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# RETROSPECTIVE ON THE 1970s PRODUCTIVITY SLOWDOWN

William Nordhaus

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**ABSTRACT**

The present study analyzes the "productivity slowdown" of the 1970s. The study also develops a new data set – industrial data available back to 1948 – as well as a new set of tools for decomposing changes in productivity growth. The major result of this study is that the productivity slowdown of the 1970s has survived three decades of scrutiny, conceptual refinements, and data revisions. The slowdown was primarily centered in those sectors that were most energy-intensive, were hardest hit by the energy shocks of the 1970s, and therefore had large output declines. In a sense, the energy shocks were the earthquake, and the industries with the largest slowdown were near the epicenter of the tectonic shifts in the economy.

William Nordhaus
Yale University, Department of Economics
28 Hillhouse Avenue
Box 208264
New Haven, CT 06520-8264
and NBER
william.nordhaus@yale.edu

The sources of the productivity slowdown in the 1970s have been a long-running thriller in macroeconomics and policy studies. It is widely accepted that the rapid productivity growth of the postwar period ended sometime around 1973. It was followed by a dismal productivity record and accompanying stagnation in real incomes until the mid-1990s, at which point productivity rebounded sharply.

The present paper returns to that episode in the spirit of economic archaeology. The first section puts the 1970s slowdown in historical context by asking whether the slowdown is "unusual" by historical standards. The second section introduces a new data set on industrial value-added data and then uses that new data set to help understand the sources of the slowdown by industry and by composition shift.

## I. Was the Productivity Slowdown of the 1970s an Unusual Event?

The first question addressed is whether the productivity slowdown of the 1970s was historically unusual. In other words, were the magnitude and duration of the slowdown something that was frequently seen in the historical record?

In answering this question, I turn to long-term data on productivity growth for the United States. The most appropriate data for such comparisons are data on productivity per hour in the non-farm sector, which are available back to 1889. There are some serious concerns about the historical comparability of these data, which are spliced together from a variety of sources. The major concern is that the data before 1947 are based on fixed-year-weighted output data, while that since 1947 uses the new chain-weighted indexes. Additionally, early data also have different source data and use different price indexes (or input indexes) to measure real output in several sectors.

A second issue concerns the appropriate technique for comparing contemporaneous and past productivity slowdowns. The approach used here is to consider periods of slowdown of different lengths – from 5 to 20 years – and to determine how many slowdowns of that magnitude occurred during the period 1889-2004. More precisely, I construct dummy variables that were 0 outside of the slowdown period and 1 in the slowdown period. I constructed a set of rolling dummy variables beginning in 1889 for lengths of 5, 10, 15, and 20 years. Note that these tests attempt to measure the deviation of productivity growth from its 1889-2004 trend.

It is tempting to perform statistical significance tests on these series. However, it is clear that the underlying series have non-stationary variances, are not normally distributed, and are inappropriate for standard tests because of the overlapping samples. The best approach is probably to examine the pattern of results.

Figure 1 shows the plots of the coefficients on the rolling dummy variables in the rolling regressions. The productivity slowdown of the 1970s is not unusual, but it is also not unique at any frequency. The 1970s is, however, dramatically different from periods since World War II – a period when the data are surely more reliable. We can also use these graphs to ask whether the productivity resurgence after 1995 was particularly unusual. For most of the time windows, the latest observations barely make it back to the trend line. Hence, the latest productivity rebound since 1995 should be characterized as return toward normal rather than as unusually high.

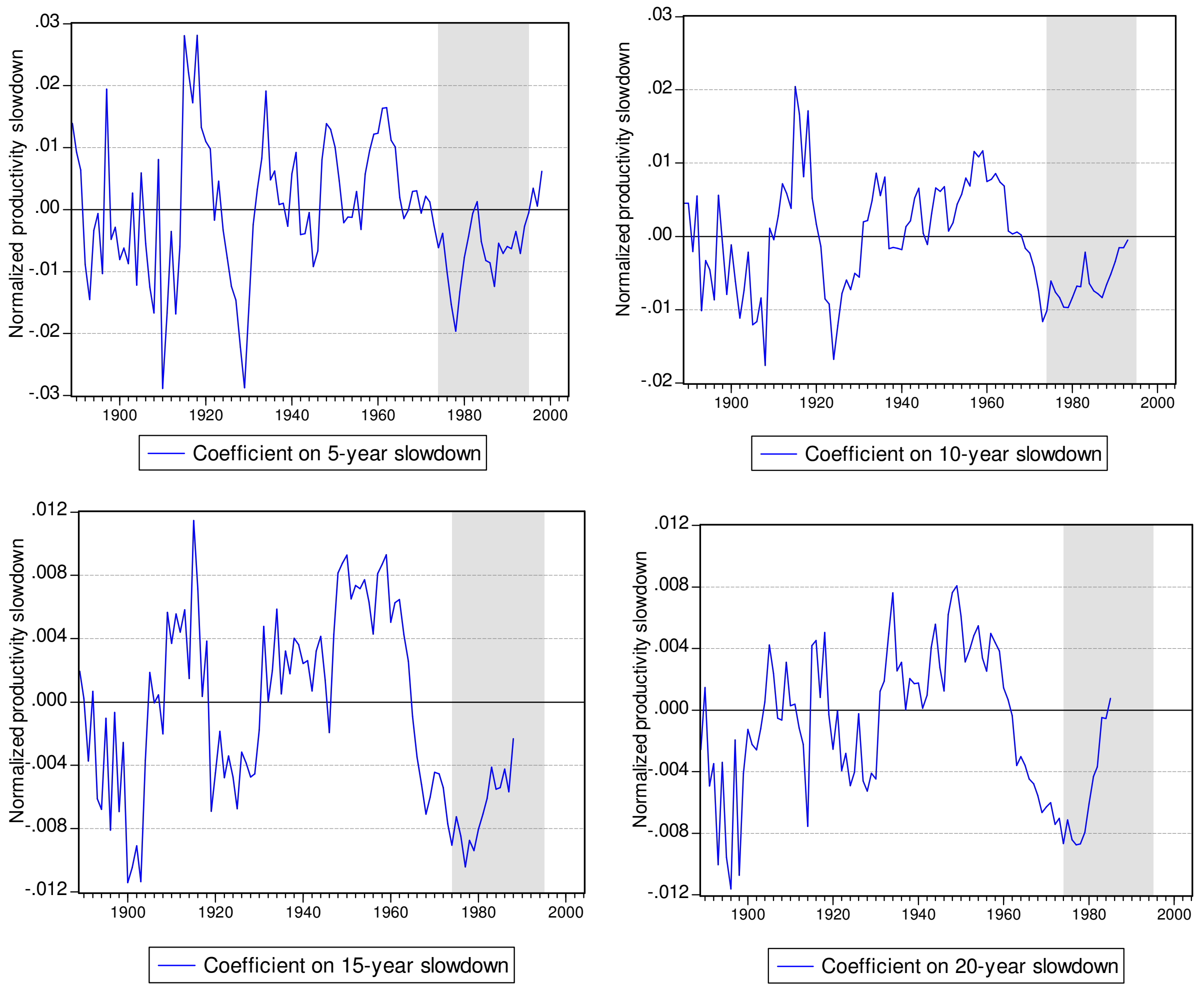


**Figure 1. Coefficients on Rolling Regressions**

This figure shows the coefficients on dummy variables of differing lengths in rolling regressions for the period 1889-2004. For example, the rolling regression of the growth in labor productivity on a constant and a 5-year dummy variable beginning in 1978 has a coefficient of -0.020, indicating an estimated deceleration of 2.0 percentage points.

One tricky issue concerns the dating of the productivity slowdown. Table 1 shows the dates of the maximum slowdown according to the length of the window: The different windows provide slightly different answers as to the inception of the slowdown, ranging from 1973 to 1978, with the end-point being from 1982 to 1996 depending on window length.

| Window length | Period of Slowdown and Midpoint |
|---|---|
| 5 year | 1978-1982 (1980) |
| 10-year | 1973-1982 (1977-78) |
| 15-year | 1977-1992 (1984) |
| 20-year | 1977-1996 (1986-87) |

**Table 1. Period Of Slowdown For Different Window Lengths**

The table shows the period in which the slowdown is largest for different window lengths. For example, for a 5-year window, the slowdown is largest for the 1978-82 period, centered on 1980.

Table 2 shows how the 1970s slowdown ranks in terms of other periods of slowdowns. By any standards, the 1970s slowdown was unusual but not unique. It ranks between fourth and sixth of slowdowns over the 1889-2004 period. For the longer period windows, the productivity slowdown that began around 1900 was slightly larger than the one that began in the 1970s. On the other hand, there was nothing remotely as large a slowdown in the period since World War II.

