Sluggish Job Growth: Is Rising Productivity or an Anemic Recovery To Blame?

By George A. Kahn

Of the many economic issues confronting U.S. policymakers, perhaps only the federal budget deficit has gained more attention in the press and on Capitol Hill than sluggish job creation in the current economic recovery. While a "typical" recovery would have produced 4.3 million jobs in its first eight quarters, the current recovery has produced fewer than 900,000. Many analysts argue that employment growth has been slow because businesses have restructured to cut labor costs and boost productivity. But other analysts blame the anemic recovery for much, if not all, of the sluggish job growth.

Understanding how relationships among employment, productivity, and output may have changed in the current recovery is an important issue for policymakers. In the short run, employment may continue to grow slowly if businesses continue to restructure. As a result, monetary and fiscal stimulus may have less of

an impact on employment than in the past. And, achieving any particular reduction in the unemployment rate would require either greater monetary stimulus than in the past or a longer lead time. In the long run, employment and output may actually grow faster than in the past as businesses begin to realize the productivity-enhancing benefits of restructuring. Thus, at some point in the future, policymakers may need to recognize that a faster rate of nominal GDP growth than in the past may be consistent with price stability.

This article examines the relationship between employment growth and economic activity. The first section compares the behavior of employment and output during the current recovery with past recoveries and reviews alternative explanations for recent sluggish employment growth. The second section uses a statistical analysis to show that sluggish employment growth in the current recovery is consistent with sluggish output growth and an increase in long-run productivity growth. The article concludes that both enhanced productivity growth and slow output growth have contributed to sluggish job growth during the current recovery.
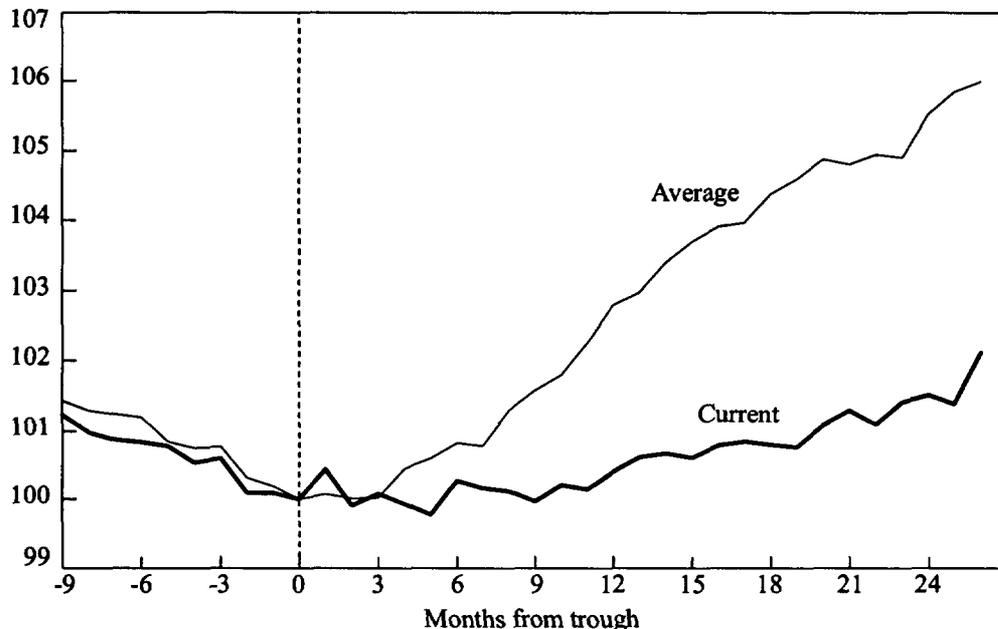
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Chart 1

Total Employment

Index Numbers, Trough=100

Months from trough

Note: "Average" is for business cycles with troughs in May 1954, April 1958, February 1961, November 1970, March 1975, and November 1982. "Current" represents the current recovery, with a trough in March 1991.

Source: Bureau of Labor Statistics.

## EMPLOYMENT, OUTPUT, AND PRODUCTIVITY IN HISTORICAL PERSPECTIVE

Compared with all previous postwar recoveries, employment growth in the current recovery has been unusually slow. What accounts for the recovery's failure to create more jobs? Two competing explanations are increased productivity growth, stemming from business restructuring, and sluggish output growth. Evidence on these two explanations is mixed. For example, while productivity growth has been no stronger than in past recoveries, it has accounted for

virtually all of the increase in output over the last two years.

Employment in the current recovery

The sluggishness of employment growth in the current recovery is apparent in data from both the Bureau of Labor Statistics' (BLS) household survey and its establishment survey. As shown in Chart 1, total employment as measured by the household survey grew much more slowly in the current economic recovery than in past recoveries. In the chart, data on

Chart 2

Civilian Unemployment Rate
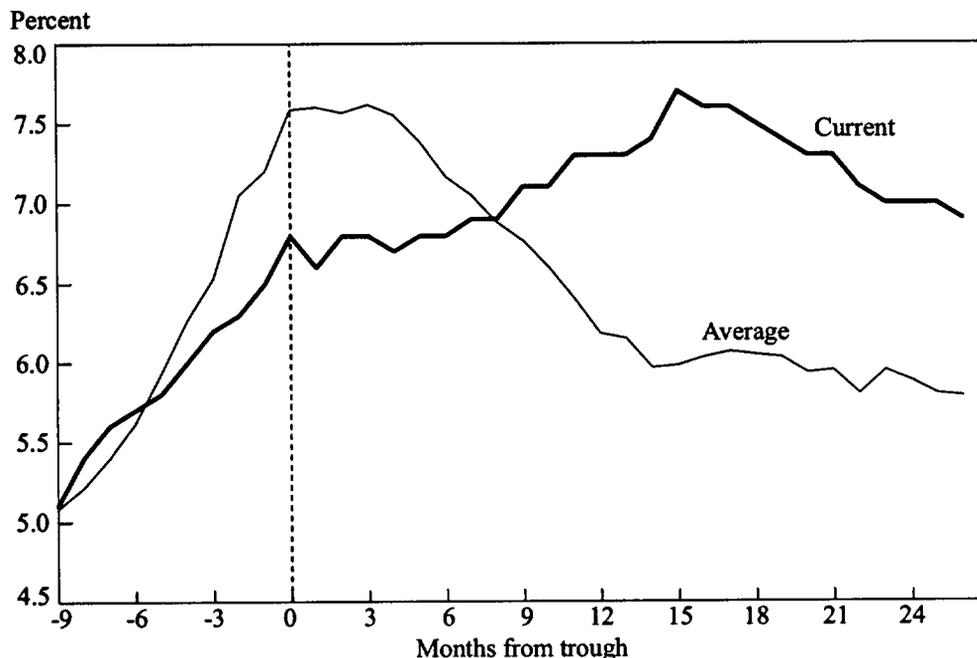
Percent

Months from trough

Note: "Average" is for business cycles with troughs in May 1954, April 1958, February 1961, November 1970, March 1975, and November 1982. "Current" represents the current recovery, with a trough in March 1991.

