

An evaluation of BLS projections of the 1985 economy

Evaluation of BLS projections of 1985 employment shows their sensitivity to underlying population, labor force, and productivity estimates; it also shows their accuracy is similar to past projections

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The Bureau of Labor Statistics regularly prepares projections of the growth of gross national product (GNP) and industrial output and employment for the U.S. economy. These projections are a framework for the Bureau's occupational projections program. They also serve as a framework for analysis of other issues. This article evaluates BLS projections for 1985,¹ and is the final step in the projections program at the Bureau.² This final evaluation is an important process. Without it we cannot quantify the limits of our projected data but can only describe them in general terms.

The Bureau has published projections of the 1985 economy on three separate occasions: 1973, 1976, and 1978. As seen in the following tabulation, the 1973 and 1976 projections underestimated the level of 1985 total employment. In contrast, the 1978 projections overestimated employment.

| | <i>Employment</i> (millions) | <i>Difference from actual:</i> | |
|-------------------|---------------------------------|--------------------------------|----------------------------|
| | | <i>Percent</i> | <i>Level</i> (millions) |
| Projected in— | | | |
| 1973 | 109.9 | -1.8 | -2.0 |
| 1976 | 109.7 | -1.9 | -2.1 |
| 1978 | 113.9 | 1.8 | 2.0 |
| Actual 1985 | 111.9 | — | — |

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The 1973 and 1976 projections underestimated both the level of the 1985 population (16 years and older) and the level of labor force participation. A low estimate of the 1985 unemployment rate offset somewhat the population and labor force errors. The error for the 1978 projections reflects an underestimate of the unemployment rate and an overestimate of the labor force, which offset somewhat the total 1978 error.

BLS prepares projections of the labor force, total economic activity, industry output and employment, and occupational employment. A forthcoming article in the *Monthly Labor Review* will evaluate the projections of the 1985 labor force. This article evaluates the projections of 1985 GNP and industry employment and describes the size of the projection errors for GNP and employment by major industries. It also describes some of the factors contributing to these errors. However, for the projections of industry employment, it is possible only to calculate the size of the errors.

Framework for the evaluation

The 1973 BLS projections of the U.S. economy estimated economic growth for the 1972-85 period; the 1976 projections were for the 1973-85 period; and the 1978 projections were for the 1977-85 period. BLS projections describe what the economy might look like in 10 to 15 years, and are designed to capture secular rather than cyclical changes. The projections, in turn, reflect the re-

sults from economic models as well as specific judgments concerning key variables such as growth of the labor force, fiscal policy, labor productivity, and unemployment.³

To emphasize the uncertainty of projections, BLS has developed three alternative projections or scenarios—high, middle, and low. Each in turn incorporates a number of alternative judgments concerning labor force, fiscal policy, labor productivity, and unemployment. The projections reviewed here are the middle scenarios from the three projection efforts.

Data revisions, as usual, complicate this evaluation. The definitions and conventions for classifying industries in the Standard Industrial Classification (SIC) system have changed. The 1973 and 1976 projections used the 1967 SIC. The 1978 projections and the actual 1985 data used the 1972 SIC. Because of this and other changes, we cannot directly compare the projected values, as originally published, with the actual 1985 values. To solve this problem, this evaluation applies the projected trends to the revised historical data series to obtain “revised” projected 1985 values consistent with the new classification system. In essence, the “jumping off point” was revised for each projection to reflect data revisions. However, the projected trends for each detailed series remained unchanged.

Review of the projection errors

The following sections describe the errors in the three sets of BLS projections. They are reviewed and discussed in the sequence in which BLS developed them. The basic principles underlying BLS procedures used to develop projections have remained constant over the years, but many changes in procedure have been made as new data series became available and as statistical tools improved. Thus, if the reader is familiar with current BLS methodology, he or she is also relatively familiar with the methodology for the projections being evaluated here.

The first several steps of the BLS projection procedure involve estimates of the aggregate economy or GNP. Another set of steps involves estimates of industry level activity. The GNP estimates reflected groups of assumptions about five major economic factors—fiscal policy, demographics, productivity, unemployment, and prices. For the projections evaluated here, BLS used the Thurow macroeconomic model. This model, like any macroeconomic model currently used, is basically a set of equations that correlate different aspects of the economy with each other. The Thurow model, which was developed in the late 1960's, divides the economy into three distinct but related blocks: supply GNP, total income, and demand GNP. Estimates of supply GNP, demand GNP, and total income were developed *simultaneously*. The specific equations used in the Thurow model differ substantially from

models currently used by BLS and other forecasters. However, all macroeconomic model work is similar in the manner in which it provides a framework for the preparation of a consistent set of projections for a given set of assumptions and goals.

In the Thurow model, the key equation for the supply GNP was the production function which estimated the level of private GNP, given the labor and capital resources available to the private sector. The demand section related personal consumption, investment, government, and net foreign trade to personal income, profits, and other income variables. The income section was oriented toward personal income, which was determined by social insurance contributions, transfer payments to persons, and other taxes; by supply GNP; and by other variables. In the next section, we review the results of the BLS projections of the aggregate economy based on the variables in the supply block of the Thurow model.

Supply GNP. As seen in the following tabulation, each projection overestimated the level of real GNP (in 1982 dollars):

| | GNP (billions) | Difference from actual | |
|-------------------|-------------------|------------------------|---------------------|
| | | Percent | Level (billions) |
| Projected in— | | | |
| 1973 | \$4,405 | 22.1 | \$797 |
| 1976 | 4,152 | 15.1 | 544 |
| 1978 | 4,017 | 11.3 | 409 |
| Actual 1985 | 3,608 | — | — |

The trends for real GNP were overestimated in each projection. Further, the differences between the projected and actual trends are similar. The percent errors for the GNP estimates were different only because the projections covered different time spans—13, 12, and 8 years, respectively.

| Year published | Period covered | Annual percent change in GNP | | |
|-------------------|-------------------|------------------------------|--------|------------|
| | | Projected | Actual | Difference |
| 1973 | 1972–85 | 4.1 | 2.7 | –1.4 |
| 1976 | 1973–85 | 3.5 | 2.3 | –1.2 |
| 1978 | 1977–85 | 3.9 | 2.5 | –1.4 |

The large errors for supply GNP reflect BLS' projected productivity trends. In each case, BLS projected that productivity in the nonfarm sector would accelerate slightly from the historical trend. In each instance, the actual productivity growth was slower than the historical growth. In the 1973 and 1976 projections, BLS underestimated employment growth which, in turn, partially offset the productivity errors in the supply GNP estimates. In the 1978 projections, BLS overestimated total employment growth, which added to the error resulting from the high productivity estimate.

