GDP. As Perry and Bosworth showed, using a consumption deflator yields a more pessimistic view of recent living standards than using the GDP deflator.

Finally, James Tobin pointed out that the increase in the relative price of consumption and investment goods is consistent with the low saving rates observed in the United States. Because investment is the means through which current consumption is traded for future consumption, a decline in the relative price of investment goods implies that the price of future consumption has fallen. With a lower price of future consumption, a smaller pool of savings today can support a higher level of future consumption.

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