In summary, the productivity slowdown of the 1970s does appear to be a major distinguishing feature of the last century. At long frequencies (more than a decade), it is one of two major productivity slowdowns of the last century. At all frequencies, it is a major outlier for the period since World War II.

| Length of slowdown window | Rank of 1970s slowdown period and beginning year | Years with slowdowns larger than 1970s |
|---|---|---|
| 5 years | 4 (1979) | 1910, 1929, 1928 |
| 10 years | 6 (1973) | 1908, 1924, 1925, 1905, 1906 |
| 15 years | 4 (1977) | 1900, 1903, 1901 |
| 20 years | 5 (1977) | 1896, 1898, 1893, 1995 |

**Table 2. Ranking of 1970s Productivity Slowdown among Historical Slowdowns Since 1889**

Table shows the rank of the 1970s productivity slowdown relative to other slowdown periods. The 1970s was unusual but not unique in terms of other slowdown periods of the 1889-2004 period.

## II. A Closer Look at the Productivity Slowdown

In this section, I focus an analytical and empirical microscope on the 1970s productivity slowdown. The occasion for this analysis is the development of a new set of detailed industrial accounts that have been extended back to 1948. These data, which are described in the Appendix, comprise an integrated set of accounts that aggregate to total GDP. The purpose of this exercise is to identify alternative ways of measuring productivity and to determining the detailed sources of the 1970s slowdown.

A. <u>Analytical Measures of Productivity Growth</u>

To begin with, I summarize alternative approaches to measuring productivity growth. The customary approach to measuring productivity growth is (a) the *difference of growth rates approach*. This defines productivity growth as the difference between the growth rate of output and the growth rate of inputs. In a companion paper, I showed that this is not an appropriate welfare-theoretic measure of productivity growth. I proposed two alternative measures: (b) a *welfare-theoretic measure*, which is defined as the current-weighted average of productivity growth where the weights are the shares of nominal output and (c) a *fixed-weight measure,* which has the same basic construction as the welfare-theoretic measure except that it uses nominal output weights of a given year. The difference between (b) and (c) is a complex set of factors including a *Baumol effect*, that captures the impact of changing shares of nominal output.

We can summarize the earlier work in terms of a decomposition equation for the growth in productivity:

$$(1) \qquad g(A_t) = \sum_i g(A_{it})\sigma_{i0} + \sum_i g(A_{it}) [\sigma_{it} - \sigma_{i0}] + \sum_i g(S_{it})[\sigma_{it} - w_{it}]$$

where $g(A_t)$ is the growth of total output per unit total input, $g(A_{it})$ is the growth of output per unit input in industry i, $\sigma_{i0}$ is the share of industry output in total nominal output in the base period, $[\sigma_{it} - \sigma_{i0}]$ is the difference between the current share and the base-period share of nominal output of industry i, and $(\sigma_{it} - w_{it})$ is the difference between the share of nominal output and of inputs in industry i. The first term in equation (1) is the fixed-weight measure of productivity growth, the second term is the Baumol effect, and the third is a set of factors I have called the Denison effect, which captures the effect of different levels of industry productivity on total productivity. The first two terms of equation (1) are the welfare-theoretic measure of productivity.

B. A New Data Set for Industrial Output, 1948-2001

At present, comprehensive industrial data for the United States are limited to recent years. Before the most recent revision, the U.S. Bureau of Economic Analysis (BEA) published detailed industrial data on quantity and price indexes for major industries for two subperiods, 1977-1987 and 1987-2001. The present author and Alexandra Miltner have developed an approach that uses earlier fixed-weight data by industry to produce a comparable set of data for the period starting in 1948. The derivation of the data is explained in the Appendix.

Three further adjustments have been made for the present study. First, the aggregates have been adjusted to be equal to the latest hours and output data (as of late October 2004). Second, the income side industrial data differ from the output side data by the statistical discrepancy; for this analysis, I have controlled real and nominal GDP to equal the average of the income and output side aggregates. Third, I have substituted Tornqvist indexes for Fisher indexes in constructing aggregates. This approach ensures that there is no aggregation bias as would occur with Fisher indexes; that is, the aggregate indexes are always the same independent of how they are derived from different subindexes.

Availability of the industrial data allows us to extend analyses of productivity to include the period before the productivity slowdown of the 1970s and to develop a decomposition of the slowdown by industry. Unfortunately, because BEA has shifted from the earlier SIC industrial classification to the NAICS system, the detailed industrial data have been discontinued, the NAICS data go back only to 1998, and it is virtually impossible for private scholars to map the SIC into the NAICS system. Therefore, it is unlikely that a continuous series on industrial output can be developed beyond 2001.

One useful comparison is between the data developed here and the business productivity data generated by the Bureau of Labor Statistics (BLS). Figure 2 shows annual productivity growth for the business sector using the new income-side data set and BEA's hours data as compared with the standard productivity growth rate from the BLS, while Table 3 shows averages for the major subperiods. The overall pattern is similar, but cyclical movements differ.

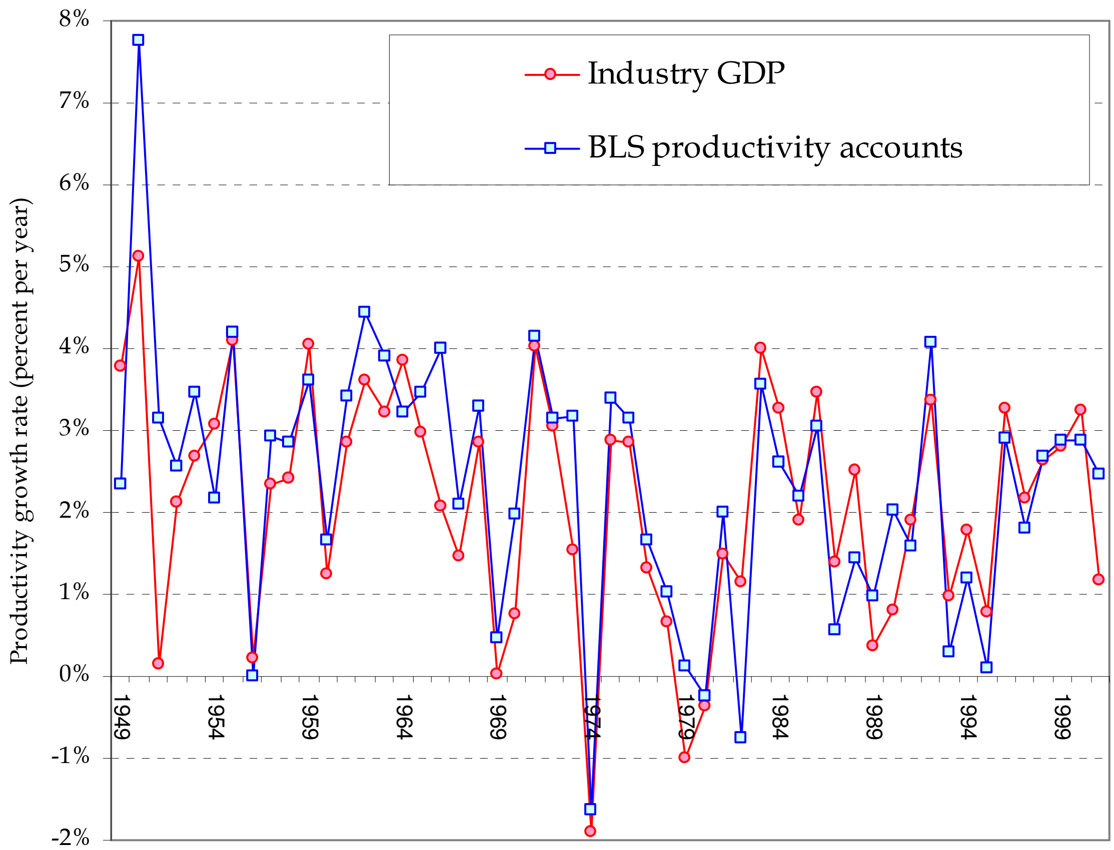


**Figure 2. Comparison of Productivity Growth for Business Sector using BLS and Income-Side Output Data**

| **Business** | (1) 1948-59 | (2) 1959-73 | (3) 1973-95 | (4) 1995-2001 | (3) - (2) Slowdown | (4) - (3) Rebound | 1948-2001 |
|---|---|---|---|---|---|---|---|
| Total Productivity Growth | | | | | | | |
| BLS | 3.18% | 3.03% | 1.47% | 2.61% | -1.56% | 1.14% | 2.37% |
| Industry output | 2.76% | 2.42% | 1.38% | 2.50% | -1.04% | 1.13% | 2.06% |

Table 3. Comparison of Industry Productivity and BLS productivity for business sector

C. Analysis of the 1970s Productivity Slowdown

Using the new data set and the techniques described in section A above, we can examine the productivity slowdown using different concepts. Table 4 shows the alternative measures for the overall economy, the private sector, the business economy, and for what I have defined as "well-measured output," or WMO.[1] The major results of this analysis are the following:

1. *Industry v. BLS estimates*. I first compare labor productivity measures under the current (income-side) aggregate as compared to the standard (product-side) measure used by the Bureau of Labor Statistics. For the business sector, average productivity growth was 2.37 percent per year compared to 2.06 percent per year for the adjusted industry data. The productivity slowdown is somewhat larger in the BLS data than in our industry data, but the post-1995 rebound is virtually identical. I have been unable to reconcile the two measures, but it appears that the differing estimates on hours worked are the major source of the discrepancy.