Demand GNP. In the demand section, projections were made of personal consumption expenditures, investment expenditures, government expenditures, and net foreign trade.

Each projection underestimated personal consumption expenditures as a proportion of GNP. The largest error occurred in the 1973 projections. At that time the projected share for 1985 was 62.3 percent of GNP but the actual 1985 share would be 65.2 percent. BLS had expected personal consumption expenditures as a share of total GNP to decline slightly from what was then a post-war high. It was argued that the large 1972 share was related to the economy being near the peak of a business cycle and was not related to longer term trends. Over the 1972–85 period, however, personal consumption expenditures rose from 62.2 percent of GNP to 65.2 percent, a proportion that was again a record high.

The projections were also incorrect in their estimates of the role of foreign trade in the 1985 economy. The share of imports was consistently underestimated in each projection. The errors in the share of projected exports were small. For example, the 1973 projection error for exports was only 0.2 percentage point (a 10.3-percent share compared to an actual 10.1-percent share). Between 1972 and 1979, exports as a share of GNP increased 2.7 percentage points; between 1979 and 1985, the export share declined by 1.1 percentage points. The export share fluctuated partly because the value of the dollar fluctuated.

Finally, BLS had difficulty projecting government's share of GNP. For example, the 1973 projections underestimated Federal Government expenditures as a share of GNP by 1.4 percentage points and overestimated the State and local government share. In 1973, BLS projected that the growth of defense expenditures would be modest after the end of the Vietnam war, and BLS did not anticipate the growth in defense expenditures during the late 1970's and the early 1980's. BLS expected State and local government expenditures to continue increasing as a share of GNP over the 1972–85 period, although not as rapidly as during the 1955–72 period. However, the State and local government share declined over this period as these government units faced budget problems which limited the growth of expenditures.

The largest errors in the 1973 projections of final demand shares of GNP were for personal consumption expenditures (a 2.9-percentage point underestimate), State and local government (a 2.4-percentage point overestimate), Federal Government (a 1.4-percentage point underestimate), and imports (a 1.2-percentage point underestimate). (See table 1.)

The largest errors in the 1976 projections were for personal consumption expenditures (a 1.5-percentage point underestimate), Federal Government (a 1.9-percentage point overestimate), and State and local government (a 1.4-percentage point overestimate).

Table 1. Distribution of projected and actual final demand, 1985

| Category | Projected in — | | | Actual |
|------------------------------------|----------------|-------|-------|--------|
| | 1973 | 1976 | 1978 | 1985 |
| Gross national product.... | 100.0 | 100.0 | 100.0 | 100.0 |
| Consumption | 62.3 | 63.7 | 64.6 | 65.2 |
| Durable goods | 7.5 | — | 9.5 | 9.8 |
| Nondurable goods | 24.0 | — | 24.0 | 23.5 |
| Services | 30.8 | — | 31.1 | 31.9 |
| Investment | 18.1 | 18.3 | 19.0 | 17.6 |
| Nonresidential structures.... | 4.7 | 4.3 | 3.5 | 4.1 |
| Producers' durable equipment | 7.3 | 7.9 | 7.8 | 8.4 |
| Residential investment | 4.9 | 5.0 | 5.8 | 4.8 |
| Inventory change | 1.2 | 1.1 | 1.9 | .2 |
| Net exports | -1.6 | -1.7 | -.6 | -3.0 |
| Exports | 10.3 | 10.6 | 9.9 | 10.1 |
| Imports | -11.9 | -12.3 | -1.6 | -13.1 |
| Government | 21.2 | 19.7 | 17.0 | 20.1 |
| Federal | 7.6 | 7.1 | 6.3 | 9.0 |
| State and local | 13.6 | 12.6 | 10.6 | 11.2 |

NOTE: Estimates are based on 1982 dollars. Dash indicates detail not available.

In 1978, the largest projections errors were for imports (a 2.5-percentage point underestimate), investment (a 1.4-percentage point overestimate), and Federal Government (a 2.7-percentage point underestimate).

Output by major industry. The next several steps of the BLS projections program involve projections of industry activity rather than projections of aggregate GNP using the macroeconomic model. Projections of industry activity are based on input-output and industry productivity models. In the first step of the industry projections, the final demand projections are combined with projections of industry technologies (based on input-output analysis) to yield industry output projections. The industry output estimates are, in turn, used to make projections of value added or gross product originating by major industries.

For each projection, the errors in projecting the share of GNP by major industry were usually modest (at least in comparison to the errors in projecting final demand shares of GNP). The largest errors generally occurred in the 1978 projections. Service industries were projected to account for 13.1 percent of GNP in 1985, while their actual share was 15 percent. (See table 2.) The source of this error is difficult to determine precisely, but it was offset by overestimates in mining and construction. However, BLS substantially underestimated (by nearly half) the growth of business services while overestimating the growth of medical services. The error might also be related to BLS projected input-output coefficients. The input-output errors cannot be determined, inasmuch as consistent historical and projected input-output tables are not available. The projected share for transportation industries was 4.7 percent in 1978; the actual share was 3.5

percent. The error in projecting manufacturing's share was only 0.2 percentage point.

For the 1973 projections, the largest errors, or differences between actual and projected shares of GNP, were usually less than 1 percentage point. For example, the projected share for retail trade was 8.8 percent of GNP; the actual share was 9.5 percent. The projected share for construction was 5.3 percent of GNP; the actual share was 4.6 percent.

