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BY THE U.S. GENERAL ACCOUNTING OFFICE

Report To The Honorable Berkley Bedell United States House Of Representatives

Bureau Of Labor Statistics Employment Projections: Detailed Analysis Of Selected Occupations And Industries

Every 2 years the Bureau of Labor Statistics (BLS) prepares and reports projections of future employment by occupation and by industry.

This report examines the process that BLS uses to generate its employment projections and analyzes the major factors affecting these projections. A companion report (GAO/OCE-85-2) lists specific technological assumptions BLS used in projecting 1995 employment levels.

GAO/OCE-85-1
APRIL 25, 1985

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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

OFFICE OF THE CHIEF ECONOMIST

B-217084

The Honorable Berkley Bedell
House of Representatives

Dear Mr. Bedell:

SUBJECT: Bureau of Labor Statistics Employment Projections: Detailed Analysis of Selected Occupations and Industries (GAO/OCE-85-1)

As the Chairman, Subcommittee on General Oversight and the Economy, Committee on Small Business, you requested that the General Accounting Office examine certain issues concerning projections of future employment levels made by the Bureau of Labor Statistics (BLS)[1]. In subsequent discussions with your office, it was agreed that we would issue two reports in response to your request. One report would focus on the process BLS uses to project future employment levels; the other report would describe in detail specific technological assumptions that BLS used in projecting 1995 employment levels for certain industries and occupations.

This first report describes the process that BLS uses to project future employment levels and analyzes the major factors that influence these projections. To accomplish these objectives, we first reviewed the entire employment projection process and prepared a brief description of that process based on our survey of the relevant literature and interviews with BLS officials. A primary purpose of this review was to identify the major factors affecting BLS' projections of future employment levels. We then analyzed in detail the relative effects of these determining factors on BLS' projections of 1995 employment levels for each of the specific industries and occupations that you asked us to examine.

During our review we learned that BLS uses a system of five inter-linked economic models to project the size of the labor force, the level of aggregate economic activity, the demand for goods and services by industry, and the demand for labor by

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[1]The Bureau of Labor Statistics is responsible for the Department of Labor's economic and statistical research activities. As the federal government's principal data-gathering agency in the field of labor economics, BLS collects, processes, analyzes and disseminates data on employment, unemployment, wages, productivity and technological change.

industry and by occupation. BLS makes certain checks to assure that the results of these models are internally consistent. If any inconsistencies are found, BLS makes judgmental adjustments to the models to eliminate them.

We also found that the BLS employment projection process is based on basic economic principles that posit changes in the level and distribution of aggregate demand and new technologies as primary determinants of changing employment levels in individual industries and occupations. Specifically, we identified five major determinants of BLS' employment projections: the projected level of gross national product (GNP), demand distribution, productivity, input-output relationships among industries, and staffing patterns.

To illustrate the relative effects of these determinants, we designed two sets of computer simulations that BLS performed at our request. These two sets of simulations generated similar results and showed that

- o the projected level of GNP has a relatively greater effect on projected employment levels than any other determinant, and
- o the relative importance of each of the other determinants varied substantially from one industry to another, and from one occupation to another. It is these factors that actually affect how the projected rates of growth in employment vary among industries and occupations.

A second, companion report (GAO/OCE-85-2) describes in detail specific technological assumptions regarding each of the 59 durable goods industries and the 40 highest growth occupations that you asked us to examine. We obtained this information through interviews with BLS officials.

Our review was made during the period October 1983 through October 1984 and was performed in accordance with generally accepted government audit standards, except that we did not review the general controls and application controls of the computer-based system that BLS uses to generate its employment forecasts.

THE BLS EMPLOYMENT PROJECTION PROCESS

On December 14, 1983, we briefed your office on the five economic models that, when linked together, comprise the system that BLS uses to produce its employment projections. The five models are: (1) a labor force model, (2) an econometric model of the U.S. economy, (3) an industry activity model, (4) an industry labor demand model, and (5) an occupational labor demand model.

During the projection process, the economic variables forecasted by any one model become inputs to one or more of the subsequent models. (A detailed explanation of these models and their interrelationships is provided in Enclosure I.)

These five economic models are used by BLS in the following six-step process:

(1) The labor force model is used to project the future size of the labor force.

(2) Based on the results of this forecast and quantifiable assumptions about the level of certain economic activity (e.g., the amount of government expenditures for national defense), the macroeconomic model is then used to project such macroeconomic variables as unemployment, inflation, and the level of GNP and its various components, such as personal consumption expenditures and business investment expenditures. These components of GNP represent aggregate final demands (which are purchases of goods and services by end users) as opposed to intermediate demands (which are purchases of goods and services by intermediate users for further production).

(3) In the industry activity model, the forecasted aggregate final demands for goods and services are allocated across various industries by means of a bridge table -- a set of percentage distributions of the aggregate final demands among industries.

(4) The resulting forecasts of final demands for industrial outputs are then transformed into total demands (final plus intermediate demands) for those outputs by use of an input-output table -- basically, a table of coefficients showing the amount of inputs required from every industry to produce one dollar's worth of a specific industry's output.

(5) The industry labor demand model is used to forecast each industry's future employment based on the projected total demand for that industry's output and the values of certain economic variables, as forecasted by the macroeconomic model.

(6) The occupational labor demand model is then used to transform the forecasted employment levels for individual industries into employment forecasts for individual occupations. This final step is accomplished by allocating industry employment forecasts among occupations by means of staffing patterns -- ratios of employment in each occupation in each industry to total employment in the industry.

After obtaining its initial set of occupational employment projections, BLS reviews the projections generated by each model in the forecasting system to assure internal consistency. Examples of such consistency checks include: (1) the summation of forecasted industry final demands must equal forecasted GNP; and (2) the summation of forecasted industry employment levels must equal the forecasted size of the labor force minus the forecasted level of aggregate unemployment. If an inconsistency is found, an adjustment is made in at least one parameter, such as a particular industry's input-output coefficient or staffing pattern ratio.

The determinations as to which parameters should be changed, and what the magnitude and direction of any such changes should be, are judgmental. But each time such a change is made, it could have ramifications for the employment projections for several industries or occupations. For example, a change in the input-output coefficient relating the use of steel in the production of motor vehicles will not only affect the employment projections of these two industries, but might also affect those of the aluminum and glass industries. Similarly, a change in the staffing pattern ratio relating the relative employment of hand bookkeepers in the motor vehicle industry could also affect the employment projections for computer programmers and computer operators in that industry. Thus, once a given set of adjustments has been made, BLS again checks for internal consistency. If necessary, further adjustments are made until (1) internally consistent results are obtained, and (2) all adjustments that have been made to input-output coefficients and staffing pattern ratios are deemed to be reasonably consistent with expected changes in technology and the occupational composition of the work force.

While the BLS employment projection process is complex, it is based on basic economic principles that posit changes in the level and distribution of aggregate demand and new technologies as primary determinants of changing employment levels in individual industries and occupations. Changes in the level of GNP -- the outcome of the second step in the BLS process -- will change the demand for labor in the entire economy, in each industry, and in each occupation. Changes in the distribution of final demands for goods and services will have differential employment effects across industries and occupations. For example, a shift in the composition of demand from agricultural produce to durable goods will result in employment increases in the durable goods industries and in those occupations more prevalent in the manufacture and distribution of those goods. Changes in the distribution of demand are considered both in the second step of BLS process when the various components of GNP are projected, and in the third step, when these forecasted final demands are allocated among industries by use of a bridge table.

Technological change can also have a substantial impact on future industry and occupational employment levels. New production techniques can substantially affect an industry's labor productivity, its interrelationships with other industries as embodied in its set of input-output coefficients, and its staffing pattern ratios. In the BLS process, an increase in an industry's labor productivity would be reflected in the fifth step by a reduction in the estimated amount of labor required to produce each unit of that industry's projected output. The employment effects of technological change might also be reflected by judgmental changes in an industry's input-output coefficients and staffing pattern ratios. Changes to the former, which show the types and amounts of intermediate products required to produce one unit of an industry's output, are made in the fourth step of the BLS process. Whether a particular adjustment to an industry's input-output coefficient increases or decreases its projected employment depends on the nature of the adjustment and whether the intermediate products complement or substitute for labor in the production process. Changes in staffing pattern ratios, which are made in the sixth and final step of the BLS process, would only affect projections of employment levels by occupation, and not the projected industry employment levels.

SIMULATIONS SHOW IMPACTS OF MAJOR DETERMINANTS

Conceptually, there are two basic ways to show the relative impacts of each of these five determinants-- GNP, demand distribution, productivity, input-output coefficients, and staffing pattern ratios--on the 1995 BLS employment projections. First, one could simulate what the projected employment levels would have been if only one determinant at a time was allowed to change. Alternatively, one could simulate what the projected levels would have been if only one determinant at a time was held constant. The two sets of computer simulations that we asked BLS to perform were based on these two respective approaches.

Results of First Set of Simulations

In the first set of simulations, one determinant at a time was assigned its 1995 projected level, while the others were held constant at their 1977 values. (This benchmark was used because BLS' input-output table has been updated to 1977.) Table 1 presents the results of these simulations for the durable goods industries. The first column of this table shows estimated wage-and-salary employment in each industry in 1977. The second column shows the actual projected 1995 industry employment of wage-and-salary workers in each industry, which is the net effect of the projected changes in all of the determinants. Columns 3 through 6 show what the BLS would have projected wage-and-salary employment to be in each industry in 1995 if only the determinant noted at the head of each column had been allowed to change.

To illustrate how these results should be interpreted, consider the first industry listed in the table, "electronic components." The BLS begins with an estimate of 1977 wage-and salary employment in this industry of 405,000 (column 1). When all determinants are assigned their 1995 levels, the result is a projected 1995 employment of 849,800 (column 2)--an increase of 110 percent. If GNP is assigned its 1995 projected level, but all other determinants are held constant at their 1977 levels, the projected 1995 wage-and-salary employment in this industry is 640,500 (column 3) -- a 58-percent increase from the 1977 level. (This percentage increase is the same as that projected for GNP.) Thus, the combined effect of the projected changes in the other three determinants--demand distribution, productivity and input-output coefficients--produce an additional net increase of 209,300 (or 52 percent) in projected 1995 employment.

Taken by itself, the projected change in the composition of final demands for goods and services would increase this industry's 1977 wage-and-salary employment of 405,000 to a projected 1995 employment of 597,800 (column 4)--an increase of 48 percent. This result implies that the pattern of final demands in the future is projected to shift toward electronic products, thus causing a relative increase in the demand for labor in this industry.

When labor productivity is the only determinant assigned its 1995 projected level, projected 1995 wage-and-salary employment is only 209,000 (column 5), which is 196,000 less than the 1977 employment level of 405,000. This result implies that labor productivity is projected to increase substantially in this industry, thereby causing a reduction in the number of wage-and-salary workers required to produce the 1977 level of output.

Finally, when the industry's set of input-output coefficients is the only one of the determinants assigned its 1995 value, the projected 1995 employment of wage-and-salary workers in this industry increases to 712,600 (column 6). This result implies that the intermediate demands for electronic components are projected to increase substantially by 1995, thus causing a significant increase in the demand for labor in this industry.

The only result which uniformly holds for all of the durable goods industries listed in Table 1 is that, with all other determinants held constant at their 1977 levels, the projected growth in GNP will cause projected 1995 employment levels in all industries to increase by 58 percent over their 1977 employment levels. Thus, it is projected differences in demand distribution, labor productivity, and input-output coefficients that actually determine how the projected rates of growth in employment vary among industries.

Table 1

First Set of Simulations of BLS Industry Employment Projections, 1977-95

[Wage and Salary Employment, in thousands]

Industry	1977 Estimated (thousands)	1995 Projected (thousands)	1995 Employment Projection Using Only Projection Of:[a] GNP	Demand Distribution	Productivity	Input-Output
Electronic components	405.0	849.8	640.5	597.8	209.0	712.6
Computers and peripheral equipment	262.0	693.6	414.3	724.6	151.5	288.7
Aircraft	500.0	708.9	790.7	517.4	420.2	515.4
Scientific and controlling instruments	190.0	348.2	300.5	185.7	206.3	206.5
Radio and communication equipment	315.0	459.8	498.1	478.1	181.5	335.8
Medical and dental instruments	128.0	272.0	202.4	158.7	138.0	128.6
Fabricated structural metal products	474.0	613.1	749.6	460.9	398.9	473.4
Construction,mining,& oilfield machinery	257.0	357.2	406.4	265.2	219.2	256.5
Fabricated metal products, n.e.c.	336.0	425.5	531.4	332.8	272.3	333.5
Nonelectrical machinery, n.e.c.	241.0	326.5	381.1	229.7	215.1	240.7
Complete guided missiles & space vehicles	66.0	139.7	104.4	66.6	86.9	66.4
Metalworking machinery	325.0	393.0	514.0	317.5	257.3	320.8
Electric transmission equipment	190.0	256.0	300.5	195.3	153.7	191.2
Telephone and telegraph apparatus	147.0	209.1	232.5	236.6	78.5	156.4
General industrial machinery	295.0	356.0	466.5	290.0	234.6	287.4
Millwork, plywood,& wood products,n.e.c	332.0	386.8	525.0	296.4	278.8	326.1
Electrical industrial apparatus	233.0	287.6	368.5	256.1	163.1	236.7
Electric lighting and wiring	205.0	252.8	324.2	205.3	159.7	204.8
Furniture and fixtures, except household	149.0	195.9	235.6	141.8	130.4	148.7
Photographic equipment and supplies	130.0	175.9	205.6	169.4	82.3	135.9
Service industry machines	171.0	214.1	270.4	205.5	112.1	171.7
Household furniture	315.0	357.4	498.1	268.4	264.1	315.7
Engines, turbines, and generators	125.0	167.4	197.7	132.7	98.9	125.8
Ship and boat building and repair	224.0	266.1	354.2	202.9	187.4	222.0
Electrical machinery and equipment, n.e.c.	151.0	187.9	238.8	158.2	113.7	149.9
Material handling equipment	93.0	124.7	147.1	94.6	76.4	94.3
Stone and clay products, n.e.c.	146.0	177.2	230.9	141.1	115.9	146.0
Primary aluminum and aluminum products	150.0	177.5	237.2	149.8	119.3	140.6
Cutlery, handtools, and general hardware	175.0	199.2	276.7	153.8	143.7	174.0
Primary copper and copper products	147.0	169.8	232.5	144.7	135.8	118.7

[a] Staffing patterns do not appear in this list of determinants because they affect occupational, not industry, employment projections.