[1] Based on discussions with experts at the Bureau of Economic Analysis, I have constructed a new measure of output for sectors that have relatively well-measured outputs. The sectors included in well-measured output are primarily Agriculture, forestry, and fishing, Mining, Manufacturing, Transportation and public utilities, Wholesale trade, Retail trade, and some services. These sectors are composed largely of well-defined and relatively simple goods or services.

2. *Slowdown by sector*. The productivity slowdown can be seen in each of the sectors (GDP, business, private, business, and well-measured). Table 4 shows total productivity growth, the welfare concept, and composition effects for each of the four sectoral aggregates. For total productivity growth, the slowdown ranges from 0.86 percent per year for total GDP to 1.15 percent per year for the private sector.

3. *Composition effects*. Composition effects are equal to the difference between the traditional measure of productivity growth and output-weighted productivity growth (i. e., the welfare measure). Compositional effects are uniformly negative for the productivity slowdown period. For total output, the slowdown of 0.86 percentage points is 0.69 percentage points from the welfare-theoretical concept and 0.17 percentage points of composition effects. In all cases, the composition effect is a small fraction of the total productivity slowdown.

4. *Baumol and Denison effects*. Table 5 shows a breakdown of composition effects derived in equation (1). The fixed-weight effects are calculated by taking output shares for the first period of each subperiod (i.e., for 1959 for the 1959-73 subperiod). The Baumol effect is the difference between the current-weighted and the fixed-weighted growth rates of productivity. The Denison effect, as defined above, reflects the interaction of differing shares of input and output

growth and input growth.

The Baumol effect is uniformly negative for both concepts and all subperiods. However, it contributed little to the productivity slowdown. It had an effect of about -10 basis points per year for total GDP, but has a zero effect for well-measured output. Overall, the Baumol effect subtracted about one-eighth of a percentage point from productivity growth over the entire period.

The Denison effect was generally small and negative, but in the last period it made a positive contribution to aggregate productivity growth. The large Denison effect in the rebound period for GDP was primarily due to a major contribution of the non-farm housing sector (which explains the difference between the two sectors in Table 5).

5. *Measurement issues.* Estimates of productivity growth have been dogged by measurement issues. We can look at our measure of productivity growth for well-measured output to get a more accurate measure of the general trend in productivity growth. This sector shows a consistently higher rate of productivity growth than do the other concepts. Over the entire period from 1948 to 2001, for the total productivity output concept, WMO has a welfare productivity growth of 2.72 percent per year as compared to 2.12 percent per year for the business

sector or 1.84 for total GDP. The differences are due to the poor measured productivity performance in many (poorly measured) service and finance sectors. However, the magnitude of the productivity slowdown is virtually identical in the business sector and in well-measured sector.

6. *The productivity rebound*. One of the major questions that can be addressed is whether productivity growth in the rebound period after 1995 has returned to the pace of productivity growth before 1973. In most aggregates, the positive rebound since 1995 has been approximately the same size as the negative slowdown. For the entire economy, productivity growth in the 1995-2001 period was 1.94 percentage points per year as compared to 2.10 percentage points per year in the 1959-73 period. In the business and well-measured sectors, productivity growth in the rebound period was slightly higher than in the pre-slowdown period.

| **Gross domestic product** | (1) 1948-59 | (2) 1959-73 | (3) 1973-95 | (4) 1995-2001 | (3) - (2) Slowdown | (4) - (3) Rebound | 1948-2001 |
|---|---|---|---|---|---|---|---|
| Total Productivity Growth | 2.34% | 2.10% | 1.24% | 1.94% | -0.86% | 0.69% | 1.78% |
| Welfare Productivity Growth | 2.36% | 2.18% | 1.48% | 1.42% | -0.69% | -0.07% | 1.84% |
| Composition Effects | -0.02% | -0.07% | -0.24% | 0.52% | -0.17% | 0.76% | -0.07% |

| **Private GDP** | (1) 1948-59 | (2) 1959-73 | (3) 1973-95 | (4) 1995-2001 | (3) - (2) Slowdown | (4) - (3) Rebound | 1948-2001 |
|---|---|---|---|---|---|---|---|
| Total Productivity Growth | 2.89% | 2.47% | 1.32% | 2.10% | -1.15% | 0.78% | 2.04% |
| Welfare Productivity Growth | 2.72% | 2.44% | 1.55% | 1.47% | -0.88% | -0.08% | 2.02% |
| Composition Effects | 0.17% | 0.03% | -0.23% | 0.63% | -0.26% | 0.86% | 0.02% |

| **Well-measured industries** | (1) 1948-59 | (2) 1959-73 | (3) 1973-95 | (4) 1995-2001 | (3) - (2) Slowdown | (4) - (3) Rebound | 1948-2001 |
|---|---|---|---|---|---|---|---|
| Total Productivity Growth | 3.00% | 2.99% | 2.01% | 3.08% | -0.99% | 1.07% | 2.59% |
| Welfare Productivity Growth | 3.02% | 3.09% | 2.17% | 3.29% | -0.92% | 1.12% | 2.72% |
| Composition Effects | -0.02% | -0.10% | -0.17% | -0.21% | -0.07% | -0.04% | -0.12% |

| **Business** | (1) 1948-59 | (2) 1959-73 | (3) 1973-95 | (4) 1995-2001 | (3) - (2) Slowdown | (4) - (3) Rebound | 1948-2001 |
|---|---|---|---|---|---|---|---|
| Total Productivity Growth | 2.76% | 2.42% | 1.38% | 2.50% | -1.04% | 1.13% | 2.06% |
| Welfare Productivity Growth | 2.73% | 2.39% | 1.53% | 2.55% | -0.87% | 1.02% | 2.12% |
| Composition Effects | 0.03% | 0.02% | -0.15% | -0.05% | -0.17% | 0.10% | -0.06% |

Table 4. Basic Results on Productivity Slowdown for Different Periods and Industry Groupings, 1948-2001

| Gross domestic product | (1) 1948-59 | (2) 1959-73 | (3) 1973-95 | (4) 1995-2001 | (3) - (2) Slowdown | (4) - (3) Rebound | 1948-2001 |
|---|---|---|---|---|---|---|---|
| Total Productivity Growth | 2.34% | 2.10% | 1.24% | 1.94% | -0.86% | 0.69% | 1.78% |
| Welfare productivity growth | 2.36% | 2.18% | 1.48% | 1.42% | -0.69% | -0.07% | 1.84% |
| Fixed weight | 2.42% | 2.29% | 1.70% | 1.43% | -0.60% | -0.27% | 1.97% |
| Baumol | -0.06% | -0.11% | -0.21% | -0.01% | -0.10% | 0.20% | -0.13% |
| Denison effect | -0.02% | -0.07% | -0.24% | 0.52% | -0.17% | 0.76% | -0.07% |

| Well-measured industries | (1) 1948-59 | (2) 1959-73 | (3) 1973-95 | (4) 1995-2001 | (3) - (2) Slowdown | (4) - (3) Rebound | 1948-2001 |
|---|---|---|---|---|---|---|---|
| Total Productivity Growth | 3.00% | 2.99% | 2.01% | 3.08% | -0.99% | 1.07% | 2.59% |
| Welfare productivity growth | 3.02% | 3.09% | 2.17% | 3.29% | -0.92% | 1.12% | 2.72% |
| Fixed weight | 3.08% | 3.14% | 2.38% | 3.35% | -0.76% | 0.97% | 2.84% |
| Baumol | -0.06% | -0.05% | -0.21% | -0.07% | 0.00% | 0.14% | -0.12% |
| Denison effect | -0.02% | -0.10% | -0.16% | -0.21% | -0.07% | -0.04% | -0.12% |

**Table 5. Composition Effects for GDP And Well-Measured Output, 1948-2001**

C. Decomposition of the Sources of the 1970s Slowdown

A final way to slice up the 1970s productivity slowdown is to examine its composition by industry. For this purpose, return to equation (1) above. We can rewrite this as:

$$(2) \qquad g^{W}(A_t) = \sum_{i} g(A_{it})\sigma_{it}$$

where $g^{W}(A_t)$ is the welfare measure of productivity growth. We can readily decompose this into industry compositions of growth, which is defined as:

$$(3) \qquad g_i^{W}(A_t) = g(A_{it})\sigma_{it}$$

where $g_i^{W}(A_t)$ is the contribution of industry i to the overall productivity growth rate and is easily calculated as productivity growth weighted by the nominal share of output. We then calculate the contribution of each industry to the productivity slowdown by taking the term on the right-hand side of (3). (Alternatively, we might decompose using fixed shares; that approach makes little practical difference and has the disadvantage of not summing to the welfare total.)