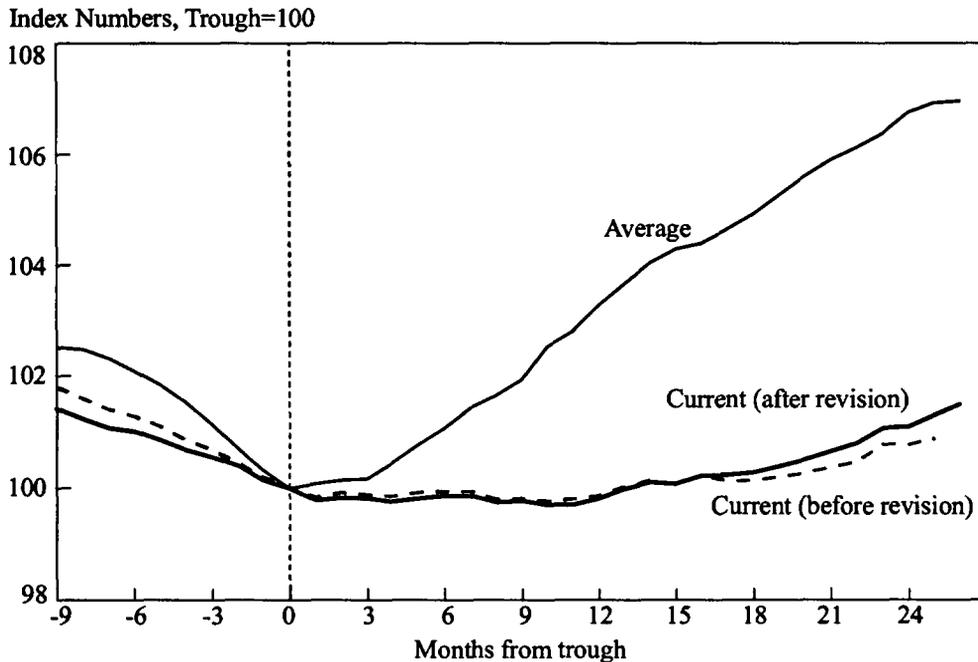Source: Bureau of Labor Statistics.

employment are expressed as indexes with values of 100 at business cycle troughs. The line labeled "current" represents the current business cycle, which reached its trough in March 1991. The line labeled "average" shows employment relative to its trough in an average of six previous business cycles. The divergence of the two lines shows how much slower employment growth has been in the current recovery than in past recoveries.

The unusual behavior of employment is also apparent in the unemployment statistics from the household survey. With employment growing slower than the labor force, the unemploy-

ment rate trended upward through the first 15 months of the current recovery. As shown in Chart 2, this pattern is in marked contrast to the typical pattern of the unemployment rate in a recovery. In particular, in a "typical" postwar recovery, the unemployment rate would have leveled off immediately and started falling after the third month.

Data from the BLS's establishment survey, which tracks employment in the private nonfarm sector, give a similar picture of job growth. Despite recent benchmark revisions to the establishment data that show a milder recession and stronger recovery than previously reported, the

Chart 3
Payroll Employment

Index Numbers, Trough=100

Months from trough

Note: "Average" is for business cycles with troughs in May 1954, April 1958, February 1961, November 1970, March 1975, and November 1982. "Current" represents the current recovery, with a trough in March 1991.

Source: Bureau of Labor Statistics.

data still show employment growth in the current recovery much weaker than in past recoveries. Chart 3 plots employment growth from the establishment survey before and after the June 1993 benchmark revisions and compares this growth to employment growth in an average of postwar recoveries. Like the previous chart, employment is reported as an index, based on a value of 100 at business cycle troughs. And like the previous chart, the establishment data show decidedly weaker job growth in the current recovery than in previous recoveries.

Explanations for sluggish employment growth

Numerous explanations have been offered for the sluggish pace of job growth. Many of the explanations, especially those appearing in the press, focus on the restructuring of business activity to produce more goods and services with less labor. Less emphasized by the press is the unusually slow growth of output in the current recovery. Because aggregate demand for goods and services has grown slowly in the recovery, firms have only gradually increased

production. Therefore, firms have only gradually increased their demand for labor.

Business Restructuring. Two recent developments that support restructuring as an explanation for sluggish employment growth are technological change and the rising cost of labor. In attributing sluggish employment growth to technological change, many analysts emphasize the absorption of computer technology into the workplace.[1] According to this view, computers that were introduced in the 1980s may only recently have been used to their full potential. Factors that pushed firms to use existing computer technology more efficiently were the recession and increased competition from abroad. To maintain profits in the recession and compete with low-cost foreign producers, businesses may have substituted computer technology for labor. The resulting absorption of computer technology into the workplace may have resulted in flatter corporate hierarchies and fewer mid-level, white-collar workers (Krugman as quoted in Trehan).

Another force possibly contributing to a restructuring of business activity is the increasing cost of labor. While wage costs have moderated considerably over the past several years, employee benefit costs have grown rapidly. A large part of the increasing cost of benefits is the soaring cost of employer-provided health-care benefits. As these costs have risen, employers may have become more reluctant to expand payrolls.[2] In addition, uncertainty over the future employer costs of federally mandated government health-care programs has likely discouraged some firms from hiring full-time workers. Because of these recent and anticipated labor cost increases, employers may have met rising demand from the current recovery by working their employees harder than in past recoveries.

Sluggish output growth. An alternative explanation is that sluggish employment growth simply reflects sluggish output growth in the current recovery. Chart 4, which compares the current recovery with an average of postwar

recoveries, shows output growth has been unusually slow. Starting from a value of 100 at the trough, the plotted index of real GDP increased to about 104 in the first eight quarters of the current recovery. In the average recovery, real GDP increased to 110—more than twice as much. With unusually slow output growth but relatively normal productivity growth, employment growth would be expected to be unusually slow.

Because *both* employment and output growth have been sluggish in the current recovery, their behavior may have a common explanation. That is, the same factors that explain why output growth has been so slow may also explain why employment growth has been so slow.

A number of factors can potentially explain the behavior of both output and employment. First, cutbacks in defense spending have clearly reduced GDP because government purchases of defense goods are a component of GDP. These defense cuts have in turn led to job cuts as defense contractors have scaled back their production of goods and services. Second, as consumers and firms have restructured their balance sheets to reduce debt burdens, spending has grown sluggishly. As a result, businesses have hired less labor and increased production of goods and services less than in a typical recovery. Third, as our trading partners' economies have slowed, so has the demand for U.S. exports. Slow growth of exports has in turn caused exporting firms in the United States to cut back production and employment growth.[3]

Preliminary evidence

A preliminary look at the data does little to resolve the issue of whether sluggish employment growth has been caused by increased productivity growth or has simply been associated with sluggish output growth. An implication of the productivity view is that slower employment growth has been offset by increased labor pro-