Labor productivity. BLS also projects labor productivity—output per hour—by industry. For each of the three projection periods, two labor productivity projections were made. First, BLS projected labor productivity in the private nonfarm sector to accelerate modestly compared to the historical trend. Second, for each major industry, projected productivity trends were developed that were similar to the historical trends. For example, in the 1973 projections, labor productivity growth in the nonfarm sector was projected at 2.9 percent per year over the 1972–85 period. During the historical period, the growth was 2.5 percent per year. (For 1973 projections, the historical period was the 1955–72 period). The projected growth of manufacturing productivity was 2.7 percent per year over the 1972–85 period, compared to 2.8 percent per year over the 1955–72 period. In each instance, the *actual* nonfarm economy productivity growth trends turned out to be substantially slower than the historical trends. The similarity between historical and projected trends held only for manufacturing industries as a group. The productivity trends for nonmanufacturing industries as a group also slowed substantially compared to historical trends.

These two errors cannot be explicitly documented because required data were not published by BLS. The point, however, can be made with actual trends. For the 1973 projections, BLS assumed that productivity trends for the 1955–72 period would essentially continue over the 1972–85 period. Over the 1959–72 period, productivity in the nonfarm business economy increased 2.3 percent per year and in the manufacturing industries, 2.5 percent per year. However, over the projected period, 1972–85, productivity in the nonfarm economy grew only 0.9 percent a year, or 1.4 percentage points less than during the reference period. Manufacturing productivity grew 2.6 percent per year over the 1972–85 period, or only 0.1 percentage point more than during the reference period.

Productivity growth for nonfarm industries as a group slowed over the projected period. BLS did not incorporate this trend in its 1973 projections. Similar errors occurred for the 1976 and 1978 projections.

Total employment. Included in the BLS projection program are estimates of total employment, employment by major industry, and employment by detailed industry. (The last element in the BLS projections program is the projection of employment by occupation. It is not possible to evaluate 1985 occupational projections because in 1982 an entirely new system of occupational classification was put in place.)

As noted in the introduction, BLS underestimated 1985 employment in the 1973 and 1976 projections and overestimated employment in the 1978 projections. Thus, BLS underestimated the growth of total employment in the 1973 and in the 1976 projections and overestimated employment growth in the 1978 projections. The following tabulation shows the projected and actual annual growth rates in total employment for each of the three projection periods:

| Year published | Period covered | Projected | Actual | Difference |
|----------------|----------------|-----------|--------|------------|
| 1973..... | 1972–85 | 1.8 | 2.0 | –.2 |
| 1976..... | 1973–85 | 1.7 | 1.8 | –.1 |
| 1978..... | 1977–85 | 2.2 | 2.0 | .2 |

These modest differences between the projected and actual growth in each of the three periods reflect substantial offsetting errors in the projection of population, labor force participation rates, and the unemployment rate. The 1973 and 1976 projection errors were further offset because an overestimate of the number of persons holding two jobs or more reduced the total error.

For each of the three projection periods, population growth among persons age 16 and older was underestimated by the Bureau of the Census. The error for the 1973 and 1976 projections was 8 million persons. The error for the 1978 projections was 5 million persons. These errors

Table 2. Distribution of projected and actual gross product originating, by major industry, 1985
[In percent]

| Industry | Projected in— | | | Actual |
|---|---------------|-------|-------|--------|
| | 1973 | 1976 | 1978 | 1985 |
| Gross national product | 100.0 | 100.0 | 100.0 | 100.0 |
| Goods-producing sector: | | | | |
| Agriculture | 1.8 | 2.1 | 2.2 | 2.6 |
| Mining | 3.5 | 4.1 | 4.2 | 3.6 |
| Construction | 5.3 | 5.6 | 5.4 | 4.6 |
| Manufacturing | 22.1 | 22.5 | 22.1 | 21.9 |
| Service-producing sector: | | | | |
| Transportation | 4.7 | 4.7 | 4.7 | 3.5 |
| Communication | 2.5 | 2.3 | 2.5 | 2.6 |
| Public utilities | 2.9 | 3.3 | 2.8 | 2.9 |
| Wholesale trade | 6.9 | 6.9 | 7.2 | 7.5 |
| Retail trade | 8.8 | 9.5 | 9.6 | 9.5 |
| Finance, insurance, and real estate | 15.0 | 14.3 | 14.9 | 14.5 |
| Services | 14.7 | 13.3 | 13.1 | 15.0 |
| Government enterprises | 1.3 | 1.3 | 1.4 | 1.2 |
| General government | 9.3 | 9.8 | 9.0 | 9.8 |
| Statistical discrepancy, rest-of-world | 1.2 | .3 | .9 | .8 |

were, in part, related to the substantial adjustment to population estimates as a result of the 1980 Census of the Population. The population errors were also partially related to an underestimate of the level of net migration during the 1980's.

BLS underestimated the level of female participation in the labor force in the 1973 and 1976 projections. In its 1973 initial projections of the 1985 labor force, BLS assumed that the large increase in female labor force participation which occurred in the early 1970's would not continue to the same extent in the 1980's. However, in its 1978 projections, BLS finally accepted the rapidly rising female labor force participation rate as a long-term phenomenon.

BLS also assumed that the economy would operate with relatively full employment over time in each of three projection periods. The 1973 projections estimated the 1985 unemployment rate at 4 percent; the 1976 projections at 4.5 percent; and the 1978 projections at 4.7 percent. The actual 1985 unemployment rate was 7.2 percent.

Major industries. Employment has been shifting from goods-producing industries to service-producing industries over the past decade. While BLS projected this shift, the size of the shift was underestimated in each of the three projection periods. In 1973, the projected 1985 share of total employment accounted for by goods-producing industries was 3.6 percentage points higher than the actual share; in 1976, it was 2.4 percentage points greater; and in 1978, it was 2.6 percentage points greater. (See table 3.)