It will be useful to examine those industries that experienced the largest productivity slowdown according to the new data set. Figure 3 shows the 12 industries with the highest productivity deceleration from 1959-73 to 1973-95. Industries affected by the energy crisis of the 1970s (pipelines, oil extraction, electric and other utilities, motor vehicles, and air transportation) make up half of the cases. The other cases are grab bag of cases, including some that are probably simply measurement error.

Another important feature of those industries with a large slowdown is that they also had a large decline in output growth. Real GDP grew 1.3 percentage points per year slower in the 1973-95 period compared to the 1959-73 period. The twelve industries shown in Figure 3 showed a decline in real output growth averaging 5.1 percentage points. This suggests that at least part of the productivity slowdown stemmed from slower output growth in industries characterized by economies of scale.

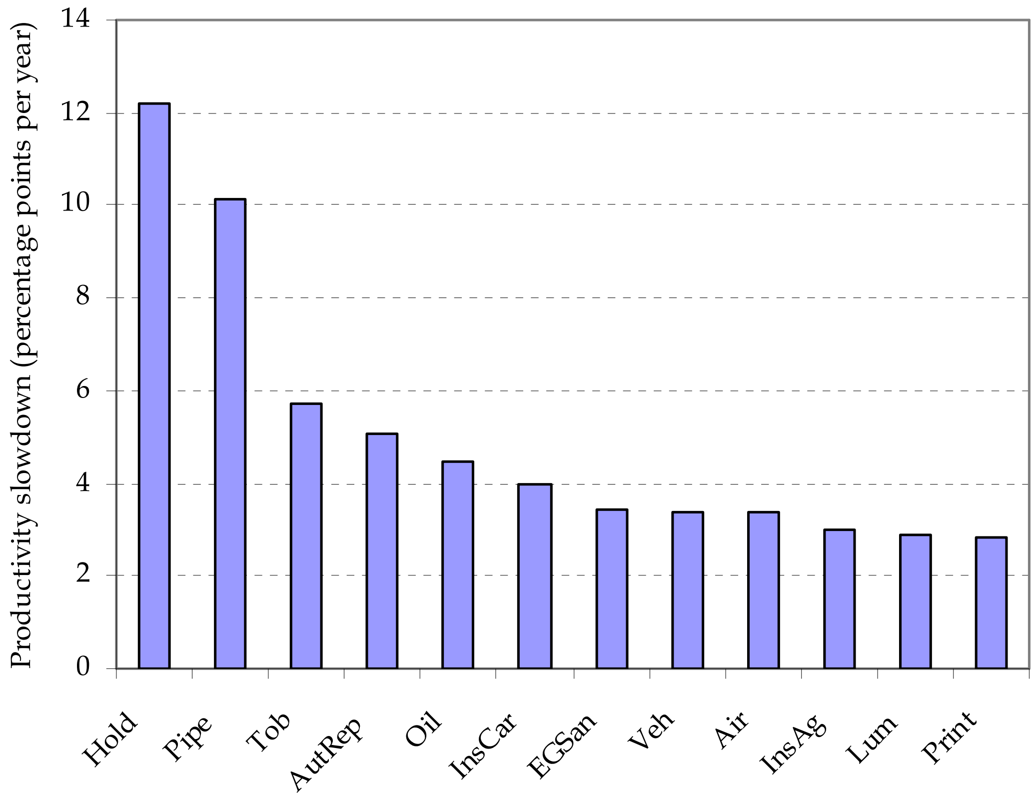


**Figure 3. Industries with Largest Declines In Productivity Growth From 1959-73 To 1973-95.** Figure shows the change in the average logarithmic rate of productivity growth (or the change between periods)

Key to labels in Figure 3:

| | |
|---|---|
| Hold | Holding and other investment offices |
| Pipe | Pipelines, except natural gas |
| Tob | Tobacco products |
| AutRep | Auto repair, services, and parking |
| Oil | Oil and gas extraction |
| InsCar | Insurance carriers |
| EGSan | Electric, gas, and sanitary services |
| Veh | Motor vehicles and equipment |
| Air | Transportation by air |
| InsAg | Insurance agents, brokers, and service |
| Lum | Lumber and wood products |
| Print | Printing and publishing |

We can further decompose the productivity slowdown by looking at how much individual industries contributed to the slowdown. For this calculation, we use equation (3) above, which weights productivity growth in each industry by its share in nominal output. For this purpose, I use current output weights, as in the welfare measure. As shown in Table 6, the major contributors were oil and gas extraction, motor vehicles, utilities, health, and farms. The one factor that is common among many of the industries experiencing a slowdown was exposure to the energy shocks of the 1970s.

| **Industry** | **Contribution of industry to change** [Percentage point per year, fixed weights, 1959-96] | | | | | |
|---|---|---|---|---|---|---|
| | **1948-59** | **1959-73** | **1973-95** | **1995-2001** | **Slowdown** | **Rebound** |
| Oil and gas extraction | 0.036 | 0.054 | -0.028 | -0.033 | **-0.082** | -0.005 |
| Motor vehicles and equipment | 0.099 | 0.094 | 0.013 | 0.017 | **-0.080** | 0.003 |
| Electric, gas, and sanitary services | 0.149 | 0.111 | 0.032 | 0.003 | **-0.079** | -0.029 |
| Health services | 0.013 | 0.006 | -0.071 | -0.030 | **-0.077** | 0.041 |
| Farm | 0.237 | 0.133 | 0.083 | 0.048 | **-0.051** | -0.035 |
| Food and kindred products | 0.109 | 0.107 | 0.058 | -0.060 | **-0.048** | -0.118 |
| Chemicals and allied products | 0.080 | 0.098 | 0.050 | 0.035 | **-0.048** | -0.014 |
| Retail trade | 0.236 | 0.157 | 0.110 | 0.454 | **-0.047** | 0.344 |
| Insurance carriers | 0.002 | 0.024 | -0.019 | 0.010 | **-0.043** | 0.029 |
| Primary metal industries | 0.023 | 0.039 | 0.001 | 0.015 | **-0.038** | 0.014 |
| | | | | | | |
| Total | 2.360 | 2.177 | 1.485 | 1.418 | **-0.692** | -0.066 |

**Table 6. Sources of Productivity Slowdown in Business Sector by Two-Digit Industry**

Finally, we can classify the industries that experienced a slowdown into three categories: those that were associated with the energy crisis (oil extraction, vehicle production, pipelines, etc.); those that have serious measurement problems and for which the slowdown is likely to be poorly measured or due to measurement error (insurance carriers, holding companies, health, and the like); and the remainder which arise from other reasons such as regulatory or environmental issues or just plain old slow innovation (wholesale trade and printing).

Table 7 shows the result of this classification. Of the industries showing a slowdown for the entire economy, two-thirds of the well-measured slowdown originated in energy-related industries, while those industries with measurement error contributed a substantial amount.

| Source of Slowdown | Contribution to Slowdown [percentage points, 1959-73 to 1973-95] |
|---|---|
| **Energy** | |
| Energy related | -0.514% |
| Measurement problems | -0.295% |
| Other slowdown sources | -0.276% |
| **Total** | **-1.085%** |
| **Acceleration** | 0.393% |
| **Total economy-side slowdown** | **-0.692%** |

**Table 7. Source of Slowdown by Ultimate Cause.** This table groups industries with productivity slowdowns by source. Industries associated with the large shocks to the energy sectors of the 1970s were responsible for more than two-thirds of well-measured industries with slowdowns.