Chart 4

Real GDP
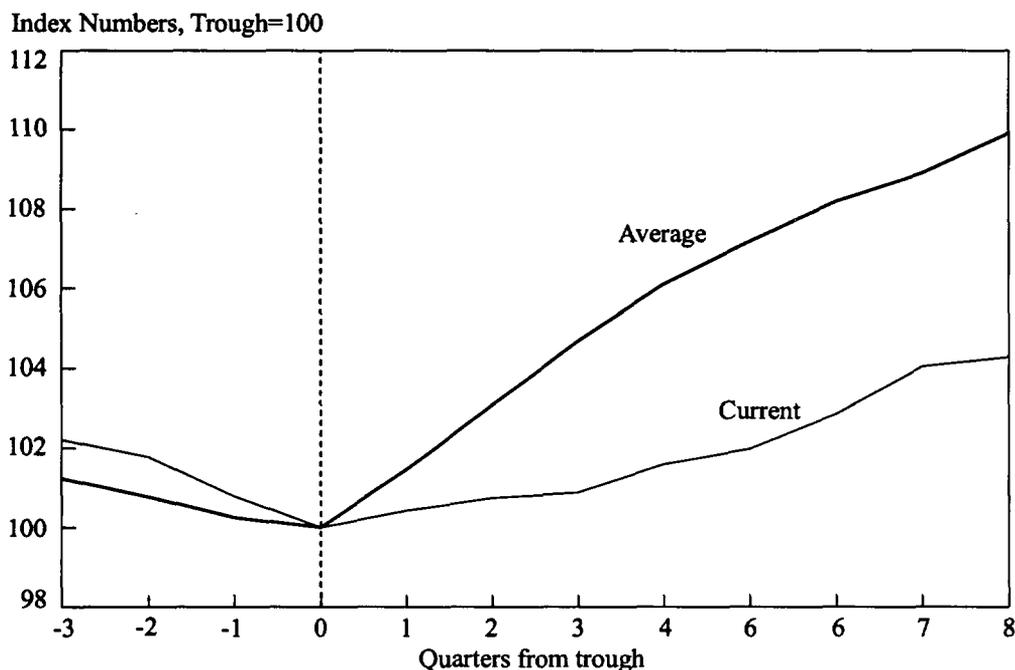
Index Numbers, Trough=100

Note: "Average" is for business cycles with troughs in 1954:Q2, 1958:Q2, 1961:Q1, 1970:Q4, 1975:Q1, and 1982:Q4. "Current" represents the current recovery, with a trough in 1991:Q1.

Source: Bureau of Economic Analysis.

ductivity in the current economic recovery. If businesses are making better use of existing computer equipment and working their labor harder than in previous recoveries, productivity growth should be faster than usual. In fact, productivity growth has not been unusually strong, but it has accounted for an unusually large share of output growth.

As shown in Chart 5, productivity in the nonfarm business sector has grown at a rate similar to the average growth of productivity in postwar recoveries. In the current recovery, productivity increased from an index of 100 at the trough (1991:Q1) to just under 105 in the seventh quarter (1992:Q4). In the average recovery, productivity increased slightly more. Moreover, productivity declined in the eighth quarter of the current recovery (1993:Q1) but continued to increase in previous recoveries. The chart therefore implies that productivity has not been unusually strong in the current recovery. This evidence appears to contradict explanations of sluggish employment growth that rely on unusually strong productivity growth.

A different interpretation of the evidence, however, supports the productivity view. By

Chart 5

Productivity

Index Numbers, Trough=100

Quarters from trough
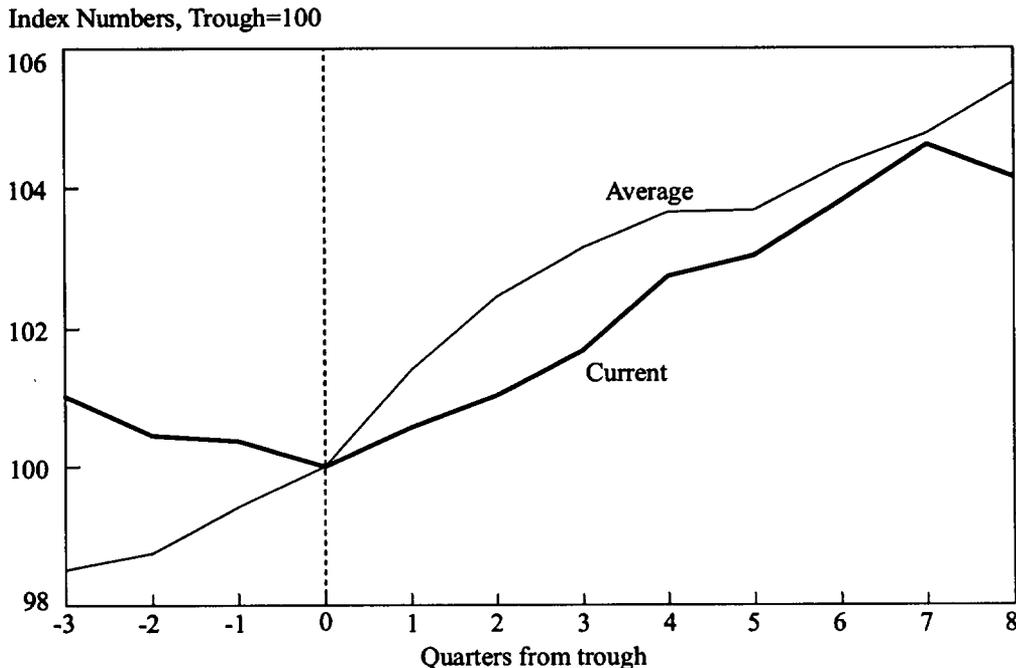
Note: Productivity is measured as output/hour in the nonfarm business sector. "Average" is for business cycles with troughs in 1954:Q2, 1958:Q2, 1961:Q1, 1970:Q4, 1975:Q1, and 1982:Q4. "Current" represents the current recovery, with a trough in 1991:Q1.
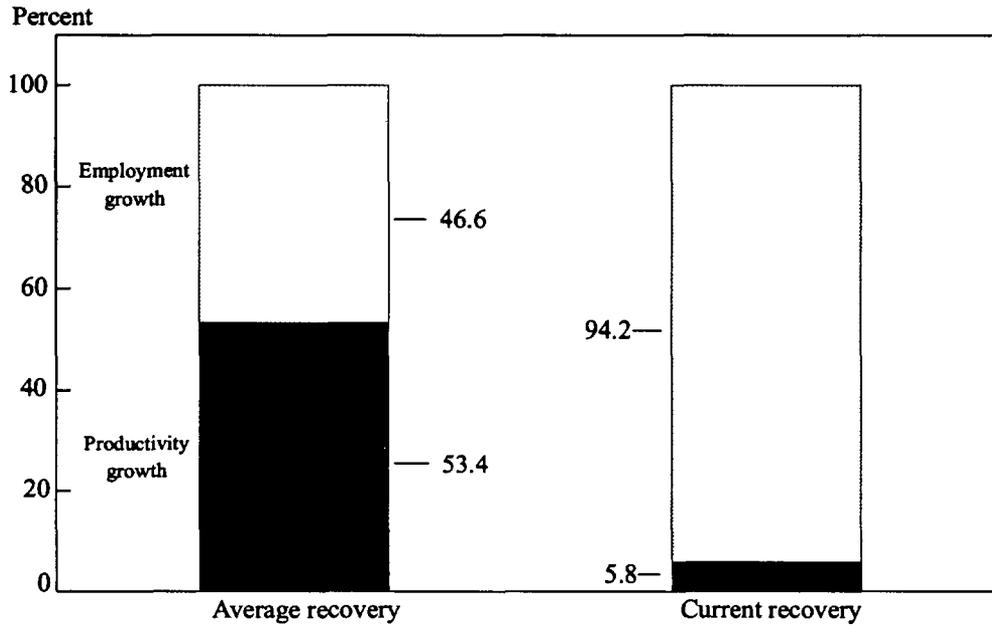
Source: Bureau of Labor Statistics.

definition, output growth is the sum of employment growth (measured as total hours worked) and productivity growth (measured as output per hour). If the anemic recovery were the only explanation for the behavior of employment, growth of both employment and productivity would likely be slower than usual. Moreover, the relative contribution of employment and productivity growth to output growth would likely be similar to that in the past. In fact, productivity growth has contributed significantly more to output growth in the current recovery than in past recoveries.