Among the major industries, the share of total employment was overestimated for manufacturing and State and local government and underestimated for services. In the

1973 projections, as an illustration, the projected increase in manufacturing employment was 4.2 million jobs over the 1972-85 period. However, the actual increase in manufacturing employment was only 200,000 jobs.

The errors occurred in part because BLS overestimated the projected output trends in manufacturing industries and underestimated the trends in service industries. These output errors in turn reflect other errors in the projections. BLS could not anticipate the severe 1981-82 recession and the subsequent slow recovery over the 1982-85 period, or the adverse foreign trade developments of the 1980's. These two related phenomena particularly affected manufacturing output and employment trends.

The errors in projecting the distribution of employment in 1985 also occurred because of errors in projecting productivity growth for the detailed industries. For each of the three periods, the projected productivity growth in the service sector was greater than the actual growth. In the 1973 projections, BLS assumed that productivity growth in the service industries would nearly match that in the manufacturing industries. However, the actual productivity growth for these sectors has not been similar. Over the 1972-85 period, manufacturing productivity grew 1.7 percent per year, while services productivity grew very little, if any. These productivity errors were the largest for the 1973 projections.

Detailed industries. BLS also projects employment among the detailed industries. For 1973, the average projected increase in industry employment was 1.6 percent per year over the 1972-85 period. The average actual increase was 0.8 percent per year, just half of the projected average trend. (See table 4.) For the 1976 projections, the difference between the average projected and actual trends was only 0.5 percentage point per year. For the 1978 projections, the difference was the largest, 1.8 percentage points per year.

We can review the accuracy of these projections in other ways. For about two-thirds of the industries in the 1973 and 1976 projections, the errors were relatively small, less than 2 percentage points per year above or below the actual trends. For the 1973 projections, the errors were relatively small for 57 of the 101 industries, and the same was true for 62 of the 101 industries in the 1976 projections; for the 1976 projections, the errors were relatively small for only about two-fifths of the industries evaluated here, or 55 of the 123 industries.

Another issue is whether BLS correctly projected the direction of change. Had employment increased or declined in all the industries where BLS projected increases or declines? In the 1973 projections, the direction of employment change was correctly projected for 65 of 101 industries; in the 1976 projections, the direction was correct for 64 of the 101

Table 3. Projected and actual employment, 1985
(Percent distribution)

| Industry | Projected in— | | | Actual |
|--|---------------|-------|-------|--------|
| | 1973 | 1976 | 1978 | 1985 |
| All industries | 100.0 | 100.0 | 100.0 | 100.0 |
| Goods-producing | 30.0 | 29.1 | 29.3 | 26.7 |
| Agriculture | 2.0 | 2.3 | 3.0 | 2.9 |
| Mining | .6 | .7 | .9 | .8 |
| Construction | 5.1 | 5.5 | 5.1 | 5.4 |
| Manufacturing | 21.6 | 20.6 | 20.3 | 17.6 |
| Service-producing | 69.7 | 70.9 | 70.7 | 73.3 |
| Transportation | 3.0 | 2.8 | 3.0 | 3.0 |
| Communication | 1.2 | 1.3 | 1.2 | 1.2 |
| Utilities | .7 | .8 | .7 | .8 |
| Wholesale trade | 4.8 | 4.8 | 5.1 | 5.4 |
| Retail trade | 14.9 | 15.3 | 17.2 | 16.9 |
| Finance, insurance, and real estate | 5.3 | 5.4 | 5.3 | 5.8 |
| Services | 19.8 | 20.3 | 20.4 | 22.3 |
| Private households | 1.8 | .8 | .9 | 1.1 |
| Government: | | | | |
| Armed Forces | 1.9 | 1.9 | 1.8 | 2.0 |
| Federal Government | 2.7 | 2.6 | 2.5 | 2.6 |
| State and local government | 14.7 | 15.0 | 12.3 | 12.1 |

Table 4. Projected and actual industry employment trends to 1985 and selected error estimates from the 1973, 1976, and 1978 projection rounds
[In percent]

| Item | Projected in— | | |
|--------------------------------|---------------|------|------|
| | 1973 | 1976 | 1978 |
| Average trends: | | | |
| Projected | 1.6 | 1.2 | 0.2 |
| Actual..... | .8 | .7 | 1.8 |
| Difference | .8 | .5 | 1.8 |
| Average absolute error: | | | |
| Jobs (thousands)..... | 177 | 151 | 97 |
| Percent error | 30.5 | 25.4 | 23.8 |
| Annual trends: | | | |
| Unweighted | 2.0 | 1.9 | 2.9 |
| Weighted | 1.5 | 1.4 | 1.5 |
| Squared | 6.4 | 5.8 | 14.6 |

industries; and in the 1978 projections, it was correct in 67 of 123 industries.

There are other measures for reviewing industry projection errors. *Average percentage errors* allow positive errors to offset negative errors. An alternative is the *average absolute percentage error* or the error without regard to sign. With this alternative, positive and negative errors are not offset. A third statistic is a *weighted average percentage error*. It weights the individual absolute percentage errors by the employment size of each industry. By weighting the errors, this third statistic emphasizes the errors of the larger industries. A final statistic is the *root mean squared error*. It is the average of the individual percentage errors after the errors have been squared. This fourth choice emphasizes extreme errors.

The average absolute error (unweighted) for the 1973 projection was 2.0 percentage points per year across all the industries in the private economy over the 1972–85 period. As a result, projected employment levels, on average, were about 30.5 percent higher or lower than the actual employment levels.

In each of the three projection periods, the detailed errors declined when industry size was considered. For the 1978 projection, the average absolute error declined from 2.9 percentage points per year to 1.5 percentage points per year when the errors were weighted for industry size.

Finally, there were many large errors in each of the three projection periods. In the 1976 projections, the average of individual errors without regard to sign was 1.9 percentage points per year. When the individual errors are squared, the average of individual errors rises sharply to 5.8 percentage points per year. The greatest errors over the three projection periods, at the individual industry level, occurred for ore mining, blast furnaces, and farm machinery. (See table 5.)