Finally, Table 8 looks at total factor productivity (TFP) rather than labor productivity. TFP measures the growth in output per unit of input where inputs are the weighted sum of growth rates of hours and capital stocks. Both are weighted by their shares in total factor income by industry. On the one hand, TFP is conceptually more satisfactory because it includes all the major inputs contributing to value added. TFP is not without its faults, however, for there are no capital stock measures for many industries, and in any case we do not have conceptually adequate measures of capital inputs.

We have total factor productivity measures for two sets of industries: for those denoted as “available,” which include all industries for which BEA provides capital stock data; and for well-measured industries, all of which have capital stock data. The basic results of a comparison of TFP and labor productivity shown in Table 8 are that TFP tends to dampen swings in labor productivity growth. For both sectors for which we can create indexes (available and well-measured industries), the basic patterns are similar between the two productivity concepts. In both, however, the slowdown is reduced by a factor of approximately half, and the rebound is reduced by slightly less than half. The other interesting factor is that TFP growth in the rebound period is higher for both industry concepts than TFP growth in the pre-slowdown period.

| Total Factor Productivity (welfare measure) | (1) 1948-59 | (2) 1959-73 | (3) 1973-95 | (4) 1995-2001 | (3) - (2) Slowdown | (4) - (3) Rebound | 1948-2001 |
|---|---|---|---|---|---|---|---|
| **Available industries** | | | | | | | |
| Labor productivity | 2.69% | 2.27% | 1.34% | 2.28% | -0.94% | 0.94% | 1.97% |
| Total factor productivity | 1.59% | 1.23% | 0.78% | 1.28% | -0.45% | 0.50% | 1.12% |
| **Well-measured industries** | | | | | | | |
| Labor productivity | 3.00% | 2.99% | 2.01% | 3.08% | -0.99% | 1.07% | 2.59% |
| Total factor productivity | 1.71% | 1.83% | 1.32% | 2.09% | -0.51% | 0.76% | 1.62% |

**Table 8. Comparison of Labor Productivity and Total Factor Productivity**

## III. Conclusions

The present study reviews the "productivity slowdown" of the 1970s and 1980s and analyzes major factors involved. The study relies on a new data set – industrial data available back to 1948 – as well as a new set of tools for decomposing changes in productivity growth. The major conclusions are the following.

The first question we ask is whether the productivity slowdown of the 1970s was historically unusual. For this question, the study examines data on productivity per hour in the non-farm sector, which are available back to 1889. A review of the amplitude and duration of productivity growth changes indicates that the productivity slowdown of the 1970s does appear to be a major distinguishing feature of the last century, and particularly of the period since World War II. At all frequencies, it is a major outlier for the period since World War II.

Second, I examine the size and sources of the productivity slowdown using a new data set on industrial output. In addition, the study explores different concepts for measuring productivity. The study also develops a new output measure, "well-measured output," that includes only those sectors, which have adequate deflation or price procedures. Using these data and concepts, we find the following:

- The productivity slowdown can be seen in each of the sectors (GDP, private GDP, business, and well-measured) for each of the three measures (total productivity growth, welfare productivity growth, and fixed-weight productivity growth). For total productivity growth, the slowdown ranges from 0.86 percent per year for GDP to 1.15 percent per year for private GDP.

- The traditional measure of productivity growth (chained output per hour worked) shows a larger slowdown than do other measures. For the total economy, the welfare-theoretic measure shows a productivity slowdown of 0.69 percent per year, which is 0.17 percent per year less than the number for total productivity growth. Similar differences are seen for well-measured output.

- Well-measured output (WMO) shows a consistently higher rate of productivity growth than do the other concepts. Over the entire period from 1948 to 2001 for total productivity, WMO has a welfare productivity growth of 2.59 percent per year as compared to 2.06 percent per year for the business sector. The difference is due to the poor measured productivity performance in many service and finance sectors.

- Productivity growth rebounded after 1995. While the size of the rebound differs according to sector and concept, in the well-measured industries, productivity growth after 1995 was higher than in the pre-slowdown period.

Third, using the new data, we can determine which sectors were most responsible for the productivity slowdown. Industries affected by the energy crisis of the 1970s (pipelines, oil extraction, electric and other utilities, motor vehicles, and air transportation) make up two-thirds of the economy-wide slowdown for industries that are well-measured. The rest of the slowdown is due to measurement error and reasons residing in individual industries.

The major result of this study is that the productivity slowdown of the 1970s has survived three decades of scrutiny, conceptual refinements, and data revisions. The slowdown was primarily centered in those sectors that were most energy-intensive, were hardest hit by the energy price shocks of the 1970s, and therefore had large output declines. In a sense, the energy shocks were the earthquake, and the industries with the largest slowdown were nearest the epicenter of the tectonic shifts in the economy.

But past is not prologue, and the 1970s productivity slowdown has over the last decade been overcome by a productivity growth rebound originating primarily in the new-economy sectors. As the economy made the transition from the oil age to the electronic age, the aftershocks of the energy crises have died off and productivity growth has attained a rate close to its historical norm.

## Appendix. Derivation of Industry Data[2]

William D. Nordhaus and Alexandra Miltner

Industry output data for major industries are important tools for examining a wide variety of issues ranging from understanding growth and price trends to productivity analysis. Unfortunately, because of changes in methodologies and source data, industry data for the United States are available for only short periods of comparability. For example, as of April 2003, the U.S. Bureau of Economic Analysis (BEA) published data on quantity and price indexes for major industries for three subperiods, 1947-87, 1977-1987, and 1987-2001. The data for these three periods are comparable for the aggregate and for several industries, but use different definitions for several important industries and have no comparable data at all for many industries such as the two major electronics industries and for the major banking sectors.

More recently, the BEA has discontinued publishing the earlier industry data and converted to the new industrial classification (NAICS), which is available only for the period since 1998 and cannot be linked to the earlier data.

For this appendix, we use the term "old data" for the data based on fixed-weight price and quantity indexes and "recent data" for the revised data published through 2003 based on 1972 and 1978 SIC industrial classifications.

[2] The data are available at http://www.econ.yale.edu/~nordhaus/homepage/recent_stuff.html. We received invaluable help in constructing the new series from Bob Yuskavage of the Bureau of Economic Analysis.

The purpose of this appendix is to describe the development of a set of industry data that are as comparable as can be developed with publicly available data. The period covered is from 1947 through 2001, with the recent estimates available for real GDP and price indexes by industry for the period 1947-1976 that are linked to the later data by SIC code.

**A. Background**

Until recently, the BEA published two full sets of industry data for the periods 1977-87 and 1987-2001. These calculate real outputs and prices with chain (Fisher) weights, and most industries use double deflation of price and quantity indexes. Unfortunately, when BEA moved to the use of chain weighted output and price indexes, it did not revise its earlier estimates of real output for the period 1947-1976.[3]

The present study describes a methodology for estimating real output and price indexes for the earlier period. The new estimates are based on the earlier fixed-year-weighted indexes with several modifications. We can make adjustments to the early data because there are 11 years of overlap (1977-87) between the early data and the recent data.

Before describing the procedure, it will be useful to outline the major differences between the early data and methodologies and the data and methodologies underlying the recent data.[4]

[3] Publications describing BEA's procedures are available online at http://www.bea.gov/bea/dn2/iedguide.htm#IIC . An additional useful survey is Robert E. Yuskavage, "Priorities for Industry Accounts at BEA," available at http://www.bea.gov/bea/about/advisory.htm .
[4] The early data for the period, 1947-87 is available in paper form only from the *Survey of Current Business*, principally from July 1987 and 1988.

1. *Chain weights.* One major difference is that recent BEA data use chain weights while the early data used prices of a fixed year. The early data are conceptually based on fixed-year price indexes using 1982 prices, although it is likely that data for some years are based on prices of earlier years and are linked together. The BEA prepared data for the 1977-1990 period using 1987 prices as well as 1982 prices. For the period 1977-87, the real output series using the 1987 base year had a difference from the recently published estimates that was approximately one-half of that for the data using 1982 prices.

2. *Double deflation.* A second difference between the early data and the recent data is the extensive use of double deflation in data produced recently. The recent data calculates chained quantity and price indexes for both the final output and the intermediate purchases of each industry. The quantities and prices are therefore calculated by the double-deflation method. Earlier data did not consistently use double deflation. This implies that, for industries in which the ratio of input to output prices was changing, the estimates of price and quantity indexes would differ. While we do not have any estimates of the importance of this factor, BEA estimates indicate that there are often large differences between output and input prices by industry.

3. *Industrial Definitions.* A third area, which is of importance in only a few industries, is the change in industrial definitions. The early data use the 1972 SIC code, while the recent data use the 1972 and 1987 SIC codes. There were major changes for Electronic equipment, Instruments, Depository and non-depository institutions, and Business, miscellaneous, professional, and other services. The BEA provides overlapping data so that the series can be

linked, but the differences are sometimes very large, so that the growth rates may be affected.