Table 1 (Continued)

First Set of Simulations of BLS Industry Employment Projections, 1977-95

[Wage and Salary Employment, in thousands]

Industry	1977 Estimated (thousands)	1995 Projected (thousands)	1995 Employment Projection Using Only Projection Of:[a] GNP	Demand Distribution	Productivity	Input-Output
Special industry machinery	190.0	212.8	300.5	156.5	164.0	189.2
Typewriters and other office equipment	49.0	68.9	77.5	74.2	28.3	50.2
Screw machine products	101.0	119.7	159.7	95.3	98.2	83.0
Optical and ophthalmic equipment	68.0	86.1	107.5	100.6	34.5	73.4
Metal stampings	238.0	251.0	376.4	208.8	204.8	212.2
Ordnance	69.0	85.4	109.1	76.7	48.3	69.4
Cement and concrete products	228.0	238.8	360.6	190.1	182.5	226.4
Glass	199.0	209.3	314.7	202.4	150.6	171.9
Heating apparatus and plumbing fixtures	69.0	78.2	109.1	60.8	56.4	68.6
Household appliances	180.0	188.4	284.7	184.9	116.1	179.8
Jewelry and silverware	93.0	98.4	147.1	69.8	82.8	92.9
Farm machinery	167.0	171.8	264.1	135.2	126.4	175.5
Prim. nonfer. metals & products, n.e.c.	82.0	85.0	129.7	82.5	72.6	59.7
Musical instruments and sporting goods	145.0	146.4	229.3	130.1	103.3	144.6
Motorcycles, bicycles, and parts	18.0	19.4	28.5	12.3	15.9	19.4
Pottery and related products	46.0	46.3	72.7	30.2	43.5	46.5
Transportation equipment, n.e.c.	107.0	107.2	169.2	98.7	73.4	107.1
Railroad equipment	56.0	50.1	88.6	38.2	48.4	54.3
Watches,clocks,& clock-oper. devices	30.0	21.0	47.4	21.9	17.4	30.6
Logging	84.0	74.8	132.8	77.3	57.7	73.6
Wooden containers	21.0	11.1	33.2	20.4	18.3	8.3
Radio and television receiving sets	123.0	111.9	194.5	189.3	45.5	124.4
Metal containers	78.0	62.4	123.4	74.7	52.5	61.6
Sawmills and planing mills	228.0	208.7	360.6	196.3	170.0	207.1
Structural clay products	50.0	30.1	79.1	33.7	28.9	49.2
Manufactured products, n.e.c.	200.0	175.6	316.3	184.7	127.3	188.8
Iron and steel foundries and forgings	302.0	269.1	477.6	274.4	254.8	220.7
Motor vehicles	947.0	859.1	1497.6	726.8	724.2	925.9
Blast furnaces and basic steel products	554.0	447.3	876.1	511.9	424.4	402.3

[a]Staffing patterns do not appear in this list of determinants because they affect occupational, not industry, employment projections.

It is the magnitude and direction of interindustry differences in these three determinants that become apparent in Table 1. For example, in addition to the "electronic components" industry, Table 1 shows that the composition of final demand in 1995 is also projected to shift in such a way that demand increases for such industries as "computers and peripheral equipment" (which shows the largest such impact), "radio and communication equipment," and "telephone and telegraph apparatus." In contrast, the table shows the projected composition of final demand shifting away from such industries as "household furniture," "ship and boat building and repair," and "cutlery, handtools, and general hardware." For all 59 durable goods industries, projected changes in demand distribution are shown to increase forecasted 1995 wage-and-salary employment in 23 industries and decrease it in 36. (All 59 industries and 40 occupations are ranked by the relative impact of each determinant in this first set of simulations in Enclosure II.)

Labor productivity is projected to increase (leading to decreases in forecasted 1995 employment levels) in all of the 59 industries except three--"scientific and controlling instruments," "medical and dental instruments," and "complete guided missiles and space vehicles." The size of the relative employment effects of this determinant, however, varies greatly among industries. For example, unlike the "electronic components" industry, labor productivity is projected to have only a slight effect on future employment in the "screw machine products" industry.

The industry employment effects of projected changes in input-output coefficients are also shown in Table 1. These changes, by themselves, lead to projected wage-and-salary employment increases in 24 of the 59 industries, projected employment decreases in 34 industries, and no change in one. The greatest positive effect occurs in the "electronic components" industry, where taken by themselves projected changes in input-output coefficients would have led to a 76-percent increase in forecasted 1995 employment above the 1977 employment level of 405,000. The greatest negative effect on employment is shown to occur in the "wooden containers" industry, where the forecasted 1995 employment level is 60 percent less than the 1977 employment level as a result of the changes made to the input-output coefficients.

The net industry employment effects of the projected changes in all three of these determinants--demand distribution, productivity, and input-output coefficients--can be ascertained by comparing the actual forecasted 1995 employment levels (column 2) with the 1995 employment levels that would have been forecast if only GNP had increased (column 3). Making these comparisons shows that the combined effect of these three determinants produces an additional net increase in projected 1995 wage-and-salary employment in only five of the 59 industries--"electronic components," "computers and peripheral equipment," "scientific and controlling instruments," "medical and dental instruments," and "complete guided missiles and space vehicles."

Table 2 presents the results of the same set of simulations for the 40 highest growth occupations. The determinants of occupational employment trends are the same as the determinants of industry employment trends shown in Table 1, except for the addition of changes in staffing patterns as a factor influencing occupational trends. The interpretation of the occupational results is similar to the interpretation of the industry results. For example, consider the simulation results for "cashiers." The BLS begins with an estimate of 1977 wage-and-salary employment of 1,406,600 (column 1). When all five determinants are assigned their projected 1995 values, the result is the actual 1995 forecasted occupational employment level of 2,384,200 (column 2)--a projected increase of approximately 70 percent. If only GNP were assigned its 1995 forecasted level, the projected 1995 employment for cashiers would be 2,224,500 (column 3), which represents the same 58-percent growth as that projected for GNP. Thus, the combined effect of the projected changes in the other four determinants produce an additional net increase of 159,700 (or 11 percent) in projected 1995 employment.

If only demand distribution were assigned its projected 1995 level, the table indicates that there would be only a slight increase of 3,300 in projected 1995 employment. This result implies that the expected composition of final demand in the future will not have any appreciable impact on the demands for the outputs of industries employing cashiers. When only labor productivity in each industry is assigned its 1995 forecasted value, the projected 1995 employment of cashiers falls to 1,279,900 (column 5)-- a 9-percent decline from its 1977 level. The implication is that labor productivity is projected to increase in those industries employing cashiers, resulting in a need for fewer cashiers to produce the 1977 level of output. Forecasted 1995 employment of cashiers remains at approximately 1.4 million (column 6) when only the input-output coefficients are assigned their projected 1995 values. This result implies that industries employing cashiers are not expected to alter their future mix of labor and nonlabor resources, such as machinery and energy. Finally, when only staffing patterns are assigned their projected 1995 values, the BLS projects a modest increase in the employment of cashiers--1,667,600 for 1995 compared with 1,406,600 for 1977. This result implies that a modest change is projected in the labor intensity of production by industries employing cashiers.

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Table 2

First Set of Simulations of BLS Occupational Employment Projections, 1977-95

[Wage and Salary Employment, in thousands]

Occupation	1977 Estimated (thousands)	1995 Projected (thousands)	1995 Employment Projection Using Only Projection Of: GNP	Demand Distribution	Productivity	Input-Output	Staff Pattern
Building custodians	2412.7	3530.6	3815.5	2339.9	2221.8	2651.4	2275.5
Cashiers	1406.6	2384.2	2224.5	1409.9	1279.9	1410.9	1667.6
Secretaries	2072.2	3078.1	3277.1	2036.3	1949.8	2167.8	2066.7
General clerks, office	2113.4	3002.3	3342.1	2078.1	1883.3	2202.6	2111.9
Sales clerks	2475.3	3346.2	3914.4	2489.7	2175.4	2482.9	2393.8
Nurses, registered	1075.7	1893.7	1701.2	1094.0	1085.1	1091.8	1149.5
Waiters and waitresses	1368.2	2210.3	2163.7	1267.4	1613.9	1326.6	1352.2
Kndrgrtn. & elementary school tchrs.	1305.6	1892.3	2064.7	1006.2	1294.1	1305.7	1561.9
Truck drivers	1375.0	1804.8	2174.5	1281.9	1212.0	1378.3	1379.2
Nursing aides,orderlies & attend.	991.7	1649.0	1568.2	1096.5	1015.1	997.4	911.5
Sales representatives, technical	1213.8	1667.8	1919.6	1208.6	1073.3	1210.1	1201.3
Accountants and auditors	652.8	1064.4	1032.4	645.3	631.6	677.0	685.4
Automotive mechanics	625.3	924.9	988.9	598.2	571.6	627.5	666.1
Blue collar worker supervisors	1173.1	1488.8	1855.2	1130.2	967.2	1174.6	1208.4
Kitchen helpers	724.3	1160.2	1145.5	678.7	795.7	712.8	726.4
Guards	519.8	952.7	822.0	525.0	458.5	676.7	521.3
Fast food prep., & service wkrs.	669.5	1107.5	1058.8	590.1	837.0	641.6	670.6
Store managers	726.6	1092.8	1149.0	736.4	633.9	726.9	781.1
Carpenters	525.8	746.2	831.4	479.5	518.2	528.5	522.6
Electrical & electronic technicians	311.2	561.4	492.1	360.3	256.5	347.8	362.5
Licensed practical nurses	482.4	785.4	762.8	501.9	489.1	496.9	460.2
Computer systems analysts	214.9	455.5	339.9	221.1	188.3	247.3	289.1
Electrical engineers	261.1	518.0	412.9	322.4	210.7	300.2	310.1
Computer programmers	219.6	455.9	347.3	248.8	186.0	257.3	271.7
Mainten. repairers gen. utility	645.0	885.3	1019.9	611.6	565.6	658.8	662.7
Helpers, trades	582.0	767.8	920.4	538.8	522.8	578.2	557.6
Receptionists	314.1	550.1	496.8	328.4	313.7	328.2	321.1
Electricians	463.1	627.9	732.3	427.6	430.8	457.9	468.6
Physicians	268.0	474.9	423.9	284.2	275.3	268.5	274.3
Clerical supervisors	411.3	621.1	650.4	436.0	344.0	444.0	420.8
Computer operators	181.5	362.3	287.0	188.1	160.3	203.9	227.9
Sales representatives, nontechnical	528.0	734.9	835.0	519.3	471.2	525.1	531.8
Lawyers	190.0	385.9	300.4	177.2	223.4	195.9	209.6
Stock clerks,stockroom & warehouse	769.4	985.3	1216.8	766.3	669.4	780.2	717.7
Typists	868.9	1117.2	1374.0	822.0	794.7	921.3	786.2
Delivery and route workers	714.5	941.7	1129.9	682.1	617.3	722.3	710.1
Bookkeepers, hand	791.0	1038.3	1251.0	780.6	737.7	809.4	710.6
Cooks, restaurant	275.8	479.7	436.1	257.4	322.7	267.8	293.4
Tellers	381.4	608.9	603.1	457.2	308.3	412.0	375.2
Cooks,short order & spec. fast food	347.3	558.7	549.3	313.4	422.2	334.4	340.4

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Overall, projected changes in demand distribution have a positive effect (relative to estimated 1977 employment levels) on forecasted 1995 employment levels for 16 occupations (cashiers, sales clerks, etc.) and a negative effect for 24 occupations (secretaries, general office clerks, truck drivers, etc.). Projected changes in labor productivity have a positive employment effect for 10 occupations (cooks, lawyers, etc.) and a negative effect for 30 occupations (tellers, electrical engineers, etc.) The results also show that projected changes in input-output coefficients have a positive employment effect for 31 occupations (computer system analysts, guards, etc.) and a negative effect for nine (cooks, electricians, etc.). Finally, projected changes in staffing patterns exhibit a positive employment effect for 24 of the occupations (computer systems analysts, computer operators and programmers, etc.) and a negative effect for 16 occupations (typists, hand bookkeepers, etc.).

Table 2 also shows that the relative size of the projected employment effects of these determinants often varies substantially from one occupation to another, as they do from one industry to another in Table 1. The combined net effect of these four determinants produces an additional net increase in forecasted employment (over and above the level that would have been forecasted assuming just the 58-percent increase in GNP) for 19 occupations, and a net decrease in 21 occupations.

Results of Second Set of Simulations

In the second set of simulations, we asked BLS to reverse the procedure used for the first set, to use 1982 as the benchmark year, and to make the analysis for all workers, not just wage-and-salary workers. Thus, in these simulations, one determinant at a time was assigned its actual 1982 value, while the other determinants were set equal to their projected 1995 values. Table 3 presents the results of this second set of simulations for the durable goods industries, and Table 4 presents the results for the 40 highest growth occupations. Although the interpretation of these results is somewhat different, they are consistent with the results of the first set of simulations presented in Table 1 and Table 2. For example, consider the results of the "electronic components" industry in Table 3.

The actual 1982 employment in this industry was 561,000 (column 1 of Table 3). If all determinants except GNP are assigned their 1995 projected values and GNP is held constant at its 1982 value, projected 1995 employment is 582,500 (column 3). Thus, the net employment effect of all other determinants except GNP is an increase of 21,500 or approximately 4 percent in projected employment. (In Table 1, the positive net effect of all other determinants except GNP was shown by comparing the 849,800 figure in column 2 with the 640,500 figure in column 3).

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Table 3
Second Set of Simulations of BLS Industry Employment Projections, 1977-95
[Total Employment, in thousands]

Industry	1982 Actual (thousands)	1995 Projected	1995 Employment Projection With Base Year: GNP	Demand Distribution	Productivity	Input-Output
Electronic components	561.0	849.8	582.5	581.4	1301.0	487.7
Computers and peripheral equipment	428.0	693.6	475.5	263.9	880.1	662.4
Fabricated structural metal products	461.0	618.8	424.2	635.9	821.8	619.1
Motor vehicles	707.0	859.8	589.4	1120.8	1342.0	879.8
Scientific and controlling instruments	226.0	349.4	239.5	355.7	343.3	319.9
Medical and dental instruments	158.0	272.0	186.5	219.1	250.6	270.5
Construction, mining, & oilfield machinery	254.0	357.2	244.9	345.9	498.0	357.6
Millwork, plywood, and wood products	317.0	418.9	287.2	469.1	493.3	426.3
Fabricated metal products, n.e.c.	331.0	430.4	295.1	432.5	592.2	431.5
Household furniture	270.0	357.4	245.0	418.6	412.3	355.9
Electrical industrial apparatus	206.0	287.6	197.1	262.0	432.2	283.5
Metalworking machinery	319.0	400.0	274.2	408.8	522.5	404.7
Aircraft	629.0	709.5	486.4	685.6	821.6	688.2
General industrial machinery	288.0	356.0	244.1	361.4	504.1	364.7
Electric lighting and wiring	187.0	252.8	173.3	252.4	319.9	252.9
Metal stampings	187.0	251.8	172.6	289.6	335.4	285.0
Telephone and telegraph apparatus	148.0	209.1	143.3	132.1	256.0	199.8
Cutlery, handtools, and general hardware	143.0	200.2	137.2	226.9	252.7	200.7
Service industry machines	159.0	214.1	146.8	178.0	306.7	213.1
Engines, turbines, and generators	113.0	167.5	114.8	157.5	269.5	166.2
Nonelectrical machinery, n.e.c.	292.0	345.3	236.7	359.3	424.8	342.9
Blast furnaces and basic steel products	394.0	447.3	306.6	487.4	704.5	620.2
Stone and clay products, n.e.c.	132.0	182.0	124.8	188.3	262.6	182.0
Iron and steel foundries and forgings	221.0	269.6	184.8	295.1	381.7	367.0
Ship and boat building and repair	223.0	269.7	184.9	297.6	318.0	272.1
Household appliances	142.0	188.5	129.2	183.4	283.0	188.6
Electrical machinery and equipment, n.e.c.	153.0	194.4	133.3	184.8	276.5	195.0
Electric transmission equipment	215.0	256.0	175.5	247.2	358.4	249.9

Table 3 [Continued]
Second Set of Simulations of BLS Industry Employment Projections, 1982-95
[Total Employment, in thousands]

