Factbook for Estimating the Manpower Needs of Federal Programs

U.S. Department of Labor
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John T. Dunlop, Secretary
Bureau of Labor Statistics
Julius Shiskin, Commissioner
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Preface

This bulletin was prepared by the Bureau of Labor Statistics (BLS) with funds provided by the Manpower Administration for a series of studies on the manpower impact of Federal programs. The BLS has for some time been engaged in estimating the employment requirements by industry and occupation of various government and private activities. This work received substantial impetus when the President, in his *Manpower Report* of March 1972, directed the Department of Labor to develop a capability for measuring the employment effects of all Federal programs and policies.

> "Both the efficiency of our economy and the well-being of the country's workers will be served by more systematic assessment of the manpower consequences of government policies and programs. Accordingly, I am instructing the Secretary of Labor to develop for my consideration recommendations with respect to the most effective mechanisms for achieving such an assessment and for assuring the findings receive appropriate attention in the government's decision-making processes."

The Department of Labor has since taken a number of steps to help in this assessment. In the BLS, techniques and models used in the past principally for long-term projections of industry and occupational employment needs are being adapted to measure the current manpower requirements of Federal spending programs, and work is underway on techniques for measuring the effects on manpower supply. Future plans include the development of new methods for measuring the employment effects of Federal policy changes and the manpower implications of programs that do not involve significant changes in outlays. The results will be published as these studies are completed.

This study was prepared in the Division of Economic Growth, Office of Economic Trends, under the supervision of Ronald E. Kutscher. It was designed and written by Richard P. Oliver with the editorial assistance of Virginia A. Broadbeck. Industry employment factors were developed by Donald P. Eldridge and Marybeth Tschetter. Thomas F. Fleming, Jr., contributed to the section illustrating the application of the factors to specific programs. The occupational demand factors and contributions to the text were provided by Daniel Hecker, George Silvestri, Joel Segaloff, and David Martin, under the direction of Michael F. Crowley of the Division of Manpower and Occupational Outlook, Office of Manpower Structure and Trends. This research was funded by the Office of Manpower Research and Development of the Manpower Administration, Howard Rosen, Director.

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Introduction

Almost all Federal Government activities affect manpower in some way. These effects range from the direct hiring of Federal personnel to the employment created in private industry by Federal spending programs, to the more complicated manpower effects of Federal standards, regulations, and economic policies. The effects on manpower vary with different activities, but a particular Federal program may significantly influence the demand for or the supply of labor, or may affect the skills and well-being of the labor force.

Federal actions affecting manpower may be classified in a number of different ways, but for analytical purposes this study broadly classifies them as actions which predominantly involve Federal money flows and those which affect manpower mainly through policies or regulatory actions. Money flow programs are defined to include all types of Federal outlays and revenue collections. Policy programs would include cases where the Federal Government encourages or requires other sectors of the economy to alter purchasing patterns, as well as cases where manpower effects are significant although money flows are small. Pollution control standards or occupational safety and health regulations, which involve the purchase of additional or modified equipment by the private sector, are representative of policy impact actions. This category also includes the military draft and immigration policies, which affect the supply of labor without involving major money flows.

This study deals with one of the more important areas of Federal manpower impact—the requirements for manpower that are created by Federal expenditures. It is intended to provide agency administrators with a means of estimating the public and private employment requirements of a program, based upon the program's outlays. The study will not address all of the effects on manpower that are generated by any Federal program, policy, or other type of Federal action. These effects would encompass all of the influences working on the quantity of manpower demanded and supplied, as well as qualitative results such as improvements in health, safety, education, and other social benefits. The effects discussed here are an important, but limited, sector of manpower impact, the demand for manpower created by program outlays.

The *Factbook* contains sets of "manpower factors" which show the amounts of employment, by industry and occupation, which were generated by a billion dollars of outlays for different Federal functions in a recent period. By applying these factors to the amounts of money projected for a Federal program, that program's future employment requirements may be roughly estimated.

Manpower factors can have many policy uses. Programs can be considered for their employment generating characteristics as well as for their public benefits and costs. The job requirements created by existing programs can be estimated for past periods, and new programs can be evaluated for their job-creating potential in individual industries and occupations. Loss of job opportunities due to cutbacks, such as have occurred in defense or space programs, can be calculated, pointing to potential problems in individual industries and occupations. Or, in the case of expanding programs, bottlenecks in particular occupations possibly may be foreseen if labor supply information is also available, providing guidance to manpower training programs. For example, calculating the effects on employment of substantial growth in health services may indicate a potential shortage of doctors and other health personnel, requiring additional professional training and a longer period of time for achieving the goals.

Chapter 1. What Are Manpower Factors?