4. *Methodological changes*. For several industries, BEA has changed the techniques used for measuring prices and output in several industries over the last two decades. The uses of hedonic price indexes, and the substitution of output indicators for input measures, have taken place particularly in electronics, telecommunications, and the banking industry.

5. *Source data*. A final area of difference is later and more comprehensive source data. This can be most easily seen in the measures for nominal output, which are unaffected by most methodological developments, such as chaining and use of different price or quantity indexes. Several industries show major changes in nominal output: Petroleum and coal products, Nondepository institutions, Insurance carriers, Holding and other investment offices, Pipelines, except natural gas, Tobacco products, and Nonmetallic minerals, except fuels are examples.

It is not possible with the information at hand to determine which of the changes listed above is responsible for the differences between old and recent data. Such detective work would require study of the underlying sources and calculations, some of which are unavailable outside BEA and some of which are probably irretrievably lost. The method we employ for this study will attempt to be sensitive to the different issues, but much uncertainty will remain pending further detective work.

**B. Construction of the New Estimates for Output and Prices**

*A. Summary of the Method*

We first summarize the approach and then present the details of the calculations. The purpose of the calculations is to produce a consistent time series on output, prices, and nominal output for major industries over the period beginning in 1947. In all cases, we will convert the data so that it is consistent with the BEA methods and data at the time that the recent data were last published (those being the data in the November 2002 revision). The steps involved are the following:

1. We estimate equations for each industry to calculate the trend in the ratio of the recent real output to the old real output for the overlap period 1977-87 and use the results of the regressions to backcast real output.

2. We then substitute several series from the product-side of the accounts for certain income-side indexes where the industrial definitions are identical or very similar.

3. Then we adjust the industry outputs so that the aggregate real GDP from the income side equals aggregate real GDP from the product side.

4. Finally, we link each of the series so as to create a continuous time series for 1947 to 2001.

In summary, we adjust real output indexes for different industries so that income-side real GDP is constrained to equal product-side real GDP. The next section explains this procedure in detail.

*B. Detailed Description*

The building blocks of the procedure are price, quantity, and nominal output indexes in 1982 prices (produced by BEA around 1990 for the period 1947-87), which we call "old data"; and price, quantity, and nominal output indexes using chain weights (recently produced by BEA for 1977-2001), which we call "recent data." The recent data are available for 72 different industries or aggregates using the 1987 SIC code, or the same number with varying degrees of difference using the 1972 SIC code. There are 11 years of overlapping data for old and recent data – from 1977 to 1987.

1. <u>Backcasts of Unadjusted Industry Series</u>

The first step was to create the "unadjusted industry series." This step prepares estimates for each industry before adjusting for the overall aggregate (the adjustment for the aggregate is described in Section 3). The major issue here is determining the procedure for estimating the different series over the 1947-76 period. We have recent data on nominal GDP for the entire period but BEA provided no data on output or price before 1977 using the new methodology. However, there are data by industry for the period 1947-87 which BEA prepared and published around 1990, but these data used the fixed-year price methodology as well as earlier source data; BEA does not, however, provide real output or prices by industry for the period before 1977.

After examining the data, we decided to use the overlap data between the recent and old data for the period 1977-87 as a way of backcasting correction trends for each of the series. The basic idea is that we can look at the behavior of the ratio of recent and old data over the overlap period to provide an estimate of the trend of the ratio of recent and old data in the period before the overlap period.

Visual inspection of the series indicated that some of the series showed a trend in the ratio of the recent to the old real output series. Figure A-1 and A-2 show two typical examples. Figure A-1 shows the log output ratio for railroads; this case suggests that there are factors which led to faster growth of the new estimate of real output compared to the old over the period – perhaps because the new series uses better intermediate input data. The pipeline example suggests that there is mainly noise in the difference between the two data series.

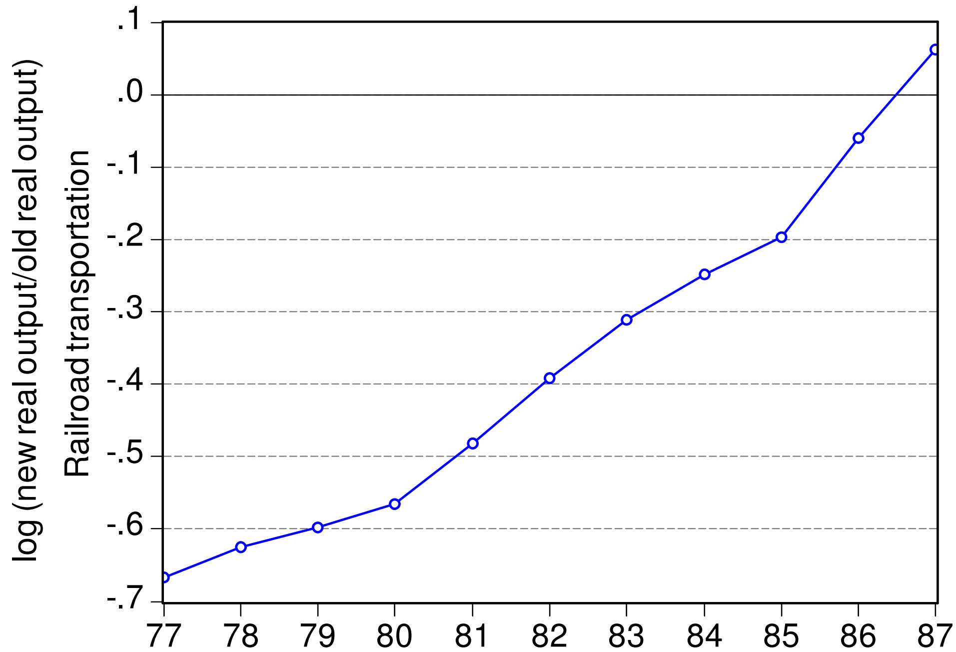


**Figure A-1. Output ratio for railroads**

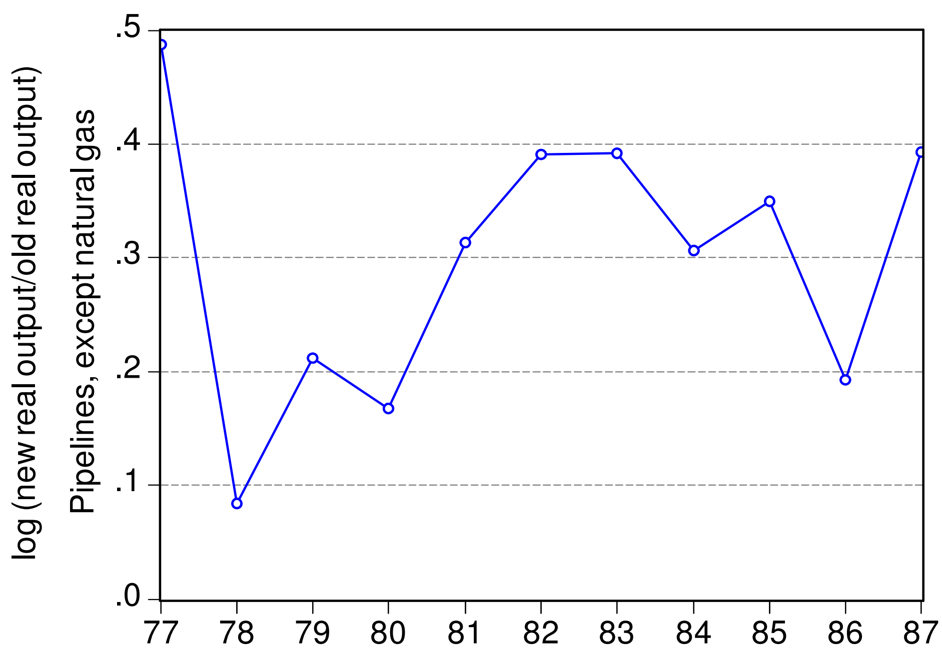


**Figure A-2. Log output ratio for pipelines**

The procedure that we follow is first to examine the trend in the different series over the overlap period; then, when there appears to be a systematic trend in the ratios of the recent to the old data, we adjust the data over the entire 1947-76 period based on the trend in the overlap 1977-1987 period. For example, we use the trend shown in Figure A-1 to adjust the data for railroads because the trend in the ratio is large and stable; for pipelines, we do not do any adjustment of the data because the trend in the ratio is both small and unstable.