Industry	1982 Actual	1995 Projected	1995 employment projections with base year: GNP	Demand Distribution	Productivity	Input-Output
	[thousands]					
Glass	173.0	212.3	145.5	208.7	268.6	245.7
Material handling equipment	87.0	125.3	85.9	122.9	182.3	123.3
Primary aluminum and aluminum products	140.0	177.7	121.8	177.0	248.8	188.7
Special industry machinery	176.0	212.8	145.9	258.3	295.3	213.5
Photographic equipment and supplies	140.0	176.7	121.2	136.7	256.8	170.4
Radio and communication equipment	424.0	459.8	315.2	306.0	633.7	435.6
Transportation equipment, n.e.c.	74.0	109.0	74.7	118.1	136.4	108.8
Primary copper and copper produts	135.0	169.8	116.4	173.4	224.4	211.4
Complete guided missiles & space vehicles	105.0	139.7	95.8	138.3	163.4	138.7
Farm machinery	139.0	172.0	117.9	210.3	259.8	162.1
Cement and concrete products	209.0	240.3	164.8	288.4	330.8	242.2
Sawmills and planing mills	179.0	208.7	143.1	244.2	279.7	231.4
Screw machine products	92.0	120.5	82.6	128.5	132.2	147.5
Furniture and fixtures, except household	180.0	206.2	141.4	216.5	243.7	206.6
Jewelry and silverware	76.0	98.4	67.4	130.8	141.2	98.3
Typewriters and other office equipment	47.0	69.1	47.4	45.9	111.1	67.9
Radio and television receiving sets	93.0	112.5	77.2	73.2	228.1	111.4
Heating apparatus and plumbing fixtures	61.0	78.2	53.6	88.7	120.0	78.6
Musical instruments and sporting goods	130.0	146.4	100.3	163.0	183.6	146.6
Optical and ophthalmic equipment	77.0	91.9	63.0	62.8	121.2	86.1
Railroad equipment	37.0	50.1	34.4	74.3	90.2	52.3
Pottery and related products	40.0	48.7	33.4	73.2	52.0	47.6
Ordnance	79.0	85.5	58.6	76.9	119.3	84.9
Motorcycles, bicycles, and parts	14.0	19.7	13.5	27.6	22.5	17.6
Primary nonferrous metals & metal products	80.0	85.1	58.3	83.6	122.3	115.6
Watches, clocks, & clock-operated devices	18.0	21.1	14.5	28.3	36.4	20.2
Logging	126.0	127.6	87.5	136.3	164.5	143.2
Manufactured products, n.e.c.	218.0	218.4	149.7	236.4	360.6	231.4
Metal containers	64.0	62.4	42.8	65.6	101.5	79.5
Structural clay products	34.0	30.2	20.7	45.0	51.0	30.8
Wooden containers	15.0	11.1	7.6	11.4	11.8	28.2

The partial effect of the projected changes in demand distribution on future employment in this industry is shown in Table 3 by comparing the level of employment projected in 1995 with all determinants assigned their 1995 values (column 2) with what the projected 1995 level of employment would have been if all determinants except demand distribution were assigned their projected 1995 values. Since the latter figure, 581,400, is substantially less than the former, 849,800, these results imply that the composition of final demand is projected to shift toward electronic products, thus causing a substantial increase in the future demand for labor in this industry. This is the same conclusion as that drawn from the first set of simulation results presented in Table 1.

Similarly, the results in Table 3 are consistent with those in Table 1 in that labor productivity is projected to increase substantially in this industry. With all determinants except productivity assigned their 1995 values, projected employment would be 1,301,000 (column 5), which is substantially more than the 849,800 actually projected. This result implies that labor productivity is expected to increase substantially, since many more workers would be needed to produce the 1995 level of output at 1982's lower level of productivity.

Finally, the results in Table 3, like those in Table 1, show that projected changes in input-output coefficients will increase the demand for labor in the industry. (All 59 industries and 40 occupations are ranked by the relative impact of each determinant in this second set of simulations in Enclosure III.)

Table 4 presents the results of this second set of simulations for the 40 highest growth occupations. These results, which should be interpreted in the same manner as those in Table 3, are also generally consistent with the results from the first set of simulations. In the case of cashiers, for example, these results once again show that labor productivity is projected to increase, that projected changes in demand distribution and input-output coefficients have no appreciable employment effects, and that projected changes in staffing patterns will increase the demand for cashiers in the future.

AGENCY COMMENTS

We requested and received written comments on a draft of this report from the Bureau of Labor Statistics. These comments are attached as Enclosure IV. BLS characterized our discussion of their employment projection process as being very careful, thorough and accurate. BLS also stated its belief that our analyses of the effects of each of the major determinants of their projected employment levels for the industries and occupations we examined were correct. BLS also suggested some minor modifications and editorial changes that we have incorporated in the final report.

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Table 4
Second Set of Simulations of BLS Occupational Projections, 1982-95
[Total Employment, in thousands]

Occupation	1982 Actual (thousands)	1995 Projected (thousands)	1995 Employment Projections With Base Year: GNP	Demand Distribution	Productivity	Input-Output	Staff Pattern
Building custodians	2827.7	3606.4	2472.3	3703.6	4028.9	3259.2	3801.4
Cashiers	1570.2	2314.0	1586.3	2328.5	2623.1	2309.1	1952.4
Secretaries	2441.4	3160.9	2166.9	3261.8	3484.5	3022.6	3213.6
General clerks, office	2348.3	3044.3	2087.0	3127.4	3473.9	2911.3	3043.2
Sales clerks	2915.9	3601.0	2468.6	3612.8	4209.8	3588.7	3716.5
Nurses, registered	1312.4	1954.2	1339.7	1919.8	2087.8	1921.4	1827.7
Waiters and waitresses	1665.0	2227.1	1526.7	2446.4	2202.7	2311.8	2255.6
Kndrgrtn. & elementary school tchrs.	1366.1	1877.3	1286.9	2431.2	1866.6	1877.0	1570.1
Truck drivers	1604.2	2029.0	1390.9	2176.1	2429.6	2010.8	1998.4
Nursing aides,orderlies & attend.	1218.3	1641.9	1125.5	1487.4	1737.3	1616.0	1784.7
Sales representatives, technical	1320.3	1706.7	1170.0	1714.1	1963.5	1710.2	1728.9
Accountants and auditors	855.7	1199.8	822.5	1233.9	1356.2	1156.6	1126.7
Automotive mechanics	844.3	1167.8	800.6	1229.8	1356.9	1162.2	1098.2
Blue collar worker supervisors	1200.1	1519.7	1041.8	1600.6	1924.9	1517.2	1477.1
Kitchen helpers	850.3	1155.4	792.0	1241.4	1160.1	1178.7	1138.9
Guards	637.0	936.8	642.2	921.5	1067.3	718.7	938.1
Fast food prep., & service wkrs	808.9	1105.8	758.0	1268.1	1031.9	1163.5	1103.8
Store managers	970.5	1262.3	865.4	1267.6	1509.2	1259.5	1181.3
Carpenters	863.1	1109.8	760.8	1217.3	1301.8	1100.7	1104.9
Electrical & electronic technicians	366.2	588.5	403.4	541.0	729.4	531.7	506.8
Licensed practical nurses	594.3	814.6	558.4	787.8	868.8	786.6	852.6
Computer systems analysts	254.3	471.4	323.2	470.9	548.5	408.0	355.3
Electrical engineers	319.5	528.2	362.1	456.0	666.1	459.1	441.1
Computer programmers	266.4	471.3	323.1	442.1	553.9	400.7	382.3
Mainten. repairers gen. utility	694.4	887.2	608.2	940.0	1037.0	865.5	859.4
Helpers, trades	608.2	798.1	547.1	865.2	891.8	800.9	834.1
Receptionists	386.7	575.6	394.6	548.0	584.2	552.0	560.0
Electricians	542.3	715.0	490.1	777.2	839.4	719.1	699.2
Physicians	479.1	641.8	440.0	626.9	684.8	639.2	620.0
Clerical supervisors	466.7	628.2	430.6	599.9	755.0	585.1	612.6
Computer operators	210.9	370.7	254.1	368.6	424.7	323.1	293.1
Sales representatives, nontechnical	583.4	743.1	509.4	755.1	854.5	745.9	740.1
Lawyers	464.5	623.7	427.6	668.3	724.0	607.1	553.4
Stock clerks,stockroom & warehouse	830.9	987.1	676.7	1001.0	1162.2	972.1	1064.5
Typists	990.0	1145.3	785.1	1219.0	1274.3	1074.5	1275.6
Delivery and route workers	797.3	950.5	651.6	990.0	1126.3	937.4	949.5
Bookkeepers, hand	956.6	1108.7	760.0	1135.9	1253.1	1088.6	1250.8
Cooks, restaurant	351.2	499.8	342.7	547.6	503.4	517.8	470.0
Tellers	471.5	613.1	420.3	516.6	757.0	575.5	632.0
Cooks,short order & spec. fast food	436.7	577.6	395.9	648.2	563.1	603.2	587.8

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We hope that the information conveyed in this report has increased your understanding of the process that BLS uses to project future industry and occupational employment levels and of the relative impacts that certain determinants have on the resulting projections. As arranged with your office, copies of this report will be sent to other interested parties and will be made available to others upon request. If we can be of further assistance, please do not hesitate to contact us.

Sincerely,

Lawrence H. Thompson

Lawrence H. Thompson
Chief Economist

Enclosures - 5

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THE BUREAU OF LABOR STATISTICS' EMPLOYMENT FORECASTING SYSTEM: ITS STRUCTURE AND METHODOLOGY

According to a former Assistant Commissioner of the Bureau of Labor Statistics (BLS), that agency's employment forecasts are used for a variety of purposes, including:

- career counseling,
- training and education planning, and
- assessments of skilled labor supply.[1]

Understanding the methodology used to generate these employment forecasts is one prerequisite for understanding the extent of their usefulness.

BLS' employment forecasts are dependent on two sets of variables: (1) those variables whose values are forecasted by a series of five interrelated economic models and (2) those variables whose values are based on judgments and assumptions made by BLS. Each of the five models, which appear in Figure 1, consists of a set of equations. The variable on the left-hand side of such an equation, the dependent variable, is the one which the equation forecasts. This forecast is obtained by simple arithmetic operations on terms appearing on the right-hand side of the equation, explanatory variables and the coefficients of those variables. An example of such an equation is $y = ax + bz$, where y, the dependent variable, is "explained" (in a statistical sense) by the variables x and z whose coefficients are a and b, respectively. For a given set of data on the variables x, y, and z, it becomes possible to estimate statistically the values of a and b. Given numerical estimates of a and b, one has only to substitute in numerical values for x and z, multiply each by its estimated coefficient, and add the resultant products to obtain a forecasted value of y.

The flow diagram in Figure 1 illustrates the interrelationships among the five economic models that make up BLS' forecasting system. A brief description of each of these models follows.

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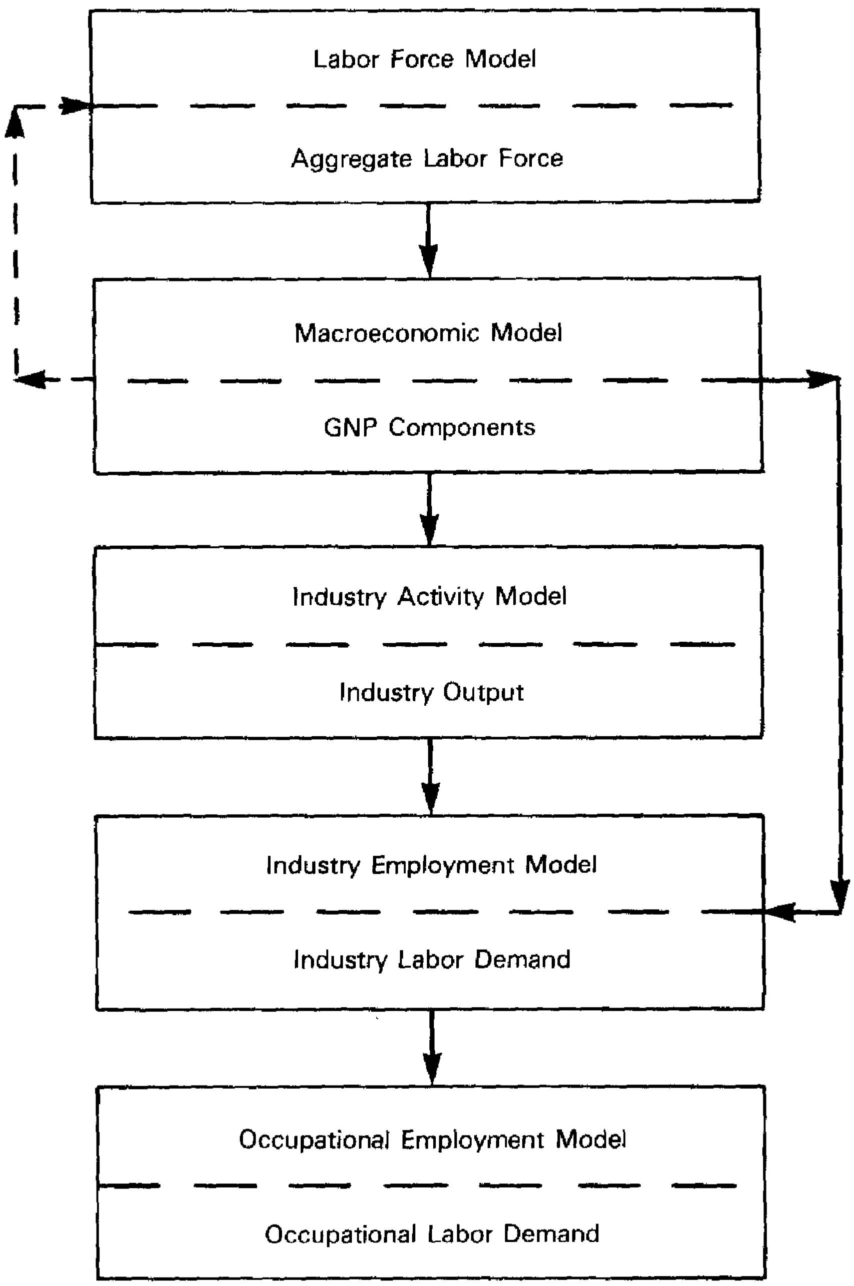
[1]Harold Goldstein, "The Accuracy and Utilization of Occupational Forecasting," in Responsiveness of Training Institutions to Changing Labor Market Demands, ed. by Robert E. Taylor, Howard Rosen, and Frank C. Pratzner (Columbus, OH: National Center for Research in Vocational Education, 1983), p. 39.

Figure 1.

Model Linkages In The BLS Employment Projections System



LABOR FORCE MODEL

Figure 2 provides a schematic representation of the labor force model. The data inputs for this model are

- the Census Bureau's annual population projections for 64 age/race/sex groups and
- BLS' annual projections of age/race/sex labor force participation rates.[2]

The labor force model forecasts the number of labor force participants belonging to each group by multiplying the projected size of the group times its projected labor force participation rate.

The Census Bureau obtains its population projections by means of standard actuarial methods. Briefly, this involves adjusting the size of each demographic group's population 16 years of age and older for the forecasting period, 1982-1995, to reflect varying mortality rates. The data used to make these projections are obtained from the decennial census, which the Census Bureau complements with other data (e.g., hospital records on deaths). Using annual averages on the size of each group's labor force in the past obtained from the Current Population Survey (CPS), which is collected every month from a probability sample of 60,000 households, BLS obtains its projections of labor force participation rates.

MACROECONOMIC MODEL

When added together, the projected labor force numbers for the various demographic groups give the projected size of the aggregate labor force, which then becomes an input into the macroeconomic model. For the 1995 projections, BLS used the macroeconomic model developed and maintained by a contractor, Chase Econometrics. Figure 3 illustrates how the major sectors of the economy are represented in the macroeconomic model. The model uses Income and Product Accounts data, obtained from the Bureau of Economic Analysis (BEA), and monetary and capacity utilization data obtained from the Federal Reserve Board. The Chase macroeconomic model contains 587 jointly dependent or endogenous variables -- variables whose values can be solved for, once the model's parameters have been statistically estimated and its 110 independent or exogenous variables assigned values by the user. Since this macroeconomic model is being used by BLS to forecast future values for aggregate economic activity (such as the level of GNP in 1995), BLS analysts must provide estimates of the exogenous variables. (Table 1 compares actual past values of selected exogenous variables with the future values assumed in the use of the macroeconomic model for the projections.)

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[2]A labor force participation rate is that fraction of a particular group engaged in or seeking gainful employment.

Figure 2.