The manpower or employment requirements factors given here relate aggregate expenditures for a particular program to the number of job opportunities created by these expenditures. They do not provide estimates of the actual employment that might result from a Federal program. Actual employment will be determined as the net result of all influences on both the demand for and supply of labor. *Manpower factors are simply multipliers which will convert planned program expenditures into estimates of job requirements based upon recent industry employment relationships.*

This *Factbook* presents manpower factors for about 40 different categories of demand. These categories cover the total economy considered as the demand side of the gross national product. In some cases, these demand categories have been separated into fairly specific functions representing or approximately describing a Federal program or one of its components. In other cases, the demand categories cover broad sectors of expenditures that have not yet been studied from a manpower point of view and assigned to specific functional programs. For example, at this time, in the area of Federal Government purchases, defense and space programs have been analyzed separately, but all other direct Federal purchases are lumped together in a single category.

Since the outlays of many Federal programs ultimately are spent by other sectors of the economy, factors for these sectors also are provided. For example, Federal grants are spent by State and local government institutions, while transfer payments to persons become primarily personal consumption expenditures. Thus, in selecting a demand category to represent the outlays of a given Federal program, it is frequently necessary to use factors for some other sector where the Federal funds ultimately are spent.

Types of factors

Two types of factors are provided—industry manpower factors, which can be used to estimate the amount of employment required in total or by industry, and occupational manpower factors, which can be used to calculate the employment required in different occupations. Each program covered includes a list of these factors for both the private and public sectors of the economy.

Industry manpower factors are ratios showing the relationship between dollars spent and the employment required by these expenditures in each industry. They represent the number of jobs required[1] by $1 billion of expenditures in 1972. As such, they reflect 1972 price and productivity relationships. The factor tables provide, for each program covered, factors for total employment requirements (table 4), factors for the employment required by major industry sector (table 5), and factors for each of 134 industries (table D-1). For example, the aggregate employment generated by $1 billion spent on defense is shown, in table 4, as a requirement for 74,193 jobs of all types. This amount is disaggregated into major industry sectors such as agriculture, mining, and manufacturing in table 5, and is further separated into individual industries in table D-1.

Occupational manpower factors show the amounts of employment required by occupation for $1 billion of expenditures. Occupational manpower factors represent the percentage distribution of industry manpower factors into specific occupations. The total number of job requirements generated in each of nine major occupational groups is given in table 6 and these requirements are broken down into the demand for each of 160 occupations in table D-3.

Methods used in deriving factors

The models and analytical approaches used to develop these factors estimate employment requirements in the private sector by tracing all production requirements generated by each program's purchases. The basic models are an interindustry employment model and an industry-occupation model, discussed in detail in appendix E. The interindustry employment model traces purchases of goods and services through each sector, determining the employment needed in each industry to

[1] Manpower requirements are a count of the number of jobs rather than the number of persons holding jobs. Thus, an individual who holds more than one job is counted more than once. The employment estimates cover wage and salary workers, self-employed, and unpaid family workers.

support these purchases. The industry-occupation model provides a distribution of the employment in each industry into 160 occupational categories.

In this framework of analysis, where employment in each industry is determined on the basis of generated production levels, coverage of employment requirements would generally be limited to direct Federal purchases of goods and services. However, this system can be extended to other types of Federal outlays, such as grants-in-aid, transfer payments, and subsidies, by determining the purchases made by the sector receiving the Federal outlay. For example, the employment requirements created by grants to State and local governments can be estimated from studies of the purchases made by State and local governments in carrying out the purposes of the grants. Similarly, transfer payments to persons can be analyzed by considering the impact of these payments on personal consumption expenditures. This, of course, involves determining the extent to which transfer payments become disposable income and consumption expenditures and then identifying the pattern of subsequent consumption purchases. Similarly, the employment effects of subsidies to businesses can be estimated once the extent and type of resulting business purchases have been determined.

Manpower factors, then, were derived from interindustry employment requirements studies which provided industry employment requirements for each program or category of demand. These estimates were used first to construct industry manpower factors. They were used next as input into the industry-occupation model to obtain the occupational requirements which provide the basis for the occupational manpower factors. Since both types of factors were based on an interindustry system, the employment included consists of both the direct employment used in producing final products and the indirect employment required in all supplying industries. A fuller explanation of the derivation of manpower factors is given in appendix A.

Limitations of factors

Manpower factors provide a consistent and reasonably comparable basis for estimating the employment requirements of various Federal programs. They are calculated within the framework of all requirements on the economy, with given control totals for sector expenditures and industry output and employment levels ensuring a reasonable degree of accuracy. However, the development of these factors for Federal programs is just getting underway and there are major limitations and gaps in the current estimating system. These limitations are covered in general terms in this section and in more detail in appendix B.

The principal deficiency of manpower factors, from the point of view of complete manpower assessment, is that they provide estimates of employment requirements and not estimates of the actual employment changes that might be expected to result from a new Federal program. Estimating actual employment effects would require comprehensive information on all of the influences on both the demand and supply sides of particular labor markets. Manpower factors estimate just a part of manpower demand and, as such, must be regarded as estimates of job opportunities created rather than the actual employment that might be created. In addition, in cases of ongoing programs or new programs that replace existing ones, there may be little or no change in actual employment. Also, Federal funds that become grants to States or transfer payments to persons may merely replace money previously spent by these groups for the same purpose, with little employment change directly attributable to the new program. In some industries operating at below capacity levels, additional Federal funds may result in better utilization of the existing labor force with a less than proportional increase in new employment. The interindustry and occupational model structures from which the manpower factors were derived describe average relationships, or the average employment required to produce the total annual output of each industry. In this study, these factors are used to estimate changes in employment requirements due to an increment in purchases from a particular industry. For this purpose, marginal or incremental manpower factors are more appropriate. That is, a directly proportional increase in employment may not be required by an increment in outlays and a different mix of production and administrative workers may result. Also, in measuring or estimating actual employment effects, one would want to include the additional employment that would be expected from the income multiplier and accelerator effects.