For each of the 62 industries, we estimated regressions of the log of the output ratio over the common sample period (1977-87). For the 62 series the average trend was 0.0038 per year (or 0.38 percent per year logarithmic growth rate). Of the 62 series, 39 series exhibited statistically significant trends. For example, for railroad transportation, we obtained the following regression:

$$\log(\textit{recent real railroad output} / \textit{old real railroad output}) = \text{constant} + \underset{(0.00426)}{0.0719}\ \textit{year}$$

where *recent real railroad output* is the chain index for railroad transportation and *old real railroad output* is output of railroad transportation in 1982 prices. This equation indicates that recent chained real output was growing at a rate of 7.2 percent per year faster than output in constant 1982 prices. The same regression for pipelines yielded a trend of 0.66 percent per year with a standard error of 1.2 percent per year.

On the basis of the regressions and other factors, we determined the relative growth rates of the old and recent real output series. For this purpose, the "relative growth rate" is the difference between the logarithmic growth rate of the recent real output series and that of the old real output series. The relative growth rates were determined as follows. First, we limited the relative growth rates to a maximum of 1 percent per year. Second, because the overall trend was positive, we set a lower bound on the relative growth rates of 0 percent per year. Finally, for those industries which were either particularly noisy (such as pipelines) or which had major changes in industry definition, the relative growth rates were set at zero. Therefore, the relative growth rates were always in the range of 0 to 1 percent per year. It should be noted that with a few exceptions to be discussed below the adjustments were small and the old and recent growth rates were relatively close.

As an example, for railroads, which had a positive and significant relative growth rate in the regression of over 1 percent per year, we set the relative growth rate at 1 percent per year. This implies that the adjusted series for railroad would grow 1 percent per year faster than the old series for railroads.

2. Substitution of output-side series

The adjustments just described can be improved because BEA has developed several product-side aggregates that are closely related to the income-side totals for selected series back to 1947. We substituted these series for the income-side data wherever the income and product side series fit closely over the 1947-1987 period. This procedure was used for Farm, Private Households, Federal General Government, and Nonfarm Housing Services. For

Nonfarm housing services (NFHS), there are slight conceptual differences between NFHS and the product-side Housing series. We therefore used the ratio of the nominal product-side Housing series and nominal NFHS to backcast real NFHS. We then divided Real Estate between NFHS and Other real estate on the basis of the ratio of the nominal series for these two variables for 1947-77.

3. Adjusting industry outputs to aggregate GDP

The final step was to adjust the income-side data to the aggregate total; in other words, the industry outputs were adjusted to ensure that they aggregate to real income-side GDP. First we constructed an income-side control real GDP. For this, we took product-side real chained GDP and adjusted it for the statistical discrepancy. This was done by taking real GDP and in each year multiplying it by the ratio of nominal gross domestic income to nominal GDP. This series is called "BEA income-side real GDP." This adjustment is appropriate because we are aggregating data that in nominal terms equal income-side GDP.

The next step was to aggregate our industry data to obtain income-side real GDP. This was accomplished using the method BEA employs to calculate chain output indexes, Fisher chain indexes.[5] The new measure of GDP is called "unadjusted income-side real GDP." Figure A-3 shows the ratio of the unadjusted income-side real GDP to BEA income-side real GDP described in the previous paragraph (Ratio 1).

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[5] Note that there is a divergence between our aggregate and BEA's because the BEA numbers are aggregated from five-digit industry figures, whereas our data are aggregated from two-digit figures. In practice, the difference between these approaches is negligible.

Ratio 1 in Figure A-3 indicates the overall accuracy of unadjusted income-side real GDP is relatively good given the many frailties of the data and procedures used to construct the new series. The unadjusted series grows about seven percent (or about 0.24 percent per year) relative to the product-side number over the 1948-1977 period, and then declines about two percent (or about 0.14 percent per year) relative to the product-side number over the 1977-1987 period.[6]

The final step was to adjust the individual industry series to match the GDP control totals; this final series is "adjusted income-side real GDP." The unadjusted income-side real GDP grows more rapidly than does the BEA income-side real GDP. We therefore reduced the adjustment factors for the series (except those for which we substituted product-side data) so that the two series have identical growth rates over the 1947-77 period. This requires adjusting the growth rates of all industries with positive trends in their backcasts by a constant ($\theta = 0.364$).[7] The final ratio of adjusted income-side real GDP to BEA income-side real GDP is shown in Figure A-3 (Ratio 2). The adjustment was on a straight-line basis.

[6] Note that the two series diverge even in the overlap period 1977-87. This is yet another aggregation error between income-side and product-side GDP. Staff at BEA believe that the difference is due primarily to different deflators used on the product and income sides of the accounts.

[7] The largest annual growth rate for any of the backcast industry series we create thus equals 0.364%.

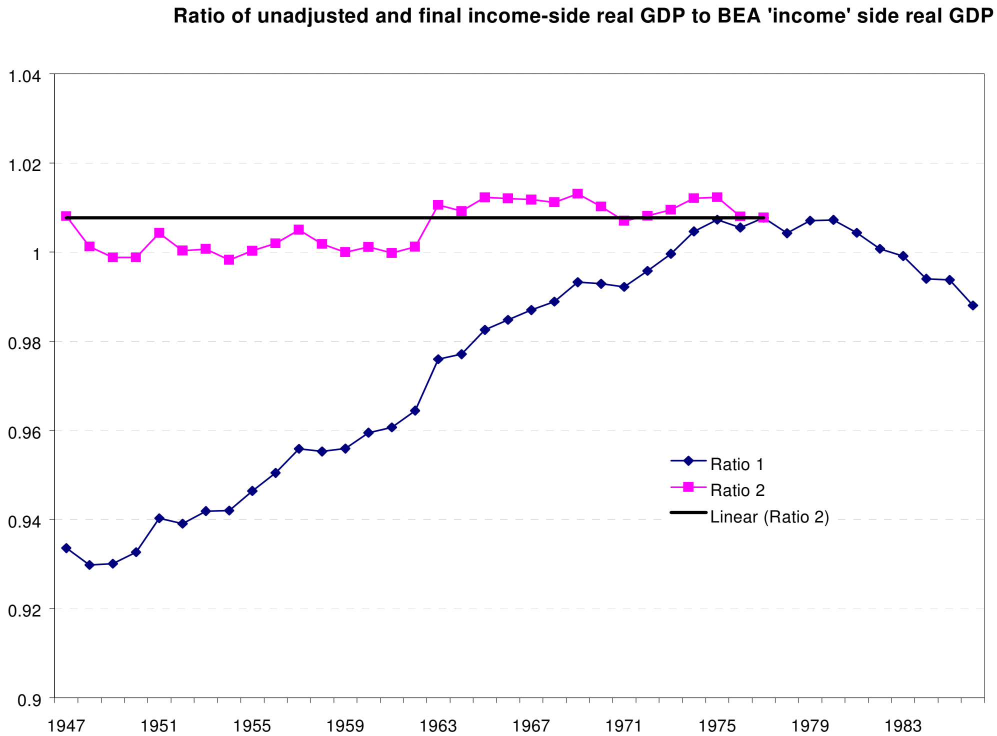


**Figure A-3. Ratio of unadjusted income-side to product-side GDP.** Ratio 1 is the ratio of *unadjusted* income-side real GDP to BEA income-side real GDP. Ratio 2 is the ratio of *adjusted* income-side real GDP to BEA income-side real GDP.

4. Creating a unified data base

Our last step was to create a consistent data set for the entire period, 1947-2000, linking the final adjusted industry series (72SIC) to the recent data (87SIC) [8]. The only serious issues arose for industries that had major definitional changes.[9] For each of these, we created sub-aggregates that chained to the aggregate provided by BEA.

**C. Some Comparative Results**

Table A-1 shows summary statistics on the different series. The underlying data are the differences in the logarithmic growth rates of nominal output, real output, and prices for each of the industries. In each case, the variable takes the difference of the logarithmic growth rate of the final (adjusted backcast) and original (data in 1982 prices). The calculations run only through 1984 to exclude revisions at the tail end of the period. From these data, we take the mean and root mean squared error (RMSE) of the growth rates. The total score is the weighted RMSE and mean absolute error, and we have sorted the industries by their scores, where a higher score is worse.

[8] The adjusted backcast series we created cover the period from 1947-76; BEA data are available for 1977-86 (72SIC) and from 1987 onward (87SIC).

[9] Electronic equipment, Instruments, Depository institutions, Nondepository institutions, Business services, and Other services are available individually in the old data. These series were chained and compared to the corresponding backcast of the combined series for the period 1947-77. Then the individual series were adjusted to fit the combined series. The combined series Social services and membership organizations from the old data was split into its two components proportional to the corresponding nominal series.