Labor Force Model

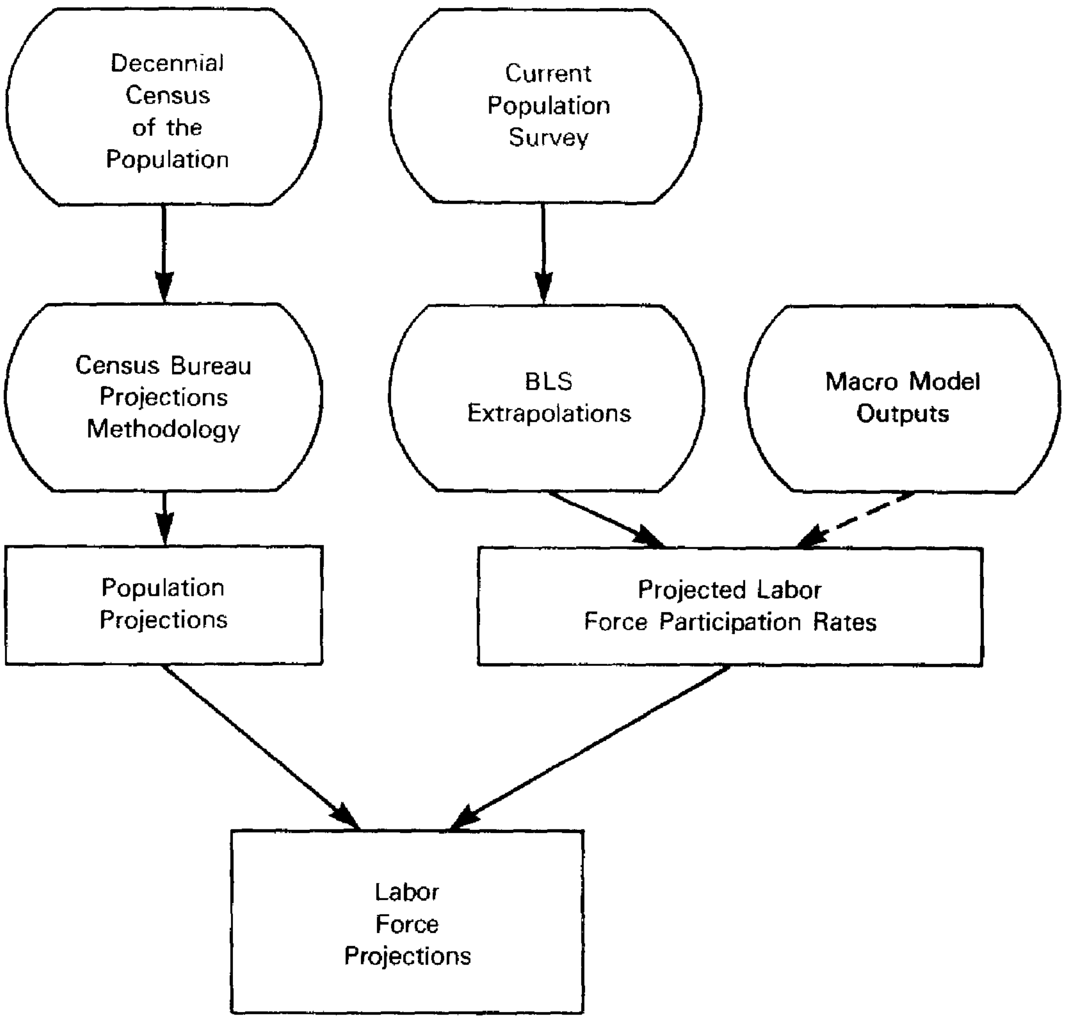
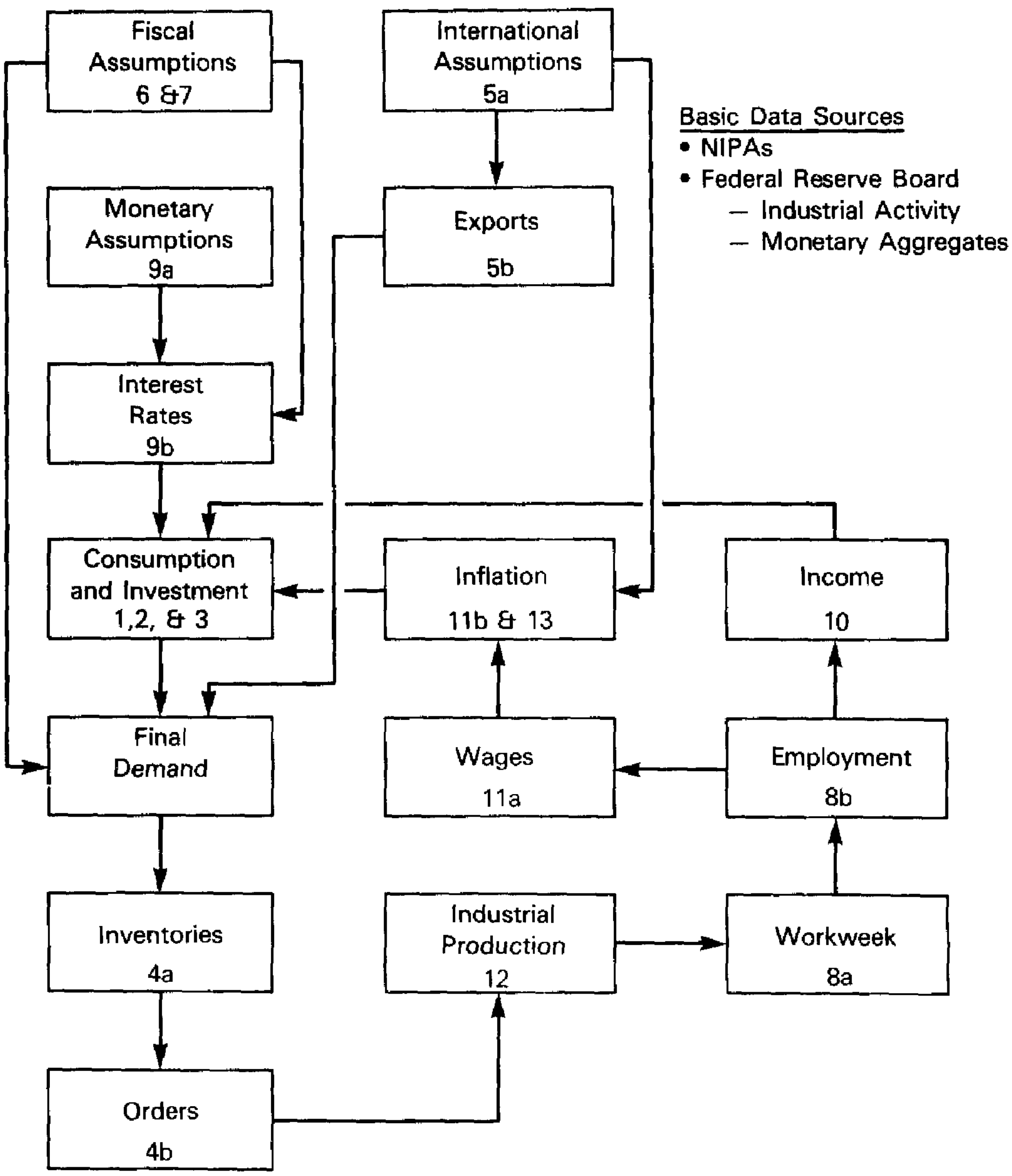


Figure 3.

The Chase Macroeconomic Model
(Numbers in Blocks are Keyed to Sectoral Taxonomy Below)



Major Sectors of the Model

1. Consumption (C)
2. Business Fixed Investment ⎫
3. Residential Investment ⎬ (I)
4. Inventory Investment ⎭
5. Foreign Trade (X)
6. Federal Government Expenditures ⎫ (G)
7. S&L Government Expenditures ⎭
8. Employment and Hours
9. Financial
10. Income
11. Wages and Prices
12. Industrial Production
13. Energy

Aggregate Demand
GNP = C + I + X + G

The macroeconomic model is composed of 13 sectors -- seven of which correspond to the components of Gross National Product (GNP). These are (1) consumption, (2) residential investment, (3) business fixed investment, (4) changes in inventories, (5) foreign trade, (6) federal expenditures, and (7) state and local government expenditures.

Another sector, representing the national labor market, contains forecasting equations for overall labor demand and supply. Forecasts of labor supply growth from the labor force model are combined with forecasts of overall labor demand growth to forecast unemployment rates. Making a forecast of the unemployment rate is essential for obtaining solutions to the forecasting equations in the macroeconomic model. This is because the unemployment rate value is postulated to influence other factors in the economy. For example, the model postulates that a larger unemployment rate will reduce the growth in money wages, which in turn can affect other parts of the economy.

INDUSTRY ACTIVITY MODEL

The projected aggregate demands -- the forecasted values of the GNP components -- are then distributed across 156 producing industries (an aggregation of BEA's taxonomy of 496 industries) by means of an input-output model. The first component of that model is a 156 by 156 industrial/sectoral transactions table. Such a table summarizes transactions in intermediate products among all industries. This information is necessary to relate the forecasts of the macroeconomic model to industry production. Forecasts of industry employment require a knowledge of total production in the industry, which includes not only that production occurring as final industry sales but also production occurring as sales to other industries in meeting their final demands.

Table 2 illustrates the relationship between final demands, interindustry transactions, and total outputs by presenting hypothetical data for an economy with three industry sectors. Consider, for example, the agriculture industry. By reading across the table's first row, one can see that this industry sells

- o $50 billion worth of its total output to itself (e.g., farmers grow and sell corn that is purchased to feed livestock),
- o nothing to the manufacturing sector,
- o nothing to the services sector, and
- o $100 billion to "final demand" (primarily domestic consumers and foreign purchasers).

Table 1.

Selected Exogenous Variables

	Actual				Assumed					
					1990			1995		
	1968	1973	1977	1982	High	Moderate	Low	High	Moderate	Low
Demographic										
Total population...............	200.75	211.94	220.29	232.05	249.56	249.56	249.56	257.68	257.68	257.68
Civilian labor force...........	78.71	89.41	98.98	110.25	126.36	124.95	123.62	133.84	131.39	129.94
Government Expenditures										
Military force level...........	3.53	2.33	2.13	2.18	2.37	2.35	2.40	2.37	2.35	2.40
Implicit wage rate,$/hr.....	2.62	4.66	5.61	8.87	13.71	13.28	13.28	17.08	16.16	16.16
Civilian defense employment....	1.11	.96	.92	.94	1.10	.99	1.15	1.15	1.00	1.15
Implicit wage rate,$/hr.....	4.63	6.88	9.42	13.82	20.75	20.26	20.26	27.21	25.86	25.86
Civilian nondefense employment.	1.15	1.18	1.29	1.26	1.3	1.30	1.33	1.36	1.34	1.38
Implicit wage rate,$/hr.....	3.91	6.36	8.76	12.43	19.05	18.35	18.35	25.49	23.42	23.42
S&L gov't employment...........	8.57	10.43	11.64	12.23	15.09	13.01	13.11	22.39	13.50	13.60
Defense purchases less comp....	46.9	36.6	50.0	111.4	269.6	241.8	261.8	422.5	307.6	331.6
Nondef purchases less comp.....	11.8	13.5	27.1	46.6	62.5	55.7	56.5	103.3	75.9	79.0
Grants-in-aid to S&L gov'ts....	18.6	40.6	67.6	83.5	138.5	137.9	142.9	203.5	191.2	192.7
Fed health insurance transfers.	5.6	9.7	21.7	50.7	112.5	109.4	122.2	189.6	154.8	193.5
Fed retirement transfers.......	4.5	9.7	18.4	35.3	66.4	65.1	69.4	103.2	96.7	107.9
Other assumed fed transfers....	9.0	18.9	33.5	51.3	97.5	95.3	101.5	147.0	133.4	148.9
Government Revenues										
Equipment tax life, yrs........	9.7	8.5	8.4	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Commercial struc tax life, yrs.	35.0	35.0	35.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Other structures, tax life, yrs	25.0	21.6	19.5	14.3	14.3	14.3	14.3	14.3	14.3	14.3
Basic corporate tax rate.......	53.0	48.0	48.0	46.0	44.0	46.0	43.0	44.0	46.0	42.0
Avg. marginal personal tax rate	24.0	25.0	28.0	26.0	22.0	23.0	24.0	22.0	23.0	24.0
Social security tax rate.......	4.0	6.0	6.0	7.0	7.7	8.0	7.7	7.7	8.0	7.7
Social security tax base.......	7,800	10,800	16,500	32,400	55,800	55,800	55,800	82,500	82,500	82,500
Fed indirect business taxes....	18.0	21.2	25.1	50.0	104.2	87.2	87.1	146.1	104.2	125.9
Monetary										
Borrowed reserves..............	.6	1.7	.5	1.1	1.2	1.2	1.2	1.2	1.2	1.2
Money market funds.............	NA	NA	2.8	170.8	366.2	396.7	439.1	605.0	716.2	866.0
Monetary base less currency....	22.6	29.4	37.3	48.2	85.6	83.2	80.8	118.3	109.7	101.5
Other Assumptions										
Industrial prod index, ROW.....	NA	106.7	110.4	114.3	148.6	146.7	144.7	175.7	171.0	167.0
Avg value of the US dollar.....	114.3	98.1	108.0	127.2	151.4	149.9	144.6	162.9	159.9	151.7
Import oil cost, $/bbl.........	2.29	3.37	13.27	32.23	41.01	41.01	42.86	51.75	51.80	57.25
Import share, new pass. cars...	11.0	16.0	19.0	28.0	28.0	30.0	30.0	28.0	30.0	33.0
PPI, gas fuels.................	92.7	126.7	387.8	1060.9	2916.4	2877.5	2877.5	4706.7	4459.1	4459.1
Domestic petr prod (mmb/day)...	NA	11.2	10.2	9.9	9.7	9.5	9.5	9.8	9.5	9.5
Avg MPG, new domestic cars.....	15.7	15.5	18.5	26.7	37.7	37.7	37.7	41.7	41.7	41.7
Ratio, domest to imp oil price.	NA	NA	.66	.92	.95	.95	.95	.95	.95	.95

Source: Office of Economic Growth and Employment Projections, Bureau of Labor Statistics.

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Table 2.

Transactions Table (Billions of $s)

Purchasing Industry / Selling Industry	Agriculture	Manufacturing	Services	Final Demand	Total Output
Agriculture	50	0	0	100	150
Manufacturing	25	100	25	50	200
Services	25	50	10	15	100
Value Added	50	50	65	165 = GNP	—
Total Inputs	150	200	100	—	450

Summing across the first row yields the value of agriculture's total output, $150 billion.

Similarly, by reading down the table's first column one can see that the agriculture sector buys

- o $50 billion worth of its total output from itself,
- o $25 billion worth of the manufacturing sector's total output, and
- o $25 billion worth of the service sector's total output.

The sector's "value added," the difference between the value of its total output and total industrial purchases, represents the total dollar value available for the purchase of other necessary inputs (these are primarily wage and salary payments in most industries). Thus, summing down the first column yields the value of resources employed in the agriculture sector.

Finally, summing down the "final demand" column yields GNP measured as total expenditures, while summing across the "value added" row yields GNP measured as total incomes. (GNP = $165 billion) Note that the upper left-hand quadrant of the table traces the economy's intermediate or interindustry transactions. Assuming that each industry's demand for inputs rises proportionately with its level of output, the data in the sectoral transactions table can be used to derive a set of technical coefficients that describe industry technology at a given moment in time. For example, since $50 billion worth of inputs from agriculture, $25 billion from manufacturing, and $25 billion from services are required to produce $150 billion of agriculture output, the technical coefficients (referred to as a_{ij}'s) for the agriculture sector are:

$$a_{11} = 50/150 = 0.33$$

$$a_{21} = 25/150 = 0.17$$

$$a_{31} = 25/150 = 0.17$$

Similarly, if each entry in the interindustry quadrant is divided by the corresponding column total, the result is a matrix of technical coefficients, or the direct requirements table (Table 3).