Industry projections

Industry projections are the results of many steps, all of which may contribute to an error in projections. The fol-

lowing discussion covers some of the difficulties in projecting a specific trend for a specific industry.

In its projections, BLS has always highlighted the fastest growing industries. In each of the three projection periods, BLS included computer and peripheral equipment and business services among the five fastest growing industries. Indeed, these two industries were the fastest growing for the respective periods. Nevertheless, BLS still underestimated their growth—by an average of 2 percentage points per year for computers and 2.9 percentage points per year for business services. These errors are similar to the average errors for all industries. They highlight the difficulty of projecting trends that are considerably above average.

Industries affected by imports pose other problems. The motor vehicles industry is one that has received considerable attention. In the 1973 and 1978 projections, BLS overestimated the growth of this industry. In 1973, BLS projected modest employment growth for the industry for the 1972–85 period, during which employment in the industry actually remained unchanged. But the 1973 error was below the average for all industries. In 1978, BLS projected considerable employment growth for this industry for the 1977–85 period when, in fact, employment in the industry would decline. But the 1978 error was above the average error for all industries. However, in 1976, BLS projected employment in the industry to decline over the 1973–85 period and employment did decline, but slightly less than BLS projected. The average error for the motor vehicles industry across the three projection periods was typical for all industries.

The iron and steel industry also has received considerable attention. In each of the projection periods, employment in blast furnaces and basic steel products and in iron and steel foundries was projected to grow modestly when, in fact, employment declined.

The economic scene

Several major economic events occurred during the late 1970's and early 1980's that had an effect upon the projections process. Energy prices and interest rates fluctuated widely. The Federal Government operated in substantial deficit and the U.S. trade imbalance grew significantly while labor productivity growth slowed. At the same time, the value of the U.S. dollar also fluctuated and the Nation experienced two recessions. The magnitude of these changes highlights the uncertainty inherent in projecting employment trends over an 8- to 12-year period.

Error sources

Employment. This section focuses on the contribution of the errors of individual variables to the error in projected total employment. To what extent were the projections of total employment wrong because the projections of one of the component variables such as the

Table 5. Errors in estimates of 1985 industry employment from the 1973, 1976, and 1978 projections rounds
 [Percentage points]