Chart 6 compares how productivity and employment growth have contributed to output

growth in the current recovery with how they contributed in an average of past recoveries. In the average recovery, employment accounted for 53 percent of output growth and productivity accounted for 47 percent. In the current recovery, employment has accounted for only 6 percent while productivity has accounted for 94 percent. Thus, despite the fact that productivity growth has not been unusually strong, productivity gains have played an essential role in supporting output growth in the current recovery.

In summary, three features of this recovery have been unusual. Employment growth has been unusually sluggish. Output growth has been un-

Chart 6

Contribution of Employment and Productivity to Output Growth

Percent

Note: "Average recovery" represents the first eight quarters of recoveries beginning in 1954, 1958, 1961, 1970, 1975, and 1982. "Current recovery" represents the first eight quarters of the recovery beginning in 1991.

Source: Bureau of Labor Statistics.

usually sluggish. And productivity growth has accounted for an unusually large share of output growth. One feature of this recovery has not been unusual: overall productivity growth in the recovery has been similar to that in previous recoveries. How can these facts be reconciled, and what do they say about possible explanations for sluggish employment growth?

WHY HAS EMPLOYMENT GROWTH BEEN SO SLUGGISH?

To examine the relationship among employ-ment, output, and productivity, this section uses a relatively simple economic identity. The iden-tity forms the basis for a statistical analysis of employment growth in the current and previous recoveries.[4] The analysis points to two conclu-sions. First, long-run trend productivity growth has increased in the 1990s. This pickup in pro-ductivity growth explains both the overall increase in productivity growth and productivity's unusu-ally large contribution to economic growth in the current recovery. Second, the short-run relation-ship between employment and output has not changed in the current recovery. As a result, sluggish output growth largely explains the slug-

gish employment growth of this recovery.

The output-employment identity

The following identity relates output to employment, productivity, and several other important labor-market indicators:

$$Q = \frac{E}{L} \times \frac{Q^B}{E^B H^B} \times \frac{L}{N} \times H^B \times N \times \frac{Q}{Q^B} \times \frac{E^B}{E}.$$

On the left side of the identity, Q represents output as measured by real GDP.[5] The various terms on the right side of the identity when multiplied together also equal Q.

The first term on the right-hand side, E/L, represents the employment rate. It is calculated as total employment (from the BLS's household survey), E, divided by the number of persons in the civilian labor force, L, and is equal to 1 minus the unemployment rate. An employment rate of 94 percent, for example, corresponds to an unemployment rate of 6 percent. The second term on the right-hand side represents productivity in the nonfarm business sector. It is calculated as nonfarm business output, Q^B, divided by the product of nonfarm business (private payroll) employment, E^B, and average hours worked, H^B. The third term, L/N, represents the labor force participation rate, which equals the labor force divided by the adult (over-16-year-old) noninstitutional population, N. The fourth term, H^B, represents average hours worked by nonfarm business employees. The fifth term, N, represents the adult noninstitutional population.

These five variables on the right-hand side form the core of the output identity. The product of four of these variables—the employment rate, the labor force participation rate, average hours, and population—equals total hours worked. The other variable—productivity—equals output divided by total hours. By definition, total hours times productivity equals output.

The last two variables on the right side of the

identity adjust for differences between the nonfarm business sector and the total economy. They are included because data on average hours and productivity are available only for the nonfarm business sector and not for the economy as a whole. The first of these terms, Q/Q^B, represents the "output mix." It is the ratio of total output to nonfarm business output. The main sectors accounting for the difference between these two measures of output are farming and government. Similarly, the second term, E^B/E, represents the "employment mix." It is the ratio of private nonfarm business employment to total employment.

The left and right sides of the identity are equivalent ways of expressing the same thing—real output. Therefore, any change in real output must somehow be divided among the seven right-hand-side components of the identity. Because the level of output is the product of its seven components, the growth rate of output must be the sum of the growth rates of its components. For example, a 3 percent increase in real GDP might be associated with a 1 percent increase in the employment rate, a 1 percent increase in productivity, and a 1 percent increase in average hours. In this case, any change in the other components on the right-hand side of the identity—labor force participation, population, and the two mix variables—would have to cancel each other out. Alternatively, a 3 percent increase in GDP might be associated with a 2 percent increase in the employment rate and a 1 percent increase in productivity, with no change in the other components of the identity.

The output identity in economic recoveries

The output identity can be used to examine the behavior of employment in the current recovery relative to past recoveries. A simple breakdown of output growth into its components clearly shows the anomalous behavior of output

Table 1

Growth Rates of Real GDP and Its Components

First eight quarters of postwar recoveries

Period	Annualized percent change							
	Real GDP	Employment rate	Output per hour	Participation rate	Average hours	Population	Output mix	Employment mix
1949:Q4-1951:Q4	10.18	1.89	5.42	.00	-1.05	.15	.48	3.29
1954:Q2-1956:Q2	4.05	.84	2.00	1.04	.00	1.19	-1.35	.33
1958:Q2-1960:Q2	4.43	1.14	1.69	-.08	.04	1.52	-.73	.86
1961:Q1-1963:Q1	4.67	.53	3.59	-.88	-.64	1.41	-.41	1.06
1970:Q4-1972:Q4	5.00	.26	3.69	-.01	-.38	2.45	-1.34	.33
1975:Q1-1977:Q1	4.72	.39	3.04	.54	-.34	1.91	-.88	.05
1982:Q4-1984:Q4	5.47	1.86	2.04	.30	.44	1.17	-1.43	1.09
1991:Q1-1993:Q1	2.07	-.27	2.03	-.06	-.12	.96	-.08	-.39

Source: Bureau of Labor Statistics and Bureau of Economic Analysis.

and employment in the current economic recovery. Table 1 breaks output growth during various economic recoveries into its seven components. Specifically, the table gives average growth rates for real GDP and its components over the first eight quarters of the current and seven previous recoveries.[6] It confirms the evidence from the previous section suggesting three unusual features of the current recovery and one typical feature. In addition, the table points to a couple of other unusual aspects of the data.

Table 1 clearly shows the unusually sluggish pace of both output and employment growth and the peculiar role of productivity. Specifically, output growth in the current recovery has been significantly slower than in the seven previous recoveries. Moreover, the decline in the employment rate over the first eight quarters of the current recovery has been unprecedented. In all other recoveries, the employment rate rose. Finally,

productivity growth in the current recovery has not been unusual by historical standards. Nevertheless, productivity has accounted for virtually all of the growth in output since 1991. In no other recovery has productivity accounted for as large a share of output growth.

Other labor market indicators behaving unusually in the current recovery are the employment and output mixes. While growth of both private nonfarm employment from the establishment survey and total employment from the household survey has been unusually sluggish, growth of private nonfarm employment has been particularly weak. As a result, the employment mix has declined at a 0.39 percent annual rate in the current recovery.[7] In all previous recoveries, the employment mix rose. Private business sector jobs have not been created, relative to total jobs, at nearly the same rate in the current recovery as in past recoveries.[8] Similarly, the output

mix has declined less in the current recovery than in any previous recovery except 1949-51. The implication is that private business output has grown slower relative to total output in the current recovery than in past recoveries.