The concepts summarized by Tables 2 and 3 can be expressed algebraically. For sector i, total output equals the sum of intermediate demands plus final demand, or:

$$(1)\quad q_i = q_{i1} + q_{i2} + q_{i3} + f_i \quad (i = 1,2,3),$$

where

q_i = total output for sector i

q_{ij} = output of sector i sold to sector j

f_i = final demand for the output of sector i.

The technical coefficients (Table 3) are defined as:

$$(2)\quad a_{ij} = q_{ij}/q_j \quad (i,j, = 1,2,3),$$

where q_{ij} is defined as above, and

q_j = total output of sector j

a_{ij} = output of sector i required to produce one unit of output of sector j.

Solving equation (2) for q_{ij}, and then substituting the result into equation (1), one obtains:

$$(3)\quad q_i = a_{i1}q_1 + a_{i2}q_2 + a_{i3}q_3 + f_i \quad (i = 1,2,3)$$

If the first of these three equations is then solved for f_1, the second for f_2, and the third for f_3, one obtains:

$$(4)\quad \begin{aligned} (1 - a_{11})q_1 &- a_{12}q_2 &- a_{13}q_3 &= f_1 \\ - a_{21}q_1 &+ (1 - a_{22})q_2 &- a_{23}q_3 &= f_2 \\ - a_{31}q_1 &- a_{32}q_2 &+ (1 - a_{33})q_3 &= f_3 \end{aligned}$$

Given the levels of the final demands (the f_i's) and the set of technical coefficients (the a_{ij}'s), system (4) can be solved to yield the sectoral output levels (the q_i's):

$$(5)\quad \begin{aligned} q_1 &= c_{11}f_1 + c_{12}f_2 + c_{13}f_3 \\ q_2 &= c_{21}f_1 + c_{22}f_2 + c_{23}f_3 \\ q_3 &= c_{31}f_1 + c_{32}f_2 + c_{33}f_3, \end{aligned}$$

where

Table 3.

Technical Coefficient Matrix

	Agriculture	Manufacturing	Services
Agriculture	0.33	0	0
Manufacturing	0.17	0.50	0.25
Services	0.17	0.25	0.10

$$c_{11} = [(1-a_{22})(1-a_{33}) - a_{23}a_{32}]/d$$

$$c_{12} = [a_{12}(1-a_{33}) + a_{13}a_{32}]/d$$

$$c_{13} = [a_{13}(1-a_{22}) + a_{12}a_{23}]/d$$

$$c_{21} = [a_{21}(1-a_{33}) + a_{23}a_{31}]/d$$

$$c_{22} = [(1-a_{11})(1-a_{33}) - a_{13}a_{31}]/d$$

$$c_{23} = [a_{23}(1-a_{11}) + a_{13}a_{21}]/d$$

$$c_{31} = [a_{31}(1-a_{22}) + a_{21}a_{32}]/d$$

$$c_{32} = [a_{32}(1-a_{11}) + a_{12}a_{31}]/d$$

$$c_{33} = [(1-a_{11})(1-a_{22}) - a_{12}a_{21}]/d,$$

and

$$\begin{aligned} d = {} & (1-a_{11})(1-a_{22})(1-a_{33}) - a_{12}a_{21}(1-a_{33}) \\ & - a_{13}a_{31}(1-a_{22}) - a_{23}a_{32}(1-a_{11}) \\ & - a_{12}a_{23}a_{31} - a_{13}a_{21}a_{32}. \end{aligned}$$

Each c_{ij} coefficient represents the quantity of total output i that must be produced to yield one unit of final output j. For example, one unit of final demand for industry 1's output (f_1) requires that more than one unit of total output (q_1) be produced by that industry. The output of industry 1 must be supplied to other industries so that they may, in turn, provide intermediate outputs also needed to produce the one unit of final output (q_1). Further, industry 1's output is needed additionally for its own production, as indicated by the nonzero value for a_{11} (see Table 3). When f_1 increases by one unit and all industries adjust to the new level, all output levels will have increased. Thus, for any specified change in the structure of final demands, one can compute the changes in total output levels that accompany it.

Too much emphasis cannot be given to the fact that the industry activity model takes into account not only the direct input requirements for each sector, but the indirect ones as well. For example, to produce $1 billion worth of agricultural output, $0.33 billion (=$1 billion x 0.33) of agricultural inputs is required. However, to produce this $0.33 billion worth of agricultural output requires $0.33 billion x 0.33 = $0.1089 billion worth of agricultural inputs. Thus, the total (direct plus indirect) agricultural input requirement to produce $1 billion worth of agricultural output is: $1 billion + $0.33 billion + $0.1089 billion + ... = $1.49 billion. By calculating the total input requirements for producing $1 billion worth of output for every sector, one obtains the c_{ij} coefficients, which are the elements of the total requirements table (Table 4).

As equation (5) shows, total output demanded cannot be computed until data on direct input requirements and final demands are obtained. As mentioned above, base-year data for the former are provided by BEA. The latter are derived from the components of GNP forecasted by the Chase macroeconomic model. To illustrate this derivation, it will be convenient to combine some of these components -- specifically, to combine all government expenditures (GNP_2), and to combine residential and business fixed investments with change in inventories to obtain aggregate investment (GNP_3). The other two GNP components are consumer expenditures (GNP_1) and net exports (GNP_4). Thus, $GNP = GNP_1 + GNP_2 + GNP_3 + GNP_4$. At any given point in time, there is a precise relationship between the components of final demand (the f_i's) and the GNP components. For example, suppose that, as shown in Table 5, final demand for agricultural output, f_1 = \$100 billion, consists of consumer purchases of f_{11} = \$60 billion, government purchases of f_{12} = \$20 billion, investment demand of f_{13} = \$0 billion, and net exports of f_{14} = \$20 billion. Total consumption, GNP_1 = \$95 billion, consists of consumer purchases of f_{11} = \$60 billion worth of agricultural output, f_{21} = \$30 billion worth of manufacturing output, and f_{31} = \$5 billion worth of services. The expanded final demand column (in the "final demand transactions" block of Table 5) is referred to as the bridge table; it gives the industrial breakdown of various GNP components, representing how final demands of various sectors are allocated among supplying industries. Algebraically, these relationships between final demand for the output of industry i and component j of GNP can be summarized as:

(6) $f_i = f_{i1} + f_{i2} + f_{i3} + f_{i4} \quad (i = 1,2,3)$

(7) $GNP_j = f_{1j} + f_{2j} + f_{3j} \quad (j = 1,2,3,4)$,

where f_{ij} = amount of industry i's output purchased by (sold to) GNP component j.

For a given set of final demands, one can derive bridge coefficients in a manner analogous to the way that the coefficients in the direct requirements table (Table 3) were derived from the interindustry transactions table (Table 2). The result is Table 6; its entries are computed from the following equation:

(8) $b_{ij} = f_{ij}/GNP_j \quad (i = 1,2,3;\ j = 1,2,3,4)$.

Table 4.

Total Requirements

	Agriculture	Manufacturing	Services
Agriculture	1.49	0	0
Manufacturing	0.75	2.32	0.64
Services	0.49	0.64	1.29

Table 5.

Expanded Transactions Table

Purchases / Sales	Interindustry Transactions			Final Demand Transactions				Total Output
	Agriculture	Manufacturing	Services	Consumption	Government	Investment	Net Exports	
Agriculture	50	0	0	60	20	0	20	150
Manufacturing	25	100	25	30	30	10	-20	200
Services	25	50	10	5	5	0	5	100
Value Added	50	50	65	—	—	—	—	—
GNP Components	GNP = 165			95	55	10	5	450

GNP = 165

ENCLOSURE I

That is, Table 6 indicates, for example, that from every \$1 billion of consumption (GNP_1), \$0.63 billion is used to purchase agricultural goods, \$0.32 billion to purchase manufacturing goods, and \$0.05 billion to purchase services. The bridge coefficients (the b_{ij}'s) computed from BEA data are used to compute final demands (the f_i's) in the following way:

$$(9) \quad f_i = b_{i1}GNP_1 + b_{i2}GNP_2 + b_{i3}GNP_3 + b_{i4}GNP_4 \; (i = 1,2,3).$$

These bridge coefficients are initially computed on the basis of historic data obtained from BEA's national income and product accounts. BLS judgmentally adjusts these bridge coefficients to reflect future demand conditions when making the agency's economic projections.

To summarize, forecasts of final demand using equation (9) are made using the GNP components forecasted by the Chase macroeconomic model (GNP_1, GNP_2, GNP_3, GNP_4) and the bridge coefficients computed from BEA data. Using the total requirements coefficients--which are illustrated numerically in Table 4 and algebraically in equation (5)--then provides a method by which the forecasts of the components of GNP can be used to obtain forecasts of individual industry output in each of the 156 industries. Figure 4 provides a flow chart overview of the entire process.

INDUSTRY EMPLOYMENT MODEL

The outputs of the industry activity model -- the forecasted industry outputs -- then become essential data requirements for BLS' industry employment (or labor demand) model. To forecast labor demand for each of the 156 industries, BLS also uses data obtained from the Current Employment Statistics (CES), which is conducted monthly. (Over 200,000 establishments are surveyed monthly.) These data are used to estimate statistically the parameters of a labor demand equation for each industry. Assuming a particular mathematical characterization of production technology,[3] this labor demand is postulated to be dependent on: (1) the industry's output, (2) capacity utilization rate,[4] (3) the real relative (i.e., inflation-adjusted) average hourly earnings paid to workers in the industry (price of labor relative to

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[3]Production technology is summarized by a production function, which shows the maximum quantity of output that can be produced by a given set of inputs (capital and labor) and a given state of technology.

[4]The rate of capacity utilization is the ratio of actual output to the maximum output that could be obtained from existing plant and equipment.

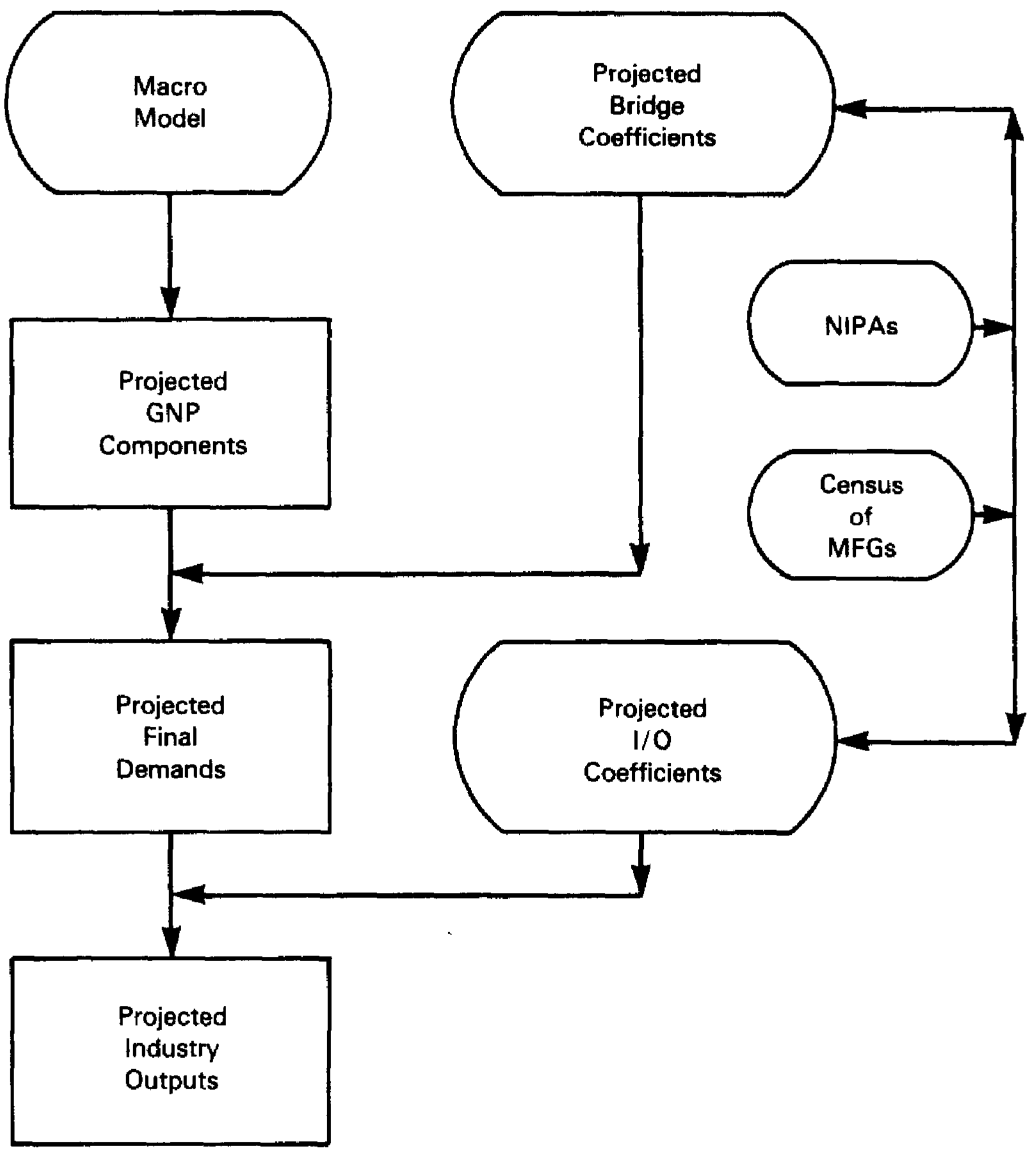
Table 6.

Bridge Coefficient Matrix

	Consumption	Government	Investment	Net Exports
Agriculture	0.63	0.36	0	4.00
Manufacturing	0.32	0.55	1.00	-4.00
Services	0.05	0.09	0	1.00

Figure 4.

Industry Output Projections Model



all prices), and (4) a capital-to-output ratio (a surrogate for the current state of technology).

The forecasted value of a given industry's output comes from the industry activity model. The way in which the capacity utilization rate is determined for any particular industry depends upon whether that industry is classified as a manufacturing or nonmanufacturing one. For a manufacturing industry, BLS uses the macroeconomic model's projection of the Federal Reserve Board's index of manufacturing capacity utilization. Capacity utilization rate statistics are not available for nonmanufacturing industries, so that the unemployment rate prevailing in the economic sector (transportation, services, etc.) to which the industry belongs is used as a proxy for the unavailable statistic. BLS projects these unemployment rates to the forecast period; these forecasts depend primarily on the current relationship of unemployment in each sector to overall unemployment, as well as the forecast of the overall unemployment rate from the macroeconomic model. The industry's real wage rate divided by all prices (i.e., the relative wage rate), the third explanatory variable in the labor demand forecasting equation, is one of 11 wage rates forecasted by the macroeconomic model. Thus, typically, a particular wage rate appears in more than one industry labor demand equation. As regards the industry's capital-to-output ratio, the denominator is based, in part, on the macroeconomic model's forecast of the variable, "gross product originating" (GPO).[5] This is divided into manufacturing or nonmanufacturing GPO based on each sector's share of total industry output. Time series data on the ratio's capital stock component, the numerator, come from a historic data base maintained by BEA. For a manufacturing industry, the forecasted capital stock is equal to the manufacturing sector's current capital stock plus an increment reflecting the percentage increase in the aggregate capital stock that is forecasted by the macroeconomic model; for a nonmanufacturing industry, this increment is added to the nonmanufacturing sector's current capital stock to obtain the sector's forecasted capital stock. When these four forecasted values are substituted into the statistically estimated labor demand equation, the resulting calculation yields the forecasted employment in the industry. An overview of all the processes and interrelationships is provided by the flow chart in Figure 5.