# Table A-1.Industry Statistics

| Industry | Difference in Logarithm of Final and Original Series, 1948-1984 | | | | | | |
|---|---|---|---|---|---|---|---|
| | Nominal GDP | | Real GDP | | Price Deflator | | Total |
| | Mean | S.D. | Mean | S.D. | Mean | S.D. | Score* |
| Petroleum and coal products | -1.79% | 19.69% | 2.08% | 14.51% | -3.87% | 21.67% | 12.11% |
| Holding and other investment offices | 1.45% | 42.77% | -0.01% | 0.46% | 1.46% | 42.85% | 10.47% |
| Pipelines, except natural gas | 1.20% | 8.14% | -0.28% | 7.73% | 1.48% | 9.14% | 4.96% |
| Auto repair, services, and parking | 0.17% | 3.13% | 2.06% | 0.66% | -1.88% | 3.18% | 4.37% |
| Metal mining | 1.05% | 5.90% | 1.46% | 5.06% | -0.41% | 5.36% | 4.14% |
| Non-depositary | -0.05% | 21.52% | -0.05% | 0.33% | 0.00% | 21.67% | 4.05% |
| Insurance carriers | -0.11% | 2.88% | -1.48% | 4.99% | 1.38% | 6.51% | 4.00% |
| Transportation by air | 0.26% | 3.08% | 1.50% | 4.35% | -1.24% | 5.55% | 3.91% |
| Farms | -0.33% | 1.75% | 1.18% | 5.05% | -1.51% | 4.23% | 3.74% |
| Security and commodity brokers | 0.77% | 9.66% | 0.35% | 1.93% | 0.43% | 9.93% | 3.36% |
| Railroad transportation | -0.02% | 1.05% | 1.43% | 2.47% | -1.45% | 2.70% | 3.20% |
| Motion pictures | 0.67% | 3.65% | 1.07% | 2.79% | -0.39% | 3.20% | 2.82% |
| Government enterprises | 0.01% | 11.38% | -0.31% | 1.64% | 0.32% | 11.39% | 2.81% |
| Tobacco products | -0.78% | 3.17% | -0.97% | 4.46% | 0.20% | 3.16% | 2.75% |
| Radio and television | -0.07% | 6.81% | -0.66% | 2.16% | 0.59% | 7.02% | 2.65% |
| Local and interurban passenger transit | 0.14% | 3.59% | 0.85% | 2.41% | -0.71% | 4.48% | 2.49% |
| Transportation services | 0.50% | 8.07% | 0.04% | 0.39% | 0.46% | 8.04% | 2.40% |
| Trucking and warehousing | -0.17% | 1.14% | 0.78% | 2.60% | -0.95% | 2.79% | 2.33% |
| Agricultural services, forestry, and fishing | 0.38% | 5.20% | 0.38% | 2.58% | 0.01% | 5.69% | 1.92% |
| General government | -0.63% | 3.09% | -0.36% | 3.43% | -0.27% | 1.50% | 1.88% |
| Insurance agents, brokers, and service | 0.10% | 2.84% | 0.54% | 2.91% | -0.44% | 3.80% | 1.84% |
| Private households | -0.48% | 2.87% | -0.62% | 2.69% | 0.14% | 1.36% | 1.76% |
| Oil and gas extraction | 0.45% | 3.88% | 0.06% | 3.80% | 0.40% | 2.47% | 1.75% |
| Food and kindred products | 0.13% | 1.76% | 0.69% | 1.71% | -0.56% | 1.88% | 1.74% |
| Other transportation equipment | 0.10% | 5.59% | -0.11% | 6.16% | 0.21% | 1.89% | 1.62% |
| Wholesale trade | 0.11% | 0.99% | 0.71% | 1.13% | -0.60% | 1.32% | 1.61% |
| Depositary | 0.43% | 3.41% | -0.05% | 0.33% | 0.48% | 3.30% | 1.51% |
| Electric, gas, and sanitary services | -0.01% | 0.91% | -0.59% | 1.73% | 0.58% | 1.86% | 1.48% |
| Educational services | 0.39% | 2.74% | -0.10% | 0.85% | 0.49% | 2.88% | 1.48% |
| Coal mining | -0.05% | 3.80% | 0.22% | 2.63% | -0.28% | 4.21% | 1.47% |
| Miscellaneous repair services | 0.03% | 3.77% | 0.10% | 4.24% | -0.07% | 5.92% | 1.45% |
| Lumber and wood products | 0.21% | 1.12% | 0.44% | 2.85% | -0.23% | 2.97% | 1.43% |
| Nonmetallic minerals, except fuels | 0.11% | 3.30% | 0.06% | 4.87% | 0.04% | 5.07% | 1.40% |
| Furniture and fixtures | 0.00% | 2.70% | 0.41% | 2.11% | -0.41% | 1.87% | 1.35% |
| Leather and leather products | 0.25% | 2.77% | 0.39% | 1.69% | -0.13% | 2.69% | 1.35% |
| Amusement and recreation services | 0.44% | 2.36% | 0.20% | 1.09% | 0.25% | 2.25% | 1.32% |
| Legal services | 0.19% | 2.16% | -0.16% | 2.22% | 0.36% | 3.00% | 1.32% |
| Motor vehicles and equipment | 0.37% | 2.48% | 0.43% | 2.30% | -0.06% | 1.11% | 1.31% |
| Miscellaneous professional services | -0.35% | 2.52% | 0.05% | 0.82% | -0.40% | 2.39% | 1.25% |
| Chemicals and allied products | 0.20% | 0.93% | -0.26% | 1.20% | 0.46% | 1.14% | 1.14% |
| Miscellaneous manufacturing industries | -0.02% | 2.66% | 0.18% | 3.13% | -0.21% | 2.57% | 1.14% |
| Stone, clay, and glass products | -0.04% | 2.17% | -0.32% | 2.40% | 0.28% | 1.54% | 1.13% |
| Retail trade | 0.02% | 0.71% | 0.49% | 0.80% | -0.47% | 0.89% | 1.12% |
| Rubber and miscellaneous plastics products | 0.02% | 1.22% | 0.38% | 1.05% | -0.36% | 1.19% | 1.00% |
| Hotels and other lodging places | 0.09% | 2.02% | -0.14% | 1.82% | 0.23% | 2.65% | 1.00% |
| Textile mill products | 0.02% | 1.57% | 0.36% | 0.74% | -0.34% | 1.19% | 0.98% |
| Electric and electronic equipment | 0.25% | 1.11% | 0.42% | 0.02% | -0.17% | 1.12% | 0.98% |
| Apparel and other textile products | 0.24% | 1.59% | 0.32% | 1.36% | -0.08% | 1.16% | 0.96% |
| Industrial machinery and equipment | 0.15% | 0.72% | -0.10% | 2.23% | 0.24% | 2.35% | 0.92% |
| Construction | -0.08% | 1.05% | 0.20% | 1.81% | -0.28% | 1.46% | 0.90% |
| Water transportation | 0.05% | 2.27% | -0.06% | 1.55% | 0.11% | 2.89% | 0.81% |
| Health services | 0.02% | 0.59% | -0.25% | 0.79% | 0.27% | 0.95% | 0.70% |
| Government enterprises | 0.19% | 1.48% | 0.03% | 0.53% | 0.17% | 1.46% | 0.67% |
| Personal services | -0.15% | 1.60% | 0.01% | 1.02% | -0.16% | 1.25% | 0.65% |
| Instruments and related products | -0.18% | 1.68% | 0.00% | 0.00% | -0.18% | 1.68% | 0.63% |
| Printing and publishing | 0.06% | 1.66% | -0.04% | 1.08% | 0.09% | 1.37% | 0.55% |
| Paper and allied products | -0.07% | 0.92% | -0.12% | 1.17% | 0.05% | 1.44% | 0.53% |
| Primary metal industries | 0.13% | 1.08% | 0.03% | 0.62% | 0.10% | 0.96% | 0.48% |
| General government | -0.15% | 0.55% | -0.03% | 0.26% | -0.13% | 0.63% | 0.41% |
| Business services | 0.00% | 1.11% | 0.05% | 0.82% | -0.05% | 1.29% | 0.39% |
| Telephone and telegraph | -0.04% | 0.63% | 0.06% | 0.98% | -0.09% | 0.77% | 0.38% |
| Fabricated metal products | 0.07% | 0.59% | -0.03% | 0.44% | 0.10% | 0.59% | 0.33% |

* "Score" is the sum of the absolute value of the average growth rate plus 0.1 times the standard deviation (S.D.) added across the three series.