With the employment rate and both mix variables declining in the current recovery, the remaining components of real GDP together have had to grow faster than GDP to add up to the realized rate of GDP growth. Growth in the labor force participation rate, average hours, and population has not been much different than in previous recoveries. Therefore, with unusually sluggish growth in several of the components on the right-hand side of the identity and no component unusually strong, GDP has grown at its slowest rate of the postwar period.

The relationship among output, employment, and productivity

While the output identity points to unusual features of the current recovery, the identity does not establish cause-and-effect relationships. Judging the extent to which sluggish output growth has caused sluggish employment growth in the current recovery therefore requires going beyond the simple identity. One approach is to look at rules of thumb that have held in the past. Another approach is to estimate econometric relationships that show how variables on the right-hand side of the identity respond to long-run and short-run movements in output.

Okun's Law. The economics literature provides a rule of thumb for judging how employment rates usually change with changes in real GDP. In the 1960s, the late Arthur Okun, former Chairman of the Council of Economic Advisors, examined the historical association between output and employment. He argued that a 3 percent increase in real GDP relative to trend was generally associated with a 1 percent increase in the employment rate. Subsequent

estimates of "Okun's Law" suggested the relationship was closer to 2 to 1 than 3 to 1 (Gordon 1984, 1990). These estimates have proven to be quite reliable in the past in projecting the effect of an increase in real GDP on employment.

Assuming trend output growth of 2.5 percent, Okun's Law predicts a decline in the employment rate close to what actually occurred in the current recovery. Given trend GDP growth of 2.5 percent, GDP has declined slightly relative to trend. (Actual GDP growth of about 2.1 percent minus trend growth of 2.5 percent equals -0.4 percent growth of GDP relative to trend.) As a result, the revised Okun's Law would predict a 0.2 percent decline in the employment rate (half of -0.4 percent): With an actual decline in the employment rate of 0.27 percent, the estimated decline of 0.2 percent is fairly accurate. In other words, Okun's Law appears to have held in the current recovery—as long as the assumption of trend output growth of 2.5 percent is accurate. If so, the decline in the employment rate in the current recovery can be attributed to sluggish output growth.[9]

But Okun's Law oversimplifies the relationship between employment and output. It requires an estimate of the trend growth rate of output, which is assumed constant. Trend growth of 2.5 percent is a common estimate that seems reasonable based on historical experience. But this experience may no longer apply. For example, if business restructuring has boosted productivity growth, trend GDP growth may be above 2.5 percent. On the other hand, slower growth of the labor force—as indicated in Table 1 by the decline in the participation rate and the slowdown in population growth—may have reduced trend output growth.

In addition, Okun's Law ignores possible lags in the short-run relationship between output and employment. Employment, however, may adjust slowly to changes in output, and the adjustment may differ depending on the pattern of output growth in any particular recovery (Gor-

Table 2

Trend Growth Rates of Real GDP and Its Components
1948:Q4 - 1993:Q1

Period	Annualized percent change							
	Real GDP	Employment rate	Output per hour	Participation rate	Average hours	Population	Output mix	Employment mix
1948:Q4-1953:Q4	4.77	.02	2.81	-.12	-.82	.78	.89	1.21
1953:Q4-1957:Q3	2.73	-.14	2.21	.52	-.14	1.19	-.58	-.33
1957:Q3-1960:Q1	2.63	-.40	2.37	-.47	-.36	1.49	-.07	.06
1960:Q1-1970:Q3	3.63	.00	2.35	.22	-.97	1.56	.02	.46
1970:Q3-1974:Q2	3.23	.00	1.36	.37	-.46	2.28	-.30	-.03
1974:Q2-1979:Q2	2.94	-.11	1.20	.73	-.72	1.87	-.30	.26
1979:Q2-1990:Q3	2.27	.01	.70	.39	-.28	1.20	-.04	.28
1990:Q4-1993:Q1*	2.06	.00	1.34	.00	-.54	.88	.14	.24

* Because no final benchmark for the current cycle yet exists, these trends are estimated using the regression analysis described in the appendix.

Source: Bureau of Labor Statistics and Bureau of Economic Analysis.

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don 1984, p. 543). Finally, because Okun's Law holds long-run productivity growth constant, it cannot help identify changes in long-run productivity growth possibly stemming from business restructuring.

Long-run trends. Identifying long-run trends in output, employment, and productivity is a necessary first step in estimating the short-run effect of output on employment in the current recovery. In addition, identifying trends reveals long-term shifts in the behavior productivity and other key variables. Table 2 provides estimates of long-run trends in the data and identifies trend shifts. The dates in the table correspond to benchmark quarters in which the economy was operating near full employment

during various economic recoveries.[10] Except for the last line, the data in the table are average annualized growth rates of each component of the output-employment identity from one benchmark to the next. These data therefore give estimates of trends between benchmarks.

Because the economy has not yet achieved full employment in the current economic recovery, no benchmark yet exists for the current cycle. As a result, trends must be estimated using a different methodology. The methodology, which is described in detail in the appendix, is based on the assumption that the employment rate is constant when the economy is growing at its trend growth rate. The last line of the table shows estimated trend growth rates based on this

Table 3

Cumulative Responses to a 1 Percent Increase in Real GDP
1949:Q2 - 1993:Q1

				Percent			
Employment rate	Output per hour	Participation rate	Average hours	Population	Output mix	Employment mix	Sum
.48	.11	.09	.05	-.05	-.15	.47	1.01

Notes: Estimates are based on the regression analysis described in the appendix.

alternative methodology. Trends for each variable are estimated from 1990:Q3—the quarter in the previous economic recovery when the economy operated near full employment—to 1993:Q1—the latest quarter for which data are available.

The most striking feature of the current recovery shown in Table 2 is the apparent slowdown in trend output growth, coupled with an apparent pickup in trend productivity growth. Specifically, trend output growth slipped from 2.27 percent in 1979-90 to 2.06 percent in 1990-93. The trend growth rate estimated for the early 1990s is therefore the slowest of the postwar period. Because trend growth has apparently fallen in the last several years, assuming a constant 2.5 percent trend growth rate in applying Okun's Law is inappropriate.

Despite the slowdown in trend output growth, trend productivity growth rose from 0.70 percent in 1979-90 to 1.34 percent in 1990-93. In all previous benchmark periods since 1957-60, trend productivity growth slipped. The pickup in trend productivity growth in the current recovery may be consistent with the view that firms have benefited from investments in productivity-enhancing equipment and technology.[11] Faster productivity growth has not yet

contributed to an increase in trend output growth, however, because the pickup in productivity growth has been accompanied by slower trend growth of both population and labor force participation.

Short-run relationships. After accounting for trend shifts in the data, short-run relationships can be estimated that show the response of each component of the output-employment identity to temporary output fluctuations.[12] As described in the appendix, estimates are based on regressions that include current and lagged real GDP among the set of explanatory variables. These regressions allow sluggish adjustment of each component of the output-employment identity to short-run fluctuations in real GDP.