| Industry | Projection year | | | Average absolute error | Industry | Projection year | | | Average absolute error |
|--------------------------------------|-----------------|------|------|------------------------|--|-----------------|------|------|------------------------|
| | 1973 | 1976 | 1978 | | | 1973 | 1976 | 1978 | |
| Agriculture | -3.1 | -2.0 | 0.6 | 1.9 | Farm machinery | 3.4 | 4.8 | 8.7 | 5.7 |
| Ore mining | 5.9 | 5.0 | 10.9 | 7.3 | Construction and mining equipment | 2.8 | 5.0 | 6.8 | 4.9 |
| Coal mining | -1.0 | .8 | 6.1 | 2.6 | Material handling equipment | 3.6 | 3.5 | 5.2 | 4.1 |
| Crude petroleum | -7.6 | -3.9 | -3.1 | 4.9 | Metalworking machinery | 1.7 | 2.0 | 3.6 | 2.4 |
| Stone and clay mining | 1.2 | .4 | .7 | .8 | Special industry machinery | 1.8 | 2.1 | 4.0 | 2.6 |
| Construction | -6 | -0 | -6 | -4 | General industrial machinery | 3.1 | 2.4 | 3.6 | 3.0 |
| Other ordnance | -1.1 | .4 | -4.5 | 2.0 | Machine shop products | -1.5 | -7 | -2 | .8 |
| Guided missiles | -8 | -3.3 | -7.8 | 4.0 | Computers | -5 | -1.8 | -3.7 | 2.0 |
| Meat products | .5 | -1 | .2 | .3 | Typewriters and other office equipment | 3.8 | 3.2 | 2.7 | 3.2 |
| Dairy products | .5 | -1 | -1.7 | .8 | Service industry machines | 1.7 | 1.2 | 3.8 | 2.2 |
| Canned and frozen products | .5 | -1 | 3.5 | 1.4 | Electric transmission equipment | 4.8 | 3.9 | 3.3 | 4.0 |
| Grain mill products | .5 | -1 | 2.4 | 1.0 | Electrical industrial apparatus | 2.0 | 3.9 | 4.5 | 3.5 |
| Bakery products | .5 | -1 | .4 | .4 | Household appliances | 3.1 | 4.3 | 5.5 | 4.3 |
| Sugar | .5 | -1 | 3.5 | 1.4 | Electric lighting and wiring | 4.6 | 3.2 | 4.3 | 4.0 |
| Alcoholic beverages | .5 | -1 | -0 | .2 | Radio and television sets | 3.1 | 3.5 | 5.2 | 3.9 |
| Soft drinks | .5 | -1 | .9 | .5 | Telephone apparatus | 1.5 | 1.8 | 4.8 | 2.7 |
| Miscellaneous food products | .5 | -1 | 2.1 | .9 | Other communications equipment | -2.5 | -4.5 | -5.4 | 4.1 |
| Tobacco manufacturing | .7 | -7 | .4 | .6 | Electronic components | -2.3 | -3.1 | -2.3 | 2.6 |
| Fabric, yarn, and thread mills | 3.1 | 3.3 | 3.0 | 3.2 | Other electrical machinery | -4 | 1.1 | .8 | .7 |
| Floor coverings | 1.9 | 1.4 | 5.1 | 2.8 | Motor vehicles | 1.2 | -4 | 3.7 | 1.8 |
| Miscellaneous textile goods | 1.9 | 1.4 | 5.1 | 2.8 | Aircraft | -8 | -7 | -2.0 | 1.2 |
| Hosiery and knit goods | 2.5 | 1.9 | 4.0 | 2.8 | Ship and boat building | 4.8 | 3.4 | 3.5 | 3.6 |
| Apparel | 3.0 | 2.8 | 4.2 | 3.3 | Railroad equipment | 3.1 | 3.3 | 10.0 | 5.4 |
| Miscellaneous fabricated textiles | 1.0 | 1.2 | 1.6 | 1.3 | Miscellaneous transportation | 3.1 | 3.3 | 8.3 | 4.9 |
| Logging | -4 | .4 | .9 | .6 | Scientific and controlling instruments | .4 | -6 | -2.3 | 1.1 |
| Sawmills and planing mills | -4 | .4 | .8 | .5 | Medical and dental instruments | -1.5 | -9 | -1 | .8 |
| Millwork and plywood | .8 | .7 | 1.7 | 1.0 | Optical and ophthalmic equipment | -1.5 | .0 | 2.6 | 1.4 |
| Household furniture | 2.8 | 1.8 | 3.6 | 2.7 | Photographic equipment | 3.0 | 2.2 | 4.1 | 3.1 |
| Other furniture | -1.1 | -1.9 | -1.4 | 1.5 | Watches and clocks | 1.2 | 2.0 | 13.0 | 5.4 |
| Paper products | 1.1 | .6 | .7 | .8 | Miscellaneous manufactured products | 1.2 | 2.0 | 3.9 | 2.4 |
| Paperboard | 3.6 | 2.9 | 2.7 | 3.1 | Railroad transportation | .2 | 1.5 | 4.6 | 2.1 |
| Newspapers | -7 | -1.2 | .5 | .8 | Local transit | .2 | -1 | -6 | .3 |
| Periodical and book printing | -9 | -1.1 | -2.5 | 1.5 | Truck transportation | .6 | -4 | .7 | .6 |
| Miscellaneous printing | -9 | -1.1 | -2.3 | 1.4 | Water transportation | .9 | -8 | -1 | .6 |
| Chemical products | 1.2 | .1 | 1.8 | 1.1 | Air transportation | -2 | -1.5 | -1.3 | 1.0 |
| Agricultural chemicals | .6 | .2 | 1.8 | .8 | Other transportation | -5.2 | -4.5 | -3.2 | 4.3 |
| Plastics materials | 4.2 | 4.3 | 5.4 | 4.6 | Communication, except broadcasting | .4 | 1.0 | .7 | .7 |
| Drugs | .4 | -6 | -1 | .4 | Radio and tv broadcasting | -2.8 | -2.0 | -9 | 1.9 |
| Cleaning and toilet preparations | .8 | .0 | .5 | .5 | Electric utilities | -2.2 | -9 | -1.0 | 1.4 |
| Paint | 1.7 | 1.4 | 3.1 | 2.1 | Gas utilities | .5 | -5 | -1.7 | .9 |
| Petroleum products | -6 | 1.1 | .1 | .6 | Water and sanitary services | .3 | 1.2 | -7 | .7 |
| Rubber products | -2.0 | -1.4 | 5.6 | 3.0 | Wholesale trade | -1.1 | -1.3 | -5 | .9 |
| Miscellaneous rubber products | -2.0 | -1.4 | 2.6 | 2.0 | Retail trade | -1.2 | -1.0 | .5 | .9 |
| Plastic products | 5.0 | 5.5 | -1.7 | 4.1 | Banking | -6 | -6 | .5 | .6 |
| Leather and footwear | 3.9 | 3.1 | 4.3 | 3.7 | Credit agencies | -6 | -6 | -3.2 | 1.5 |
| Glass | 3.5 | 2.5 | 4.3 | 3.4 | Insurance | -6 | -5 | -4 | .5 |
| Cement and concrete products | 2.3 | 1.8 | 1.6 | 1.9 | Other real estate | -2.1 | -2.0 | -1.7 | 2.0 |
| Structural clay products | 2.3 | 1.8 | 2.4 | 2.1 | Hotels and lodging places | -1.2 | -1.6 | -2 | 1.0 |
| Steel mill products | 4.9 | 5.8 | 8.2 | 6.3 | Personal and repair services | -6 | -1.6 | -1.4 | 1.2 |
| Iron and steel foundries | 2.0 | 2.7 | 8.0 | 4.2 | Business services | -2.2 | -2.7 | -3.7 | 2.9 |
| Primary copper products | 2.0 | 2.7 | 3.5 | 2.7 | Professional and legal services | -2.1 | -1.9 | -2.6 | 2.2 |
| Primary aluminum products | 2.0 | 2.7 | 4.6 | 3.1 | Automobile repair | -2.0 | -2.5 | -3.1 | 2.5 |
| Metal containers | 3.1 | 2.4 | 5.6 | 3.7 | Motion pictures | -1.6 | -1.0 | .2 | .9 |
| Heating and plumbing apparatus | 2.4 | 1.4 | 1.7 | 1.8 | Other amusements | -5 | -1.5 | .8 | .9 |
| Fabricated structural metal products | 2.5 | 2.3 | 4.6 | 3.1 | Health services except hospitals | -1.6 | .3 | -1.4 | 1.1 |
| Screw machine products | 5.7 | 4.9 | 1.7 | 4.1 | Hospitals | 1.1 | 1.3 | 1.8 | 1.4 |
| Metal stampings | 5.7 | 4.9 | 4.6 | 5.0 | Other medical services | -1.6 | .3 | 2.1 | 1.3 |
| Cutlery and hand tools | 5.7 | 4.9 | 5.1 | 5.2 | Educational services | -8 | -1 | -6 | .5 |
| Other fabricated products | 5.7 | 4.9 | 1.8 | 4.1 | Nonprofit organizations | -8 | -1.1 | -2 | .7 |
| Engines and turbines | 4.0 | 3.1 | 4.7 | 3.9 | Private households | 3.7 | -3.3 | -1.8 | 2.9 |

unemployment rate were incorrect? To isolate the impact of the errors in the labor force projection, for example, we had to determine what the projected total employment level would have been if BLS had correctly projected the unemployment rate, the number of persons in the Armed Forces, and other variables and had only made an error in projecting the labor force. The difference between this calculated total employment level and actual 1985 em-

ployment is the effect of the erroneous labor force projection. We repeated this process for each variable in the employment projection. Table 6 shows the results of these calculations.