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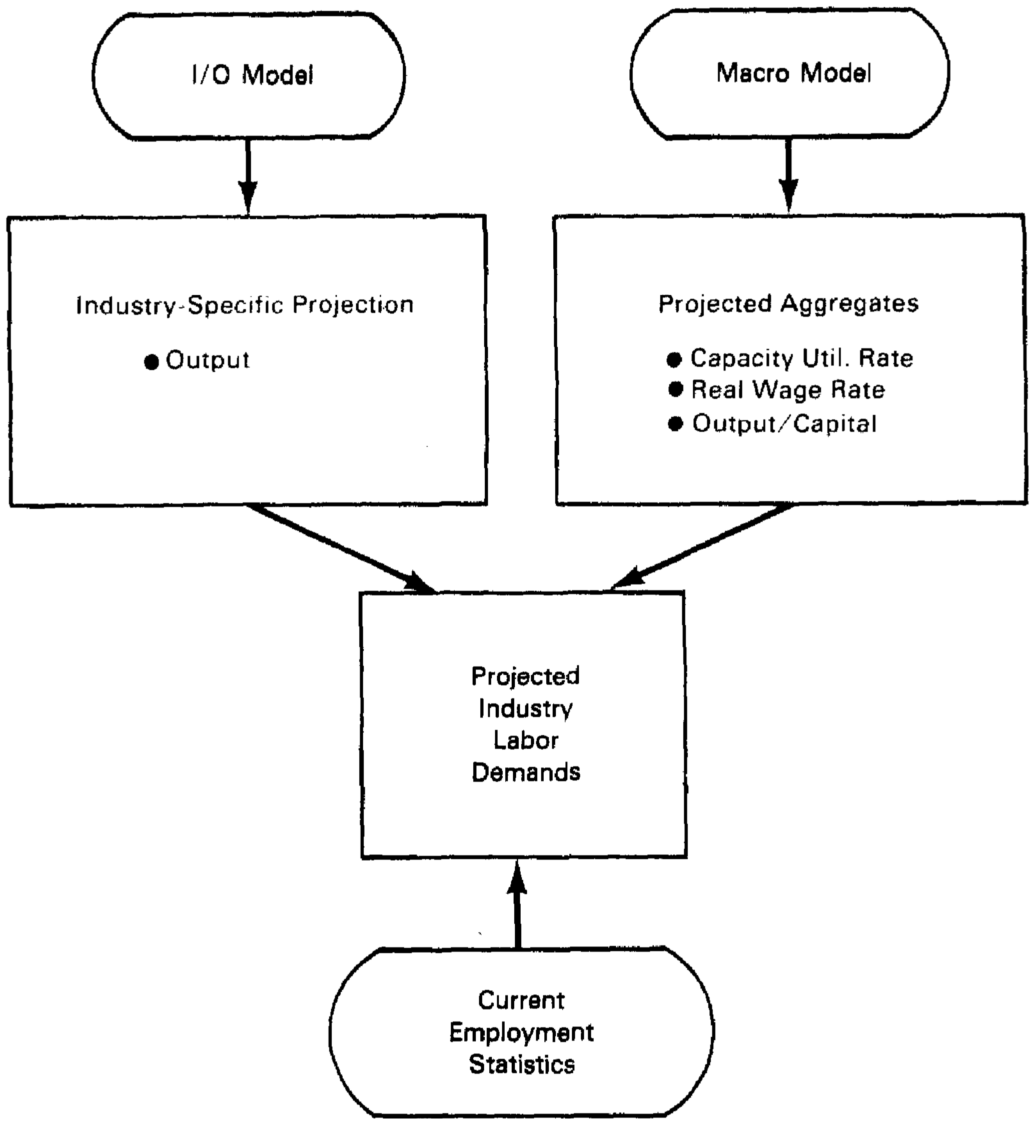
[5]GPO is identical to a supply-side measure of GNP, "charges against gross national product." For a discussion of the latter concept, see George Jaszi and Carol S. Carson, "The National Income and Product Accounts of the United States: An Overview," Survey of Current Business, Vol. 59 (October 1979), pp. 25-34.

Figure 5.

Industry Employment Model



OCCUPATIONAL EMPLOYMENT MODEL

The projections of the occupational employment model, illustrated in Figure 6, are a function of two sets of inputs:

- o the industry employment model's forecasted employment levels, which are disaggregated to 372 industries corresponding to OMB's 3-digit Standard Industrial Classification and

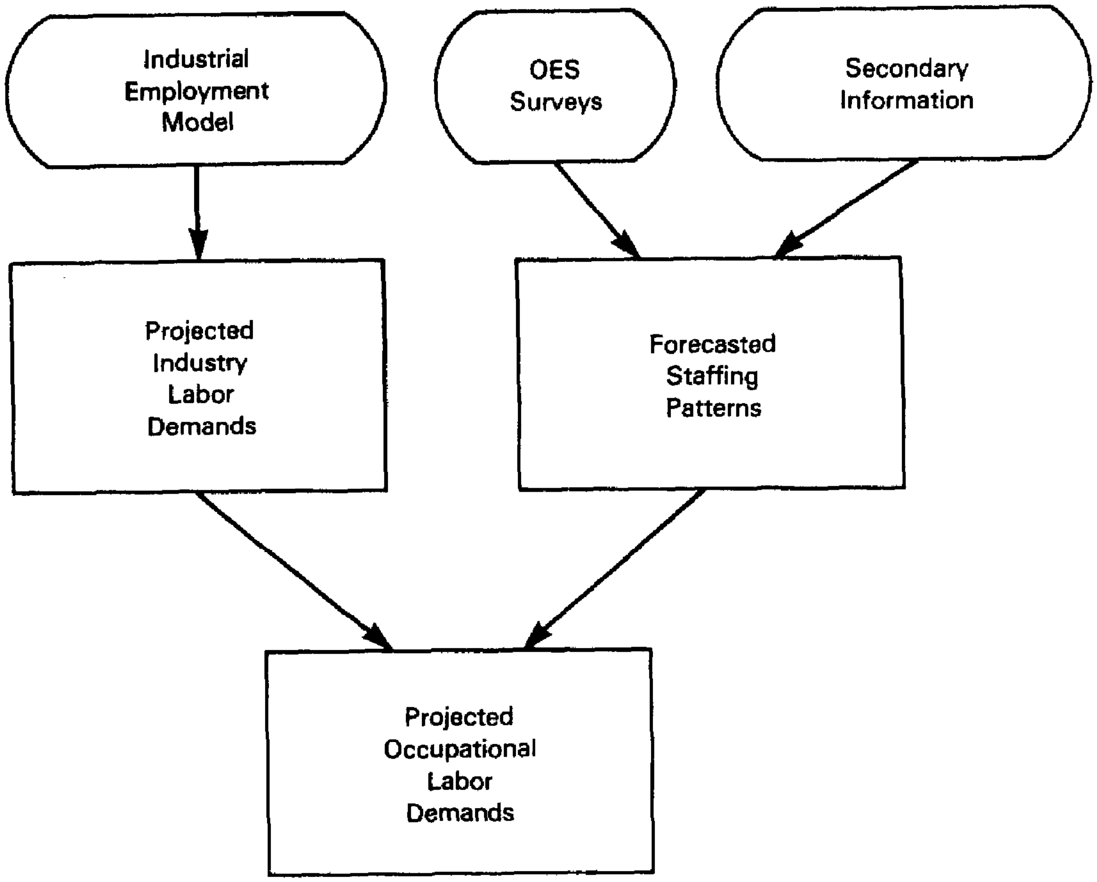
- o BLS-developed staffing patterns for each industry.

An industry staffing pattern refers to the distribution or composition of the industry labor force in terms of the occupations represented; for example, fifty percent of a particular industry's labor force may be assemblers and the other half typists. BLS obtains data on staffing patterns from the Occupational Employment Survey (OES). The staffing pattern data are collected from employers by state employment agencies on a 3-year cycle -- manufacturing 1 year and nonmanufacturing divided over the next 2 years. This employment information is collected for approximately 1,500 occupations, and allows calculation of a ratio between employment in an occupation as a percent of total employment in each industry.

The ratios so obtained are, of course, based on historic data. Although past staffing patterns may not continue through 1995, data collection activities in the OES have not been undertaken for a sufficiently long period to permit the application of formal statistical methods to forecast future staffing patterns. As a result, BLS has to make judgmental forecasts of the future values of them. Where some concern exists that a particular staffing pattern ratio may in the future depart substantially from its current value, BLS uses a variety of ways to adjust that ratio. One way is to conduct field interviews with persons deemed knowledgeable about either the occupation or the industries where this occupation is most heavily concentrated (or both). The final steps in the occupational forecasting process are to: (1) multiply each forecasted staffing pattern ratio by the corresponding labor demand by industry (as forecasted by the industry employment model) to forecast occupational employment from each industry, and (2) sum, across industries, forecasted employment in each occupation to obtain total projected occupational employment levels.

Figure 6.

Occupational Employment Model



ENCLOSURE II

RELATIVE EFFECTS OF THE DETERMINANTS OF INDUSTRY AND OCCUPATIONAL EMPLOYMENT PROJECTIONS -- THE FIRST SET OF SIMULATIONS

Relative Impact of Gross National Product
On Projected 1995 Industry Employment Levels
Resulting from the First Set of Simulations
(percentage change from estimated 1977 levels)

Aircraft	58.14
Blast furnaces and basic steel products	58.14
Cement and concrete products	58.16
Complete guided missiles & space vehicles	58.18
Computers and peripheral equipment	58.13
Construction, mining,& oilfield machinery	58.13
Cutlery, handtools, and general hardware	58.11
Electric lighting and wiring	58.15
Electric transmission equipment	58.16
Electrical industrial apparatus	58.15
Electrical machinery and equipment, n.e.c.	58.15
Electronic components	58.15
Engines, turbines, and generators	58.16
Fabricated metal products, n.e.c.	58.15
Fabricated structural metal products	58.14
Farm machinery	58.14
Furniture and fixtures, except household	58.12
General industrial machinery	58.14
Glass	58.14
Heating apparatus and plumbing fixtures	58.12
Household appliances	58.17
Household furniture	58.13
Iron and steel foundries and forgings	58.15
Jewelry and silverware	58.17
Logging	58.10
Manufactured products, n.e.c.	58.15
Material-handling equipment	58.17
Medical and dental instruments	58.13
Metal containers	58.21
Metal stampings	58.15
Metalworking machinery	58.15
Millwork, plywood,& wood products,n.e.c	58.13
Motor vehicles	58.14
Motorcycles, bicycles, and parts	58.33
Musical instruments and sporting goods	58.14
Nonelectrical machinery, n.e.c.	58.13
Optical and ophthalmic equipment	58.09
Ordnance	58.12
Photographic equipment and supplies	58.15
Pottery and related products	58.04
Prim. nonfer. metals & products, n.e.c.	58.17
Primary aluminum and aluminum products	58.13
Primary copper and copper products	58.16
Radio and communication equipment	58.13
Radio and television receiving sets	58.13
Railroad equipment	58.21

Relative Impact of Gross National Product
On Projected 1995 Industry Employment Levels
Resulting from the First Set of Simulations
(percentage change from estimated 1977 levels)

Sawmills and planing mills	58.16
Scientific and controlling instruments	58.16
Screw machine products	58.12
Service industry machines	58.13
Ship and boat building and repair	58.13
Special industry machinery	58.16
Stone and clay products, n.e.c.	58.15
Structural clay products	58.20
Telephone and telegraph apparatus	58.16
Transportation equipment, n.e.c.	58.13
Typewriters and other office equipment	58.16
Watches, clocks,& clock-oper. devices	58.00
Wooden containers	58.10

Relative Impact of Demand Distribution
On Projected 1995 Industry Employment Levels
Resulting from the First Set of Simulations
(percentage change from estimated 1977 levels)

Computers and peripheral equipment	176.56
Telephone and telegraph apparatus	60.95
Radio and television receiving sets	53.90
Radio and communication equipment	51.78
Typewriters and other office equipment	51.43
Optical and ophthalmic equipment	47.94
Electronic components	47.60
Photographic equipment and supplies	30.31
Medical and dental instruments	23.98
Service industry machines	20.18
Ordnance	11.16
Electrical industrial apparatus	9.91
Engines, turbines, and generators	6.16
Electrical machinery and equipment, n.e.c.	4.77
Aircraft	3.48
Construction, mining,& oilfield machinery	3.19
Electric transmission equipment	2.79
Household appliances	2.72
Material-handling equipment	1.72
Glass	1.71
Complete guided missiles & space vehicles	0.91
Prim. nonfer. metals & products, n.e.c.	0.61
Electric lighting and wiring	0.15
Primary aluminum and aluminum products	-0.13
Fabricated metal products, n.e.c.	-0.95
Primary copper and copper products	-1.56
General industrial machinery	-1.69
Scientific and controlling instruments	-2.26
Metalworking machinery	-2.31
Fabricated structural metal products	-2.76
Wooden containers	-2.86
Stone and clay products, n.e.c.	-3.36
Metal containers	-4.23
Nonelectrical machinery, n.e.c.	-4.69
Furniture and fixtures, except household	-4.83
Screw machine products	-5.64
Blast furnaces and basic steel products	-7.60
Manufactured products, n.e.c.	-7.65
Transportation equipment, n.e.c.	-7.76
Logging	-7.98
Iron and steel foundries and forgings	-9.14
Ship and boat building and repair	-9.42
Musical instruments and sporting goods	-10.28
Millwork, plywood,& wood products,n.e.c	-10.72
Heating apparatus and plumbing fixtures	-11.88

Relative Impact of Demand Distribution
On Projected 1995 Industry Employment Levels
Resulting from the First Set of Simulations
(percentage change from estimated 1977 levels)

Cutlery, handtools, and general hardware	-12.11
Metal stampings	-12.27
Sawmills and planing mills	-13.90
Household furniture	-14.79
Cement and concrete products	-16.62
Special industry machinery	-17.63
Farm machinery	-19.04
Motor vehicles	-23.25
Jewelry and silverware	-24.95
Watches, clocks,& clock-oper. devices	-27.00
Motorcycles, bicycles, and parts	-31.67
Railroad equipment	-31.79
Structural clay products	-32.60
Pottery and related products	-34.35

Relative Impact of Productivity
On Projected 1995 Industry Employment Levels
Resulting from the First Set of Simulations
(percentage change from estimated 1977 levels)

Complete guided missiles & space vehicles	31.67
Scientific and controlling instruments	8.58
Medical and dental instruments	7.81
Screw machine products	-2.77
Pottery and related products	-5.43
Primary copper and copper products	-7.62
Nonelectrical machinery, n.e.c.	-10.75
Jewelry and silverware	-10.97
Prim. nonfer. metals & products, n.e.c.	-11.46
Motorcycles, bicycles, and parts	-11.67
Furniture and fixtures, except household	-12.48
Wooden containers	-12.86
Railroad equipment	-13.57
Special industry machinery	-13.68
Metal stampings	-13.95
Construction, mining,& oilfield machinery	-14.71
Iron and steel foundries and forgings	-15.63
Fabricated structural metal products	-15.84
Aircraft	-15.96
Millwork, plywood,& wood products,n.e.c	-16.02
Household furniture	-16.16
Ship and boat building and repair	-16.34
Material-handling equipment	-17.85
Cutlery, handtools, and general hardware	-17.89
Heating apparatus and plumbing fixtures	-18.26
Fabricated metal products, n.e.c.	-18.96
Electric transmission equipment	-19.11
Cement and concrete products	-19.96
Primary aluminum and aluminum products	-20.47
General industrial machinery	-20.47
Stone and clay products, n.e.c.	-20.62
Metalworking machinery	-20.83
Engines, turbines, and generators	-20.88
Electric lighting and wiring	-22.10
Blast furnaces and basic steel products	-23.39
Motor vehicles	-23.53
Farm machinery	-24.31
Glass	-24.32
Electrical machinery and equipment, n.e.c.	-24.70
Sawmills and planing mills	-25.44
Musical instruments and sporting goods	-28.76
Ordnance	-30.00
Electrical industrial apparatus	-30.00
Logging	-31.31
Transportation equipment, n.e.c.	-31.40