Table 3 summarizes the short-run relationships for the postwar period as a whole, based on quarterly data. It shows the cumulative response of each variable to a change in real GDP. For example, the cumulative response of the employment rate to real GDP gives a summary measure, analogous to Okun's Law, of the short-run relationship between employment and output. The estimated cumulative response of employment to real GDP was 48 percent. In other words, a 1 percent increase in real GDP relative to trend was associated with a cumula-

tive 0.48 percent increase in the employment rate.[13] Thus, the estimated cumulative response was consistent with the 2 to 1 rule of thumb from revised estimates of Okun's Law (that is, a 50 percent employment response).[14]

With the employment rate accounting for about half of the cumulative increase in output, the other components of the output-employment identity together had to account for the other half. Table 3 shows that labor force participation, average hours, and population contributed trivially to short-run movements in output.[15]

The more important components were productivity and the output and employment mix variables. Productivity, measured as output per hour, contributed 11 percent to output, implying that a 1 percent increase in output growth was associated with a cumulative 0.11 percent increase in productivity growth. More than offsetting productivity growth, however, was the output mix, which subtracted 15 percent from output. Thus, a 1 percent increase in output growth was associated with a 0.15 percent decline in the growth of total output relative to private business output. Finally and most importantly, the employment mix contributed 47 percent, roughly the same contribution as employment.[16] Thus, in the typical recovery, private payroll employment rises faster than total household employment and contributes importantly to explaining real GDP in the output-employment identity.

While the estimated short-run relationship between employment and output was consistent with Okun's Law over the postwar period as a whole, did the relationship hold up in the current economic recovery? Of all of the components of the output-employment identity other than population, which was well explained by its trend growth, the relationship between the employment rate and output was tightest. Thus, it is not surprising that the behavior of the employment rate was well predicted in the current economic recovery.

Chart 7 demonstrates the predictive power of the estimated relationship between the employment rate and output in the current recovery. For ease of interpretation, the employment rate is converted to the unemployment rate (the unemployment rate is 1 minus the employment rate). As the chart shows, the historical relationship fairly closely predicts the actual path of unemployment over the first eight quarters of the current recovery.[17] While the unemployment rate was somewhat overpredicted—meaning predicted unemployment was greater than actual—in the first three quarters of the recovery, it was somewhat underpredicted in the last three quarters shown. However, the prediction errors in all cases were less than half a percentage point.[18] Thus, evidence suggests the short-run relationship between the unemployment rate and output has not changed in the current recovery.[19]
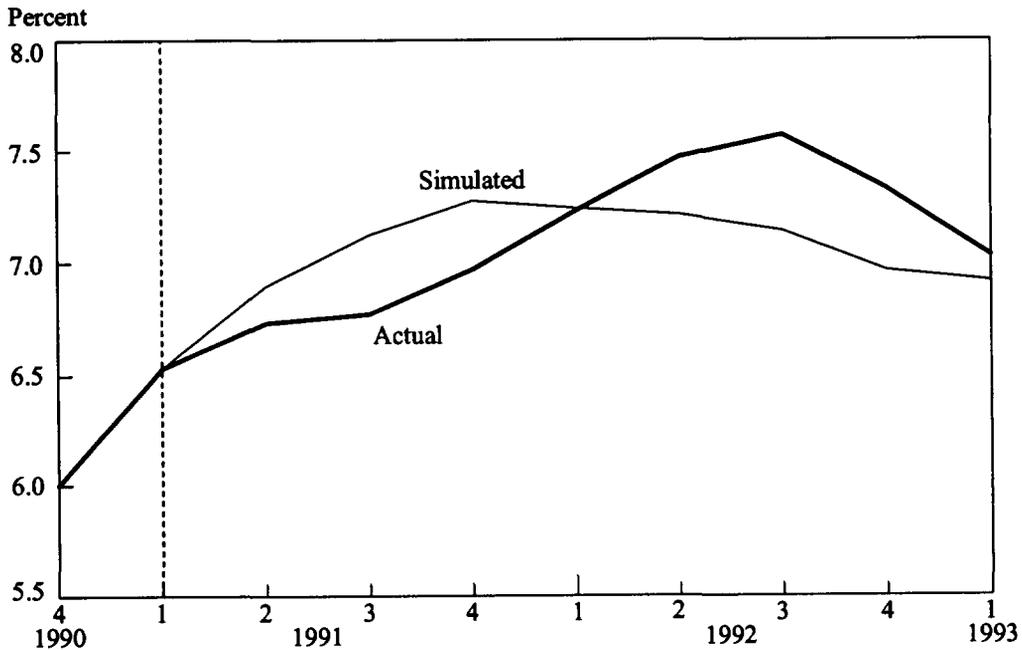
Together, the long-run and short-run results indicate that both restructuring and sluggish output growth have played roles in explaining sluggish employment growth. After accounting for trends in the data, the short-run effect of output on employment in the current recovery was similar to that in previous recoveries. In addition, evidence suggests trend productivity growth has increased in the current recovery. A possible cause of this productivity increase is business restructuring.

CONCLUSIONS

Employment growth in the current economic recovery has been unusually sluggish. One explanation is that businesses have restructured to increase productivity and rely less heavily on labor. Another explanation is that sluggish employment growth simply reflects sluggish growth of real output.

Evidence presented in this article shows that sluggish employment growth in the current recovery is consistent with sluggish output growth

Chart 7

Actual and Simulated Unemployment Rates

Percent

[Chart showing actual and simulated unemployment rates from 1990 to 1993, with y-axis values 5.5, 6.0, 6.5, 7.0, 7.5, 8.0. Two curves labeled "Simulated" and "Actual". X-axis shows quarters 4 (1990), 1, 2, 3, 4 (1991), 1, 2, 3, 4 (1992), 1 (1993).]

Note: Simulated unemployment is based on the regression analysis described in the appendix.

and an increase in long-run productivity growth. If business restructuring is responsible for the increase in productivity, then both explanations for slow job growth have merit.

These findings have important policy implications. In the short run, monetary and fiscal policies that increase output will likely have the same proportional effect on employment as in the past. In the long run, the estimated increase in productivity growth potentially implies faster long-run growth for both employment and output in the future. If so, a faster rate of nominal GDP growth than in the past may be consistent with price stability.

APPENDIX

This appendix describes the procedure used in estimating long-run trends in the data and short-run cyclical relationships between each component of the output-employment identity and real GDP. The procedure is a variation of the approach used by Gordon (1984). Each component on the right side of the identity was regressed on eight 0-1 dummy variables, four lagged values of the dependent variable, and current and four lagged values of real GDP. The specific equations were as follows:

$$y_{it} = \sum_{p=1}^{8} a_{ip}D_{ip} + \sum_{s=1}^{4} b_{is}y_{t-s} + \sum_{s=0}^{4} c_{is}q_{t-s} + u_{it} \, ,$$

where y_{it} represents each of the seven right-hand-side components of the output-employment identity, D_{ip} is a vector of dummy variables, q_{t-s} represents real GDP, and u_{it} represents a zero mean, finite variance error term. All variables, except the dummies, were measured as annualized quarterly growth rates (400 times first differences in logs).

A different 0-1 dummy variable, D_{ip}, was included for each of the seven benchmark periods, p, defined in the text. An additional dummy variable was included for the period from 1990:Q4 to 1993:Q1 (where no final benchmark could be determined). The dummy variables allow for trend shifts in the data. Following Okun and Clark (1984), trend GDP growth was estimated using the employment rate equation ($i = 1$), under the assumption that the employment rate is constant when real GDP is growing at trend. Thus, for each period, trend GDP growth is as follows:

$$q_P^T = \frac{-a_{1p}}{\sum_{s=0}^{4} c_{1s}} \, ,$$

where q_P^T represents trend GDP growth in bench-mark period p, and the 1 subscript references the employment rate equation.