For 1973, the largest error was the projected 1985 labor force. If labor force had been the only error, BLS projections would have underestimated total 1985 employment by 8.9 million jobs. However, this large neg-

ative error was partially offset by two large positive errors in unemployment and in the adjustment for dual jobholders.

In 1976, the projected labor force again had the largest negative error. That error was also partially offset by positive errors in projecting unemployment and in the adjustment for dual jobholders.

For 1978, the largest error was projected unemployment. This positive error was partially offset by a modest negative error for the projected labor force.

Supply GNP. Supply GNP is one of three parts of the BLS simultaneous macroeconomic projection. As noted earlier, supply GNP includes projections of labor productivity, average annual hours, and other variables, as well as total employment. Here we want to determine the contribution of the errors in each underlying variable to the error in the supply GNP estimate. Our analysis is limited to the first-round effects.

As with the projection of total employment, in order to isolate the impact of the erroneous labor force projection on the GNP projection, we have to determine what the projected GNP level would have been if BLS had correctly projected the unemployment rate, average annual hours, labor productivity, and other variables and had only made an error in projecting the labor force. The difference between this GNP level and the actual 1985 GNP is the effect of the erroneous labor force projection. We repeated this process for each variable in the GNP projection. Table 7 shows the results of these calculations.

The 1973 projections overestimated GNP because of the productivity projection. That error contributed \$920 billion to the total error of \$797 billion. This positive error was partially offset by the effect that negative errors in the labor force projection had on supply GNP.

The 1976 projection also overestimated GNP because of its productivity projection. The error of the productivity projection matched the total error of \$544 billion. This positive error was again partially offset by the negative error for the labor force projection.

The 1978 projections continued to overestimate GNP because of the productivity projection error. That error accounted for \$355 billion of the total \$409 billion error.

It was not possible to carry out a similar set of calculations for the detailed industry projections. To do that, a current input-output table comparable to the table used in each of the three sets of projections would be required. Such current tables do not exist.

BLS projections: on target or off the mark?

In this article, we only list the errors of BLS projections of the 1985 economy. At some point, we need a standard to gauge the relative accuracy of the published data. One gauge of relative accuracy is past BLS projections. An-

other is to compare BLS projections with other medium-term projections. Because employment projections are the primary product of the BLS projection program, we limit this comparison to employment.

Past BLS projections. BLS has now evaluated eight employment projections. The errors in the projections of total employment growth range from a -0.4 percentage point per year for the 1976 projection of the 1980 economy to a positive 0.6 percentage point per year for the 1973 projection of the 1975 economy. (See table 8.) The average absolute errors in projecting industry trends have ranged from 1.3 to 2.9 percentage points per year. The spread of error is slightly smaller when the errors are weighted for industry size, ranging from 1.0 to 2.1 percentage points per year. The 1980 projections prepared in 1970 were the most accurate, while the 1980 projections prepared in 1973 were the least accurate. The three projections for the 1985 economy fall about in the middle of the error range of past BLS projections.

Other medium-term projections. Finally, how do BLS projections compare with other projections? Several forecasters conducting similar studies underestimated the 1985 level of total employment. Their errors were similar to those of BLS because all the forecasters used the same population projections and assumed similar unemployment rates. BLS and another forecaster underestimated the employment shift from goods-producing industries to service-producing industries.

In the 1970's, several organizations prepared projections of the mid-1980's economy. In 1973, Clopper Almon of the University of Maryland and the National Planning

Table 6. Factored errors in projection of 1985 total employment

| Item | Projected in — | | |
|--------------------------------------|------------------------|--------|-------|
| | 1973 | 1976 | 1978 |
| Total error | -1,986 | -2,219 | 2,054 |
| Error due to: | | | |
| Labor force | -8,931 | -8,724 | -758 |
| Armed Forces | -16 | -11 | -13 |
| Unemployment | 3,775 | 3,185 | 2,949 |
| Adjustment factor ¹ | 3,662 | 1,748 | -113 |
| Interaction | -476 | -327 | -13 |
| | Percent of total error | | |
| Total error | 100 | 100 | 100 |
| Error due to: | | | |
| Labor force | -450 | -316 | -37 |
| Armed Forces | -1 | 0 | -1 |
| Unemployment | 190 | 150 | 143 |
| Adjustment factor ¹ | 184 | 82 | -6 |
| Interaction | -24 | -15 | -1 |

¹Includes adjustment for multiple jobholders and other statistical differences between employment as measured by the Current Population Survey and the Current Employment Survey (790).

Association (NPA) published projections for the 1973–85 and 1973–83 periods, respectively.⁴ In this brief comparison, we assume that NPA's 1973–83 trends continued through 1985. In 1976, the NPA published projections for the 1976–86 period.⁵ Like BLS, Almon and NPA use models and judgments to make projections. (Again, this comparison is *limited* because very few medium-term employment projections are developed. Most projections are for 1 year ahead, *not 10 years ahead*.)

1973–85 projections. Total employment growth was slightly underestimated in the BLS and Almon projections of the mid-1980's economy and slightly overestimated in the NPA projections. The errors were small, less than 0.3 percentage point per year, and similar because each economic projection used the Bureau of the Census population projections. Further, each assumed the economy would operate in the longer run at full employment.

Almon overestimated real GNP growth for the 1973–85 period by 0.4 percentage point per year. NPA overestimated GNP growth by 1.3 percentage points per year. As previously noted, BLS overestimated the trend by 2.1 percentage points per year. The differences reflect the respective productivity projections. Almon projected a slowdown in productivity while NPA projected a slight acceleration. BLS projected a more substantial acceleration.