Relative Impact of Productivity
On Projected 1995 Industry Employment Levels
Resulting from the First Set of Simulations
(percentage change from estimated 1977 levels)

Metal containers	-32.69
Service industry machines	-34.44
Household appliances	-35.50
Manufactured products, n.e.c.	-36.35
Photographic equipment and supplies	-36.69
Watches, clocks,& clock-oper. devices	-42.00
Computers and peripheral equipment	-42.18
Structural clay products	-42.20
Typewriters and other office equipment	-42.24
Radio and communication equipment	-42.38
Telephone and telegraph apparatus	-46.60
Electronic components	-48.40
Optical and ophthalmic equipment	-49.26
Radio and television receiving sets	-63.01

Relative Impact of Input-Output Coefficients
On Projected 1995 Industry Employment Levels
Resulting from the First Set of Simulations
(percentage change from estimated 1977 levels)

Electronic components	75.95
Computers and peripheral equipment	10.19
Scientific and controlling instruments	8.68
Optical and ophthalmic equipment	7.94
Motorcycles, bicycles, and parts	7.78
Radio and communication equipment	6.60
Telephone and telegraph apparatus	6.39
Farm machinery	5.09
Photographic equipment and supplies	4.54
Aircraft	3.08
Typewriters and other office equipment	2.45
Watches,clocks,& clock-oper. devices	2.00
Electric transmission equipment	1.68
Electrical industrial apparatus	1.59
Material-handling equipment	1.40
Radio and television receiving sets	1.14
Pottery and related products	1.09
Engines, turbines, and generators	0.64
Complete guided missiles & space vehicles	0.61
Ordnance	0.58
Medical and dental instruments	0.47
Service industry machines	0.41
Household furniture	0.22
Transportation equipment, n.e.c.	0.09
Stone and clay products, n.e.c.	0.00
Electric lighting and wiring	-0.10
Jewelry and silverware	-0.11
Household appliances	-0.11
Nonelectrical machinery, n.e.c.	-0.12
Fabricated structural metal products	-0.13
Construction, mining,& oilfield machinery	-0.19
Furniture and fixtures, except household	-0.20
Musical instruments and sporting goods	-0.28
Special industry machinery	-0.42
Cutlery, handtools, and general hardware	-0.57
Heating apparatus and plumbing fixtures	-0.58
Cement and concrete products	-0.70
Electrical machinery and equipment, n.e.c.	-0.73
Fabricated metal products, n.e.c.	-0.74
Ship and boat building and repair	-0.89
Metalworking machinery	-1.29
Structural clay products	-1.60
Millwork, plywood,& wood products,n.e.c	-1.78
Motor vehicles	-2.23
General industrial machinery	-2.58

Relative Impact of Input-Output Coefficients On Projected 1995 Industry Employment Levels Resulting from the First Set of Simulations (percentage change from estimated 1977 levels)

Railroad equipment	-3.04
Manufactured products, n.e.c.	-5.60
Primary aluminum and aluminum products	-6.27
Sawmills and planing mills	-9.17
Metal stampings	-10.84
Logging	-12.38
Glass	-13.62
Screw machine products	-17.82
Primary copper and copper products	-19.25
Metal containers	-21.03
Iron and steel foundries and forgings	-26.92
Prim. nonfer. metals & products, n.e.c.	-27.20
Blast furnaces and basic steel products	-27.38
Wooden containers	-60.48

Relative Impact of Gross National Product
On Projected 1995 Occupational Employment Levels
Resulting from the First Set of Simulations
(percentage change from estimated 1977 levels)

Accountants and auditors	58.15
Automotive mechanics	58.15
Blue collar worker supervisors	58.15
Bookkeepers, hand	58.15
Building custodians	58.14
Carpenters	58.12
Cashiers	58.15
Clerical supervisors	58.13
Computer operators	58.13
Computer programmers	58.15
Computer systems analysts	58.17
Cooks, restaurant	58.12
Cooks, short order & spec. fast food	58.16
Delivery and route workers	58.14
Electrical & electronic technicians	58.13
Electrical engineers	58.14
Electricians	58.13
Fast food prep., and service worker	58.15
General clerks, office	58.14
Guards	58.14
Helpers, trades	58.14
Kitchen helpers	58.15
Lawyers	58.11
Licensed practical nurses	58.13
Mainten. repairers gen. utility	58.12
Nurses, registered	58.15
Nursing aides, orderlies & attend.	58.13
Physicians	58.17
Receptionists	58.17
Sales clerks	58.14
Sales representatives, nontechnical	58.14
Sales representatives, technical	58.15
Kndrgrtn. & elementary school tchrs.	58.14
Secretaries	58.15
Stock clerks, stockroom & warehouse	58.15
Store managers	58.13
Tellers	58.13
Truck drivers	58.15
Typists	58.13
Waiters and waitresses	58.14

Relative Impact of Demand Distribution
On Projected 1995 Occupational Employment Levels
Resulting from the First Set of Simulations
(percentage change from estimated 1977 levels)

Electrical engineers	23.48
Tellers	19.87
Electrical & electronic technicians	15.78
Computer programmers	13.30
Nursing aides, orderlies & attend.	10.57
Physicians	6.04
Clerical supervisors	6.01
Receptionists	4.55
Licensed practical nurses	4.04
Computer operators	3.64
Computer systems analysts	2.89
Nurses, registered	1.70
Store managers	1.35
Guards	1.00
Sales clerks	0.58
Cashiers	0.23
Stock clerks, stockroom & warehouse	-0.40
Sales representatives, technical	-0.43
Accountants and auditors	-1.15
Bookkeepers, hand	-1.31
Sales representatives, nontechnical	-1.65
General clerks, office	-1.67
Secretaries	-1.73
Building custodians	-3.02
Blue collar worker supervisors	-3.66
Automotive mechanics	-4.33
Delivery and route workers	-4.53
Mainten. repairers gen. utility	-5.18
Typists	-5.40
Kitchen helpers	-6.30
Cooks, restaurant	-6.67
Lawyers	-6.74
Truck drivers	-6.77
Waiters and waitresses	-7.37
Helpers, trades	-7.42
Electricians	-7.67
Carpenters	-8.81
Cooks, short order & spec. fast food	-9.76
Fast food prep., & service workers	-11.86
Kndrgrtn. & elementary school tchrs.	-22.93

Relative Impact of Productivity
On Projected 1995 Occupational Employment Levels
Resulting from the First Set of Simulations
(percentage change from estimated 1977 levels)

Fast food prep., & service workers	25.02
Cooks, short order & spec. fast food	21.57
Waiters and waitresses	17.96
Lawyers	17.58
Cooks, restaurant	17.01
Kitchen helpers	9.86
Physicians	2.72
Nursing aides, orderlies & attend.	2.36
Licensed practical nurses	1.39
Nurses, registered	0.87
Receptionists	-0.13
Kndrgrtn. & elementary school tchrs.	-0.88
Carpenters	-1.45
Accountants and auditors	-3.25
Secretaries	-5.91
Bookkeepers, hand	-6.74
Electricians	-6.97
Building custodians	-7.91
Typists	-8.54
Automotive mechanics	-8.59
Cashiers	-9.01
Helpers, trades	-10.17
Sales representatives, nontechnical	-10.76
General clerks, office	-10.89
Sales representatives, technical	-11.58
Computer operators	-11.68
Guards	-11.79
Truck drivers	-11.85
Sales clerks	-12.12
Mainten. repairers gen. utility	-12.31
Computer systems analysts	-12.38
Store managers	-12.76
Stock clerks, stockroom & warehouse	-13.00
Delivery and route workers	-13.60
Computer programmers	-15.30
Clerical supervisors	-16.36
Blue collar worker supervisors	-17.55
Electrical & electronic technicians	-17.58
Tellers	-19.17
Electrical engineers	-19.30

Relative Impact of Input-Output Coefficients On Projected 1995 Occupational Employment Levels Resulting from the First Set of Simulations (percentage change from estimated 1977 levels)

Guards	30.18
Computer programmers	17.17
Computer systems analysts	15.08
Electrical engineers	14.98
Computer operators	12.34
Electrical & electronic technicians	11.76
Building custodians	9.89
Tellers	8.02
Clerical supervisors	7.95
Typists	6.03
Secretaries	4.61
Receptionists	4.49
General clerks, office	4.22
Accountants and auditors	3.71
Lawyers	3.11
Licensed practical nurses	3.01
Bookkeepers, hand	2.33
Mainten. repairers gen. utility	2.14
Nurses, registered	1.50
Stock clerks, stockroom & warehouse	1.40
Delivery and route workers	1.09
Nursing aides, orderlies & attend.	0.57
Carpenters	0.51
Automotive mechanics	0.35
Sales clerks	0.31
Cashiers	0.31
Truck drivers	0.24
Physicians	0.19
Blue collar worker supervisors	0.13
Store managers	0.04
Kndrgrtn. & elementary school tchrs.	0.01
Sales representatives, technical	-0.30
Sales representatives, nontechnical	-0.55
Helpers, trades	-0.65
Electricians	-1.12
Kitchen helpers	-1.59
Cooks, restaurant	-2.90
Waiters and waitresses	-3.04
Cooks, short order & spec. fast food	-3.71
Fast food prep., & service workers	-4.17

Relative Impact of Staffing Patterns
On Projected 1995 Occupational Employment Levels
Resulting from the First Set of Simulations
(percentage change from estimated 1977 levels)

Computer systems analysts	34.53
Computer operators	25.56
Computer programmers	23.72
Kndrgrtn. & elementary school tchrs.	19.63
Electrical engineers	18.77
Cashiers	18.56
Electrical & electronic technicians	16.48
Lawyers	10.32
Store managers	7.50
Nurses, registered	6.86
Automotive mechanics	6.52
Cooks, restaurant	6.38
Accountants and auditors	4.99
Blue collar worker supervisors	3.01
Mainten. repairers gen. utility	2.74
Physicians	2.35
Clerical supervisors	2.31
Receptionists	2.23
Electricians	1.19
Sales representatives, nontechnical	0.72
Truck drivers	0.31
Kitchen helpers	0.29
Guards	0.29
Fast food prep., & service workers	0.16
General clerks, office	-0.07
Secretaries	-0.27
Carpenters	-0.61
Delivery and route workers	-0.62
Sales representatives, technical	-1.03
Waiters and waitresses	-1.17
Tellers	-1.63
Cooks, short order & spec. fast food	-1.99
Sales clerks	-3.29
Helpers, trades	-4.19
Licensed practical nurses	-4.60
Building custodians	-5.69
Stock clerks, stockroom & warehouse	-6.72
Nursing aides, orderlies & attend.	-8.09
Typists	-9.52
Bookkeepers, hand	-10.16

RELATIVE EFFECTS OF THE DETERMINANTS OF INDUSTRY AND OCCUPATIONAL EMPLOYMENT PROJECTIONS -- THE SECOND SET OF SIMULATIONS

Relative Impact of Gross National Product
On Projected 1995 Industry Employment Levels
Resulting from the Second Set of Simulations
(percentage change from projected 1995 levels)

Electronic components	-31.45
Computers and peripheral equipment	-31.44
Fabricated structural metal products	-31.45
Motor vehicles	-31.45
Scientific and controlling instruments	-31.45
Medical and dental instruments	-31.43
Construction, mining, & oilfield machinery	-31.44
Millwork, plywood, and wood products	-31.44
Fabricated metal products, n.e.c.	-31.44
Household furniture	-31.45
Electrical industrial apparatus	-31.47
Metalworking machinery	-31.45
Aircraft	-31.44
General industrial machinery	-31.43
Electric lighting and wiring	-31.45
Metal stampings	-31.45
Telephone and telegraph apparatus	-31.47
Cutlery, handtools, and general hardware	-31.47
Service industry machines	-31.43
Engines, turbines, and generators	-31.46
Nonelectrical machinery, n.e.c.	-31.45
Blast furnaces and basic steel products	-31.46
Stone and clay products, n.e.c.	-31.43
Iron and steel foundries and forgings	-31.45
Ship and boat building and repair	-31.44
Household appliances	-31.46
Electrical machinery and equipment, n.e.c.	-31.43
Electric transmission equipment	-31.45
Glass	-31.46
Material-handling equipment	-31.44
Primary aluminum and aluminum products	-31.46
Special industry machinery	-31.44
Photographic equipment and supplies	-31.41
Radio and communication equipment	-31.45
Transportation equipment, n.e.c.	-31.47
Primary copper and copper products	-31.45
Complete guided missiles & space vehicles	-31.42
Farm machinery	-31.45
Cement and concrete products	-31.42
Sawmills and planing mills	-31.43
Screw machine products	-31.45
Furniture and fixtures, except household	-31.43
Jewelry and silverware	-31.50
Typewriters and other office equipment	-31.40
Radio and television receiving sets	-31.38

Relative Impact of Gross National Product
On Projected 1995 Industry Employment Levels
Resulting from the Second Set of Simulations
(percentage change from projected 1995 levels)

Heating apparatus and plumbing fixtures	-31.46
Musical instruments and sporting goods	-31.49
Optical and ophthalmic equipment	-31.45
Railroad equipment	-31.34
Pottery and related products	-31.42
Ordnance	-31.46
Motorcycles, bicycles, and parts	-31.47
Primary nonferrous metals & metal products	-31.49
Watches, clocks, & clock-operated devices	-31.28
Logging	-31.43
Manufactured products, n.e.c.	-31.46
Metal containers	-31.41
Structural clay products	-31.46
Wooden containers	-31.53

Relative Impact of Demand Distribution
On Projected 1995 Industry Employment Levels
Resulting from the Second Set of Simulations
(percentage change from projected 1995 levels)

Pottery and related products	50.31
Structural clay products	49.01
Railroad equipment	48.30
Motorcycles, bicycles, and parts	40.10
Watches, clocks, & clock-operated devices	34.12
Jewelry and silverware	32.93
Motor vehicles	30.36
Farm machinery	22.27
Special industry machinery	21.38
Cement and concrete products	20.02
Household furniture	17.12
Sawmills and planing mills	17.01
Metal stampings	15.01
Heating apparatus and plumbing fixtures	13.43
Cutlery, handtools, and general hardware	13.34
Millwork, plywood, and wood products	11.98
Musical instruments and sporting goods	11.34
Ship and boat building and repair	10.34
Iron and steel foundries and forgings	9.46
Blast furnaces and basic steel products	8.96
Transportation equipment, n.e.c.	8.35
Manufactured products, n.e.c.	8.24
Logging	6.82
Screw machine products	6.64
Metal containers	5.13
Furniture and fixtures, except household	5.00
Nonelectrical machinery, n.e.c.	4.05
Stone and clay products, n.e.c.	3.46
Fabricated structural metal products	2.76
Wooden containers	2.70
Metalworking machinery	2.20
Primary copper and copper products	2.12
Scientific and controlling instruments	1.80
General industrial machinery	1.52
Fabricated metal products, n.e.c.	0.49
Electric lighting and wiring	-0.16
Primary aluminum and aluminum products	-0.39
Complete guided missiles & space vehicles	-1.00
Glass	-1.70
Primary nonferrous metals & metal products	-1.76
Material-handling equipment	-1.92
Household appliances	-2.71
Construction, mining, & oilfield machinery	-3.16
Aircraft	-3.37
Electric transmission equipment	-3.44

Relative Impact of Demand Distribution
On Projected 1995 Industry Employment Levels
Resulting from the Second Set of Simulations
(percentage change from projected 1995 levels)