Given estimates for trend GDP and the assumption that the full employment rate remains constant between benchmark dates, trends in the right-hand-side components of the output-employment identity can be estimated as follows:

$$y_{ip}^T = \frac{a_{ip} + (\sum_{s=0}^{4} c_{is}) \, q_p^T}{1 - \sum_{s=1}^{4} b_{is}} \, ,$$

where i equals 2 to 7, and y_{ip}^T is the trend growth rate for benchmark period p of the ith component of the output-employment identity. The trend employment rate, y_1^T, is assumed to remain constant within benchmark periods.

Table A1 gives the coefficient estimates and summary statistics for the equations explaining each of the seven components of the output-employment identity. The table also gives the long-run elasticity of each component with respect to output. The elasticity, which is also reported in Table 3 of the text, is calculated as:

$$\frac{\sum_{s=0}^{4} c_{is}}{1 - \sum_{s=1}^{4} b_{is}} \, .$$

These elasticities do not add up exactly to one because of the lagged dependent variables that were included in the regressions to correct for serial correlation.

Table A2 gives the calculated trends for each component of the identity for each period. These estimates are close to the actual growth rates between benchmarks reported in Table 2 in the text. Because of the lagged dependent variables

Table A1

Regression Equations for Components of GDP Identity
1949:Q2 - 1993:Q1

Independent variable	Lag length	Dependent variable (growth rates)						
		Employment rate	Output per hour	Participation rate	Average hours	Population	Output mix	Employment mix
Intercept terms:								
1949:Q2-1953:Q4		-2.81**	2.88**	-.73	-1.30**	.61**	1.91**	-1.09*
1954:Q1-1957:Q3		-1.60**	2.00**	.34	-.44	.74**	-.23	-1.56**
1957:Q4-1960:Q1		-1.82**	2.30**	-.82	-.60	.96**	.40	-1.19*
1960:Q2-1970:Q3		-2.09**	2.36**	-.17	-1.38**	.98**	.66	-1.39**
1970:Q4-1974Q:2		-2.04**	1.52*	.08	-.75	1.39**	.18	-1.80**
1974:Q3-1979:Q2		-1.81**	.95	.65	-1.08**	1.14**	.25	-1.19**
1979:Q3-1990:Q3		-1.29**	.54	.24	-.48	.74**	.35	-.86**
1990:Q4-1993:Q1		-1.19**	1.32	-.24	-.78	.55**	.55	-.80
Lagged dependent variable	1	.18*	.02	-.11	-.05	.38**	-.02	-.05
	2	-.14	-.07	-.10	-.14	.10	-.01	-.06
	3	-.18*	-.11	-.13	.04	-.04	-.17*	.00
	4	-.06	-.03	.04	-.07	-.02	-.03	.01
Real GDP growth	0	.23**	.56**	-.01	.15**	.01	-.15**	.20**
	1	.12**	-.20**	.07*	.00	-.01	-.10*	.10**
	2	.09**	-.09	-.05	-.04	-.02*	.02	.15**
	3	.09**	.00	.04	-.05	-.01	-.02	.04
	4	.04	-.14*	.06*	-.01	.01	.06	.02
Addendum:								
Standard error of estimate		.98	2.33	1.33	1.37	.41	1.90	1.69
Sum of real GDP growth coefficients		.57**	.13	.12*	.06	-.03	-.18*	.51**
Long-run effect of a change in real GDP growth		.48	.11	.09	.05	-.05	-.15	.47

* Significant at the 5 percent level.
** Significant at the 1 percent level.

Table A2

Estimated Trends from Regression Equations
1949:Q2 - 1993:Q1

Period	Annualized percent change							
	Real GDP	Employment rate	Output per hour	Participation rate	Average hours	Population	Output mix	Employment mix
1949:Q2-1953:Q4	4.89	.00	2.97	-.13	-.83	.84	.83	1.30
1954:Q1-1957:Q3	2.78	.00	2.00	.51	-.22	1.16	-.60	-.13
1957:Q4-1960:Q1	3.18	.00	2.29	-.34	-.33	1.54	-.14	.40
1960:Q2-1970:Q3	3.64	.00	2.39	.19	-.95	1.55	.00	.44
1970:Q4-1974:Q2	3.55	.00	1.67	.38	-.44	2.28	-.38	.02
1974:Q3-1979:Q2	3.15	.00	1.15	.78	-.73	1.85	-.26	.39
1979:Q3-1990:Q3	2.25	.00	.70	.38	-.28	1.19	-.04	.27
1990:Q4-1993:Q1	2.06	.00	1.34	.00	-.54	.88	.14	.24

in the regressions, the trends for each right-hand-side component of the output-employment identity do not add up exactly to trend GDP growth.

The approach differs in at least one important respect from the approach taken by Gordon (1984). Gordon estimated trends as actual growth rates between benchmark dates. Because a benchmark could not be determined for the last period, Gordon used a cumbersome grid-search method to identify trend growth for the last period. Regressions were then run on the levels of variables defined as deviations from trend. A constant term was used in place of the vector of dummy variables. Gordon's results did not "add up," however, in the sense that the sum of the long-run responses of y_i to q ($i= 1$ to 7) was only 0.6—a "moderately serious problem" (p. 549).

As noted earlier, the approach used in this article was to estimate equations in logged first differences and estimate trends by including a set of dummy variables in each equation. The results come closer to adding up. The sum of the long-run responses to real GDP was 1.01 as reported in Table 3 in the text.

Chart 7 in the text shows that unemployment is well predicted by output in the current recovery. In addition, the employment mix is well predicted. Chart A1 compares the actual behavior of the employment mix in the current recovery with its predicted value based on its historical relationship to real GDP[20]. In the first three quarters of the recovery, the predicted employment mix is close to the actual mix. In the last five quarters of the recovery, however, the predicted mix exceeds actual by as much as 0.5 percentage point. While this prediction error seems large compared with errors from earlier in the recovery, it is not unusual by historical standards.[21] Thus, as with the employment rate, the response of the employment mix to output in the current recovery has not been unusual.

Chart A1

Actual and Simulated Employment Mix

Percent
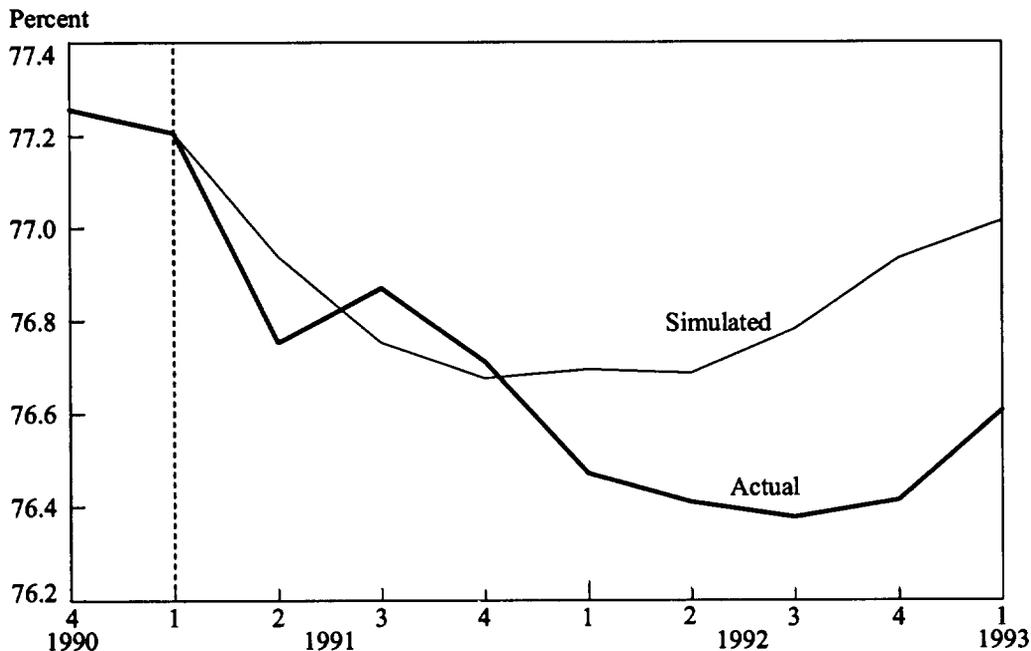
Note: Simulated employment mix is based on the regression analysis described in the appendix.