Both Almon and BLS underestimated the employment shift from the goods-producing sector to the service-producing sector. Almon projected that employment in the goods-producing sector would account for 7 percent of the net new jobs over the 1973–85 period, while the ac-

Table 7. Factored errors in projection of 1985 supply GNP
[Billions of 1982 dollars]

| Item | Projected in— | | |
|----------------------------|------------------------|-------|-------|
| | 1973 | 1976 | 1978 |
| Total error | \$797 | \$544 | \$409 |
| Error due to: | | | |
| Labor force | -306 | -230 | -26 |
| Unemployment rate | 129 | 109 | 101 |
| Adjustment factor | 125 | 60 | -4 |
| Government including | | | |
| Armed Forces | -28 | -23 | -6 |
| Average annual hours | 10 | 57 | 3 |
| Labor productivity | 920 | 544 | 355 |
| Interaction | -53 | 27 | 6 |
| | Percent of total error | | |
| Total error | 100 | 100 | 100 |
| Error due to: | | | |
| Labor force | -38 | -42 | -6 |
| Unemployment rate | 16 | 20 | 25 |
| Adjustment factor | 16 | 11 | -1 |
| Government including | | | |
| Armed Forces | -4 | -4 | -1 |
| Average annual hours | 1 | 10 | 1 |
| Labor productivity | 115 | 100 | 82 |
| Interaction | -7 | 5 | 1 |

Table 8. BLS errors in projecting employment trends, selected periods

[Percentage points]

| Year published | Year projected | Difference between projected and actual trends | | |
|----------------|----------------|--|--|------------------------------|
| | | Total employment | Industry trends (Average absolute errors) | |
| | | | Unweighted | Weighted by size of industry |
| 1966 | 1970 | -0.2 | 1.4 | 1.1 |
| 1973 | 1975 | .6 | 2.3 | 1.3 |
| 1970 | 1980 | -.3 | 1.3 | 1.0 |
| 1973 | 1980 | -.2 | 2.7 | 2.1 |
| 1976 | 1980 | -.4 | 1.5 | 1.2 |
| 1973 | 1985 | -.2 | 2.0 | 1.5 |
| 1976 | 1985 | -.1 | 1.9 | 1.4 |
| 1978 | 1985 | .2 | 2.9 | 1.5 |

tual share was 2 percent. BLS projected that employment in the goods-producing sector would account for 16 percent of the additional jobs, while the actual share was 7 percent. (The estimates of the actual share differ because the two forecasters used different employment measures. For example, Almon's measure converts part-time workers to full-time equivalents, while the BLS measure does not.) Because NPA did not project employment for all industries, this point cannot be evaluated.

1977–85 projections. BLS overestimated total employment growth between the late 1970's and mid-1980's, while NPA underestimated the growth. The respective errors were less than 0.3 percentage point per year. The difference between the projections reflects the respective labor force projections. BLS overestimated the labor force growth, while NPA underestimated it. Both assumed the economy would be operating at near full employment.

Both BLS and NPA overestimated real GNP growth by about 1.5 percentage points per year. Each assumed productivity would accelerate.

Finally, both underestimated the employment shift from the goods-producing sector to the service-producing sector. Both projected that about one-fourth of the additional employment would occur in the goods-producing sector; the actual share was less than one-tenth during the 1977–85 period.

Future benefits

Evaluations of the projections are designed to show their strengths and weaknesses. Without an evaluation, we might only guess at the accuracy of the projections and probably compound any errors introduced into the process. Accordingly, the judgments and economic models which go into any projection are continuously reviewed.

In this evaluation no pattern of errors emerged which would suggest changes in the data or procedures. We have not separated the effects of data or procedural errors on

the projection process. However, it does seem important to explore wider ranges of assumptions because, at least

for 1985, many of the broad assumptions about the U.S. economy were wide of the mark. □

—FOOTNOTES—

¹The initial projections of the 1985 economy were described in "Projections of GNP, income, output, and employment," *Monthly Labor Review*, December 1973, pp. 27-42; and in detail in *The Structure of the U.S. Economy in 1980 and 1985*, Bulletin 1831 (Bureau of Labor Statistics, 1975). The second projections of the 1985 economy were described in Ronald E. Kutscher, "Revised projections of the U.S. economy to 1980: an overview," *Monthly Labor Review*, March 1976, pp. 3-8; Charles T. Bowman and Terry H. Morlan, "Revised projections of the U.S. economy to 1980 and 1985," *Monthly Labor Review*, March 1976, pp. 9-21; and Thomas J. Mooney and John H. Tschetter "Revised projections to 1985," *Monthly Labor Review*, November 1976, pp. 3-9. The third projections were published in Norman C. Saunders, "The U.S. economy to 1990: two projections for growth," *Monthly Labor Review*, December 1978, pp. 36-46; Valerie A. Personick, "Industry output and employment: BLS projections to 1990," *Monthly Labor Review*, April 1979, pp. 3-14; and Arthur Andreassen, "Changing patterns of demand: BLS projections to 1990," *Monthly Labor Review*, December 1978, pp. 47-55.

²BLS periodically evaluates its labor force, industry employment, and occupational employment projections. See John Tschetter, "An evalua-

tion of BLS' projections of 1980 industry employment," *Monthly Labor Review*, August 1984, pp. 12-21; Max L. Carey and Kevin Kasunic, "Evaluating the 1980 projections of occupational employment," *Monthly Labor Review*, July 1982, pp. 22-30; and Howard N Fullerton's evaluation of projections of the 1985 labor force, *Monthly Labor Review*, forthcoming.

³The distinction between judgment and economic models is artificial in the context of projections. Judgments are usually based on analysis of trends and relationships between variables, that is, models. The distinctions between independent and dependent variables (which is where the distinction between judgment and model originates) is important in the context of model building or econometrics.

⁴Clopper Almon, Jr., Margaret B. Buckler, Lawrence M. Horwitz, and Thomas C. Reimbold, *1985: Interindustry forecasts of the American economy* (Lexington, MA, Lexington Books, 1974).

⁵*The U.S. economy: 1973-83*, NEPS report no. 76-N-1 (National Planning Association, 1974).

⁶*The next ten years*, NEPS report no. 76-N-2/3 (National Planning Association, 1976).