Electrical machinery and equipment, n.e.c.	-4.94
Engines, turbines, and generators	-5.97
Electrical industrial apparatus	-8.90
Ordnance	-10.06
Service industry machines	-16.86
Medical and dental instruments	-19.45
Photographic equipment and supplies	-22.64
Electronic components	-31.58
Optical and ophthalmic equipment	-31.66
Radio and communication equipment	-33.45
Typewriters and other office equipment	-33.57
Radio and television receiving sets	-34.93
Telephone and telegraph apparatus	-36.82
Computers and peripheral equipment	-61.95

Relative Impact of Productivity On Projected 1995 Industry Employment Levels Resulting from the Second Set of Simulations (percentage change from projected 1995 levels)

Radio and television receiving sets	102.76
Railroad equipment	80.04
Watches, clocks, & clock-operated devices	72.51
Structural clay products	68.87
Manufactured products, n.e.c.	65.11
Metal containers	62.66
Engines, turbines, and generators	60.90
Typewriters and other office equipment	60.78
Blast furnaces and basic steel products	57.50
Motor vehicles	56.08
Heating apparatus and plumbing fixtures	53.45
Electronic components	53.09
Farm machinery	51.05
Electrical industrial apparatus	50.28
Household appliances	50.13
Material-handling equipment	45.49
Photographic equipment and supplies	45.33
Stone and clay products, n.e.c.	44.29
Primary nonferrous metals & metal products	43.71
Jewelry and silverware	43.50
Service industry machines	43.25
Electrical machinery and equipment, n.e.c.	42.23
General industrial machinery	41.60
Iron and steel foundries and forgings	41.58
Primary aluminum and aluminum products	40.01
Electric transmission equipment	40.00
Ordnance	39.53
Construction, mining, & oilfield machinery	39.42
Special industry machinery	38.77
Radio and communication equipment	37.82
Cement and concrete products	37.66
Fabricated metal products, n.e.c.	37.59
Sawmills and planing mills	34.02
Metal stampings	33.20
Fabricated structural metal products	32.81
Primary copper and copper products	32.16
Optical and ophthalmic equipment	31.88
Metalworking machinery	30.63
Logging	28.92
Computers and peripheral equipment	26.89
Electric lighting and wiring	26.54
Glass	26.52
Cutlery, handtools, and general hardware	26.22
Musical instruments and sporting goods	25.41
Transportation equipment, n.e.c.	25.14

Relative Impact of Productivity
On Projected 1995 Industry Employment Levels
Resulting from the Second Set of Simulations
(percentage change from projected 1995 levels)

Nonelectrical machinery, n.e.c.	23.02
Telephone and telegraph apparatus	22.43
Furniture and fixtures, except household	18.19
Ship and boat building and repair	17.91
Millwork, plywood, and wood products	17.76
Complete guided missiles & space vehicles	16.96
Aircraft	15.80
Household furniture	15.36
Motorcycles, bicycles, and parts	14.21
Screw machine products	9.71
Pottery and related products	6.78
Wooden containers	6.31
Scientific and controlling instruments	-1.75
Medical and dental instruments	-7.87

Relative Impact of Input-Output Coefficients
On Projected 1995 Industry Employment Levels
Resulting from the Second Set of Simulations
(percentage change from projected 1995 levels)

Wooden containers	154.05
Blast furnaces and basic steel products	38.65
Iron and steel foundries and forgings	36.13
Primary nonferrous metals & metal products	35.84
Metal containers	27.40
Primary copper and copper products	24.50
Screw machine products	22.41
Glass	15.73
Metal stampings	13.19
Logging	12.23
Sawmills and planing mills	10.88
Primary aluminum and aluminum products	6.19
Manufactured products, n.e.c.	5.95
Railroad equipment	4.39
General industrial machinery	2.44
Motor vehicles	2.33
Structural clay products	1.99
Millwork, plywood, and wood products	1.77
Metalworking machinery	1.17
Ship and boat building and repair	0.89
Cement and concrete products	0.79
Heating apparatus and plumbing fixtures	0.51
Special industry machinery	0.33
Electrical machinery and equipment, n.e.c.	0.31
Fabricated metal products, n.e.c.	0.26
Cutlery, handtools, and general hardware	0.25
Furniture and fixtures, except household	0.19
Musical instruments and sporting goods	0.14
Construction, mining, & oilfield machinery	0.11
Household appliances	0.05
Fabricated structural metal products	0.05
Electric lighting and wiring	0.04
Stone and clay products, n.e.c.	0.00
Jewelry and silverware	-0.10
Transportation equipment, n.e.c.	-0.18
Household furniture	-0.42
Service industry machines	-0.47
Medical and dental instruments	-0.55
Nonelectrical machinery, n.e.c.	-0.70
Ordnance	-0.70
Complete guided missiles & space vehicles	-0.72
Engines, turbines, and generators	-0.78
Radio and television receiving sets	-0.98
Electrical industrial apparatus	-1.43
Material-handling equipment	-1.60

Relative Impact of Input-Output Coefficients
On Projected 1995 Industry Employment Levels
Resulting from the Second Set of Simulations
(percentage change from projected 1995 levels)

Typewriters and other office equipment	-1.74
Pottery and related products	-2.26
Electric transmission equipment	-2.38
Aircraft	-3.00
Photographic equipment and supplies	-3.57
Watches, clocks, & clock-operated devices	-4.27
Telephone and telegraph apparatus	-4.45
Computers and peripheral equipment	-4.50
Radio and communication equipment	-5.26
Farm machinery	-5.76
Optical and ophthalmic equipment	-6.31
Scientific and controlling instruments	-8.44
Motorcycles, bicycles, and parts	-10.66
Electronic components	-42.61

Relative Impact of Gross National Product On Projected 1995 Occupational Employment Levels Resulting from the Second Set of Simulations (percentage change from projected 1995 levels)

Building custodians	-31.45
Cashiers	-31.45
Secretaries	-31.45
General clerks, office	-31.45
Sales clerks	-31.45
Nurses, registered	-31.45
Waiters and waitresses	-31.45
Kndrgrtn. & elementary school tchrs.	-31.45
Truck drivers	-31.45
Nursing aides, orderlies & attend.	-31.45
Sales representatives, technical	-31.45
Accountants and auditors	-31.45
Automotive mechanics	-31.44
Blue collar worker supervisors	-31.45
Kitchen helpers	-31.45
Guards	-31.45
Fast food prep., & service wkrs.	-31.45
Store managers	-31.44
Carpenters	-31.45
Electrical & electronic technicians	-31.45
Licensed practical nurses	-31.45
Computer systems analysts	-31.44
Electrical engineers	-31.45
Computer programmers	-31.44
Mainten. repairers gen. utility	-31.45
Helpers, trades	-31.45
Receptionists	-31.45
Electricians	-31.45
Physicians	-31.44
Clerical supervisors	-31.45
Computer operators	-31.45
Sales representatives, nontechnical	-31.45
Lawyers	-31.44
Stock clerks, stockroom & warehouse	-31.45
Typists	-31.45
Delivery and route workers	-31.45
Bookkeepers, hand	-31.45
Cooks, restaurant	-31.43
Tellers	-31.45
Cooks,short order & spec. fast food	-31.46

Relative Impact of Demand Distribution
On Projected 1995 Occupational Employment Levels
Resulting from the Second Set of Simulations
(percentage change from projected 1995 levels)

Kndrgrtn. & elementary school tchrs.	29.51
Fast food prep., & service wkrs.	14.68
Cooks, short order & spec. fast food	12.22
Waiters and waitresses	9.85
Carpenters	9.69
Cooks, restaurant	9.56
Electricians	8.70
Helpers, trades	8.41
Kitchen helpers	7.44
Truck drivers	7.25
Lawyers	7.15
Typists	6.43
Mainten. repairers gen. utility	5.95
Blue collar worker supervisors	5.32
Automotive mechanics	5.31
Delivery and route workers	4.16
Secretaries	3.19
Accountants and auditors	2.84
General clerks, office	2.73
Building custodians	2.70
Bookkeepers, hand	2.45
Sales representatives, nontechnical	1.61
Stock clerks, stockroom & warehouse	1.41
Cashiers	0.63
Sales representatives, technical	0.43
Store managers	0.42
Sales clerks	0.33
Computer systems analysts	-0.11
Computer operators	-0.57
Guards	-1.63
Nurses, registered	-1.76
Physicians	-2.32
Licensed practical nurses	-3.29
Clerical supervisors	-4.50
Receptionists	-4.79
Computer programmers	-6.20
Electrical & electronic technicians	-8.07
Nursing aides, orderlies & attend.	-9.41
Electrical engineers	-13.67
Tellers	-15.74

Relative Impact of Productivity
On Projected 1995 Occupational Employment Levels
Resulting from the Second Set of Simulations
(percentage change from projected 1995 levels)

Blue collar worker supervisors	26.66
Electrical engineers	26.11
Electrical & electronic technicians	23.94
Tellers	23.47
Clerical supervisors	20.18
Truck drivers	19.74
Store managers	19.56
Delivery and route workers	18.50
Stock clerks, stockroom & warehouse	17.74
Computer programmers	17.53
Electricians	17.40
Carpenters	17.30
Sales clerks	16.91
Mainten. repairers gen. utility	16.88
Computer systems analysts	16.36
Automotive mechanics	16.19
Lawyers	16.08
Sales representatives, technical	15.05
Sales representatives, nontechnical	14.99
Computer operators	14.57
General clerks, office	14.11
Guards	13.93
Cashiers	13.36
Accountants and auditors	13.04
Bookkeepers, hand	13.02
Helpers, trades	11.74
Building custodians	11.72
Typists	11.26
Secretaries	10.24
Nurses, registered	6.84
Physicians	6.70
Licensed practical nurses	6.65
Nursing aides, orderlies & attend.	5.81
Receptionists	1.49
Cooks, restaurant	0.72
Kitchen helpers	0.41
Kndrgrtn. & elementary school tchrs.	-0.57
Waiters and waitresses	-1.10
Cooks, short order & spec. fast food	-2.51
Fast food prep., & service wkrs.	-6.68

Relative Impact of Input-Output Coefficients On Projected 1995 Occupational Employment Levels Resulting from the Second Set of Simulations (percentage change from projected 1995 levels)

Fast food prep., & service wkrs.	5.22
Cooks, short order & spec. fast food	4.43
Waiters and waitresses	3.80
Cooks, restaurant	3.60
Kitchen helpers	2.02
Electricians	0.57
Sales representatives, nontechnical	0.38
Helpers, trades	0.35
Sales representatives, technical	0.21
Kndrgrtn. & elementary school tchrs.	-0.02
Blue collar worker supervisors	-0.16
Cashiers	-0.21
Store managers	-0.22
Sales clerks	-0.34
Physicians	-0.41
Automotive mechanics	-0.48
Carpenters	-0.82
Truck drivers	-0.90
Delivery and route workers	-1.38
Stock clerks, stockroom & warehouse	-1.52
Nursing aides, orderlies & attend.	-1.58
Nurses, registered	-1.68
Bookkeepers, hand	-1.81
Mainten. repairers gen. utility	-2.45
Lawyers	-2.66
Licensed practical nurses	-3.44
Accountants and auditors	-3.60
Receptionists	-4.10
General clerks, office	-4.37
Secretaries	-4.38
Tellers	-6.13
Typists	-6.18
Clerical supervisors	-6.86
Building custodians	-9.63
Electrical & electronic technicians	-9.65
Computer operators	-12.84
Electrical engineers	-13.08
Computer systems analysts	-13.45
Computer programmers	-14.98
Guards	-23.28

Relative Impact of Staffing Patterns
On Projected 1995 Occupational Employment Levels
Resulting from the Second Set of Simulations
(percentage change from projected 1995 levels)

Bookkeepers, hand	12.82
Typists	11.38
Nursing aides, orderlies & attend.	8.70
Stock clerks, stockroom & warehouse	7.84
Building custodians	5.41
Licensed practical nurses	4.66
Helpers, trades	4.51
Sales clerks	3.21
Tellers	3.08
Cooks, short order & spec. fast food	1.77
Secretaries	1.67
Sales representatives, technical	1.30
Waiters and waitresses	1.28
Guards	0.14
General clerks, office	-0.04
Delivery and route workers	-0.11
Fast food prep., & service wkrs.	-0.18
Sales representatives, nontechnical	-0.40
Carpenters	-0.44
Kitchen helpers	-1.43
Truck drivers	-1.51
Electricians	-2.21
Clerical supervisors	-2.48
Receptionists	-2.71
Blue collar worker supervisors	-2.80
Mainten. repairers gen. utility	-3.13
Physicians	-3.40
Automotive mechanics	-5.96
Cooks, restaurant	-5.96
Accountants and auditors	-6.09
Store managers	-6.42
Nurses, registered	-6.47
Lawyers	-11.27
Electrical & electronic technicians	-13.88
Cashiers	-15.63
Kndrgrtn. & elementary school tchrs.	-16.36
Electrical engineers	-16.49
Computer programmers	-18.88
Computer operators	-20.93
Computer systems analysts	-24.63

BLS 1884-1984

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[of] Labor
[St]atistics

U.S. Department of Labor

Commissioner for
Bureau of Labor Statistics
Washington, D.C. 20212

Mr. Fogel
Mr. Bernstein
Mr. Densmore
Mr. Fasenaugh
Mr. May
Associate Director
Control

31 DEC 1984

DEC 21 1984

Mr. Richard L. Fogel
Director
Human Resources Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Fogel:

This is in response to your letter of November 26, to Under Secretary Ford B. Ford, requesting review and comment on your draft of the proposed report, "Bureau of Labor Statistics Employment Forecasts: Detailed Analysis of Selected Occupations and Industries GAO/OCE-85-1." In reviewing this draft report we feel your staff has done a very careful, thorough, and accurate presentation of the projection procedures used by the Bureau of Labor Statistics in preparing our 1995 projections. Also, our review of the analyses and calculations in this report showing the effect of each of the factors which determine the projected employment level for an industry or occupation found them to be correct.

We have a few suggested corrections or modifications for the report. These suggested changes are made directly on the attached report and are for your consideration in preparing the final report.

Sincerely yours,

Janet L. Norwood

JANET L. NORWOOD
Commissioner

Enclosure

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United States House of Representatives
Committee on Small Business
Subcommittee on General Oversight and the Economy
B-363 Rayburn House Office Building
Washington, D.C. 20515

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December 16, 1983

The Honorable Charles A. Bowsher
Comptroller General of the United States
United States General Accounting Office
441 G Street N.W.
Washington, D.C. 20548

Dear Mr. Bowsher:

As I believe you know, Charles McMillion of my subcommittee and I have met with your Economic and Program staff since last May to discuss GAO assistance in our work on occupational projections. It is my belief that the accelerating pace and broad scope of technological change has made occupational forecasting increasingly difficult as it becomes even more vital to our economic future.

BLS occupational forecasts are the basis for virtually all other such forecasts and they figure significantly in a wide range of public policy considerations. Because of the importance of the BLS analysis Dr. McMillion and I, with your staff and others, have devoted considerable time to understanding the complex BLS employment projections system. (see attachment A)

There appears to be significantly differential treatment among industries and occupations of historic input/output coefficients and staffing pattern ratios. Certainly new technolc and more efficient managerial practices can be expected to result in changes in relative industry demand for labor, and in the types of labor. But how does the BLS determine differential change in productivity growth between industries and job growth between occupations?

I would request the GAO to explicate the methodology by which the BLS arrives at adjustments to industry input/output coefficients and staffing pattern ratios. That is, that you explain the rationale for any and all adjustments to base line projections within both the Labor Demand Model and the Occupational Demand Model. I suggest that the universe be limited to durable goods industries and to the 40 occupations (attachment B) expected to provide the largest job growth to 1995.

This project is already several months beyond the timetable we agreed to with you staff. I believe that it is a most important project and I or Dr. McMillion are available to work with your staff to facilitate its rapid completion.

Sincerely,

Berkley Bedell

Berkley Bedell

Attachments: Copy to Arthur J. Corazzini

31071

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