ENDNOTES

[1] See, for example, Trehan.

[2] Moreover, rising health-care costs may have led some employers to substitute part-time workers—who typically receive little or no health-care benefits—for full-time workers and to employ more overtime hours. The substitution of part-time workers for full-time workers would not, however, be reflected in the employment series used in this article.

[3] Other "third factors" explaining both sluggish output and employment growth are discussed in Meckstroth. They include increases in state and local income taxes, which have reduced consumer spending; overbuilding of commercial offices, shopping centers, and hotels, which has slowed investment spending on new structures; and the adoption of new inventory management techniques, which has reduced the buildup of inventories.

[4] This section draws heavily on Gordon (1984).

[5] Clark (1983) and Gordon (1984) used this identity to study the output-employment relationship.

[6] The 1981 recovery was excluded because it did not last eight quarters.

[7] The decline in the employment mix was even greater according to the unrevised data on payroll employment. According to data available before June 1993, the employment mix declined at a 0.55 percent annual rate.

[8] Two factors may underlie the decline in private nonfarm payrolls relative to total employment. First, the decline in the employment mix may simply reflect statistical discrepancies between the two labor market surveys. For example,

the BLS has to adjust data from the establishment survey to account for jobs created by new firms. If more jobs were created by new firms in the current recovery than in past recoveries, the adjustment procedure might tend to understate recent job growth in the nonfarm business sector. Second and more fundamentally, the decline in the employment mix may reflect a greater adjustment of employment in the private sector than in the public sector to structural changes. For example, the private sector may have been more aggressive in controlling costs through reductions in its work force than the public sector.

9 Okun's Law can also be applied looking across recoveries under the assumption of no change in trend output growth. For example, real GDP growth was 3.4 percentage points slower in the 1991-93 recovery than in the 1982-84 recovery. Therefore, according to the 2 to 1 ratio from the revised Okun's Law and assuming no change in trend growth, employment growth should have slowed in the current recovery by one-half of 3.4 percentage points, or 1.7 percentage points. The actual slowdown of 2.1 percentage points was only a little greater than expected. Thus, the decline in the employment rate from the previous recovery to the current recovery was close to what might be expected based on Okun's Law.

10 Trends are estimated between "benchmark" quarters in which the economy was operating at or near full employment. The benchmarks from 1949 to 1974 are the same as in Gordon 1984. However, the 1979 benchmark was moved back from the third quarter to the second quarter because of data revisions since Gordon's study. Benchmarks after 1979 were estimated using Gordon's (1984) methodology and his 1990 series for the "no shock" natural unemployment rate. This series represents the unemployment rate at which there is no tendency for inflation to increase or decrease. It can be thought of as a measure of "full" employment. Gordon's series for the natural rate ends in 1989:Q2. As a result, from 1989:Q2 to 1993:Q1, the natural rate was assumed to remain unchanged at 6.0 percent.

The actual unemployment rate fluctuates around the natural unemployment rate, falling below the natural rate as the economy moves toward a business cycle peak and rising above the natural rate as the economy slips into recession. Thus in each business cycle, the actual unemployment rate corresponds to the natural rate at two different points in time. To generate one benchmark for each business cycle, the second crossing point is used as the benchmark quarter. Following Gordon, benchmarks were chosen as the quarter before the quarter when the actual unemployment rate was closest to the natural rate. Choosing the benchmarks in this way allows for lags in the adjustment of unemployment to the rapid decreases in GDP that are typical at the beginning of

recessions. The specific benchmark quarters are 1953:Q4, 1957:Q3, 1960:Q1, 1970:Q3, 1974:Q2, 1979:Q2, and 1990:Q3. The current business cycle has no benchmark associated with it because the economy has not yet returned to its natural unemployment rate.

11 But it is not necessarily consistent with the view that firms are substituting away from labor over the long run. For example, the pickup in productivity growth is accompanied by an assumed constant trend employment rate. With only eight quarters of data in the current recovery with which to identify new trends, however, these estimates must be viewed with a healthy dose of skepticism. Moreover, because the trend shifts between the last benchmark period and the current recovery are statistically small, they should be viewed as merely suggestive.

12 Strictly speaking, trend shifts and short-term relationships are estimated simultaneously.

13 Strictly speaking, a 1 percent increase in the *growth* rate of real GDP was associated with a 0.48 percent increase in the *growth* of the employment rate. For expository ease, the text describes relationships between the levels of variables rather than the growth rates of variables. But estimated responses come from regressions estimated in first differences of logs, as described in the appendix.

14 Unlike simple rules of thumb, however, the estimated response comes from a statistical relationship that allows employment to adjust sluggishly to output. The relationship also allows the employment response to differ across recoveries, at least to the extent that output behaves differently in each recovery.

15 It is not surprising that the adult population does not vary cyclically. Other components perhaps have a smaller-than-expected cyclical component.

16 As explained in the appendix, the long-run responses do not add up exactly to 100 percent because of the presence of lagged dependent variables in the regressions.

17 The employment rate-output equation described in the appendix was simulated dynamically, in sample, from 1991:Q2 to 1993:Q1. Actual growth in real GDP was plugged into the right-hand side of the equation. Forecast growth rates of the employment rate were converted to levels, based on the actual employment rate in 1991:Q1. The forecast employment rates were then converted to unemployment rates. A similar procedure was followed to generate forecasts in each of the earlier recoveries (not shown). Forecast errors from the current recovery were then compared with errors from the earlier recoveries.

[18] Moreover, the prediction errors were not unlike those in previous recoveries. The root mean square error (RMSE), a measure of predictive power, was 0.28 in the current recovery. In previous recoveries the RMSE ranged from 0.12 to 0.57.

[19] As shown in the appendix, the other major contributor to output in the output-employment identity—the employment mix—was also unchanged. While the relationship between the employment mix and output is not nearly as tight as the relationship between the employment rate and output, the employment mix-output relationship appears to have held up fairly well in the current recovery. This is perhaps somewhat surprising in light of the unusual recent behavior of the employment mix.

[20] The procedure for simulating the employment mix-output relationship was similar to the one used for the employment rate-output relationship. The employment mix equation is described in Table A1 of the appendix.

[21] The root mean square prediction error in the current recovery was 0.31, compared with a range of 0.21 to 0.71 in seven previous recoveries.

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