The other major criticism of manpower factors is that coverage is limited. Factors are not available for a number of major Federal programs. Specific interindustry employment studies in depth are required to produce manpower factors. At this time only defense and space programs have been subjected to this kind of analysis. Other Federal programs have been estimated as a single aggregate or category of demand. Studies, currently underway, will add a few new programs and reduce this aggregate. Some Federal programs that are conducted principally in other sectors of the economy, such as highway construction grants, are covered in other programs. However, a number of major programs such as social security payments or Medicare and Medicaid cannot be adequately expressed in existing factors and

require detailed study. Further, manpower factors are calculated on a national basis and do not identify requirements by region or demographic characteristic such as age, sex, or race. Assessment of a program's consequences and the development of any needed remedies require a more specific determination of the people affected.

Since the manpower data included in these estimates were basically derived from an interindustry employment model, these estimates will have the characteristic features and limitations of an interindustry system. The industries used here are those defined in the 1963 input-output study of the Department of Commerce. Employment is on a "jobs" basis so that both full- and part-time job requirements are estimated by using the factors. Although the estimated employment includes the direct employment in each industry and the indirect employment generated in all of the supplying industries, these estimates do not include the income multiplier and accelerator effects. The limitations of the interindustry system are covered in detail in appendix B.

Chapter 2. Using Manpower Factors to Develop Employment Requirements

This chapter explains how to use manpower factors to develop employment requirements. The summary below outlines the major steps in the procedure; a more detailed list of instructions is provided in appendix C.

Summary

A. Program analysis
   1. Determining economic effects
   2. Tracing program outlays to the sectors which ultimately spend them

B. Selection of factor programs
   Matching program outlays to factor programs by:
   1. purchasing sector
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C. Data adjustment
   1. Organizing expenditures by factor program
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D. Factor adjustment
   1. Adjusting industry factors for productivity change
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Program analysis

Economic analysis. Before estimating the employment requirements of a Federal program or other activity, it is first desirable to broadly examine the various economic effects of the program to determine in general how they will influence manpower. This examination should focus on which sectors of the economy would be affected by the program, the mechanism or way in which manpower effects would be transmitted, and the kinds of effects on manpower that would result. Such an analysis would serve as the basis for estimating employment requirements and would give perspective to these estimates by providing a general framework of manpower effects in which employment requirements could be considered. It would determine the sectors of the economy that ultimately spend program funds for subsequent use in calculating estimates of employment requirements. In addition, it would outline the range and general magnitude of all types of manpower effects generated by the program. For example, a Federal program might have relatively low expenditures and consequently create relatively small employment requirements using manpower factors, but still have substantial impact in other ways on the demand, supply, or quality of manpower. While these aspects are not measurable through use of employment requirements factors, their overall significance should be considered in an agency's assessment of its programs.

Tracing outlays. Once an overall analytical framework has been established, an agency is better able to proceed with the more specific assessment of the job requirements created by outlays for a particular program. Analyzing employment requirements involves tracing the activities of a Federal program throughout the economy and determining the effects on manpower at various stages. At this time, when only Federal outlay programs can be assessed, employment requirements are determined by tracing money flows. Of course, the direct Federal employment for a particular program may be readily available from agency personnel records. Most of the employment effects, however, will usually occur in other sectors, and these are determined by tracing program funds to the actual spender.

National income accounting procedures are followed in tracing Federal outlays, which are considered to consist of direct purchases of goods and services, grants-in-aid to State and local government institutions, transfer and interest payments to persons, and subsidies, transfers, and interest paid to businesses. This definition classifies Federal outlays by the economic sector, or component of demand, that ultimately spends the program money. The way in which the money is spent determines the employment requirements. Manpower factors are based upon recent purchasing patterns of the

sectors receiving Federal funds and relate these purchases to employment requirements.

Direct Federal purchases of goods and services include compensation for the direct employment of Federal Government personnel and expenditures for goods and services bought from the private economy. These outside purchases create employment requirements both directly in the industries producing the products purchased and indirectly in supporting industries. Grants-in-aid are Federal funds transferred to State and local governments to be spent for particular purposes, such as highway construction, or for broader purposes, as in the case of revenue sharing. Transfer payments to persons are Federal payments where productive services are not required in return from the recipients, such as Medicare and other social security benefits. Subsidies are monetary grants to business to achieve certain economic goals. In the case of direct purchases of goods and services, the Federal Government is the final spender, while grant outlays are spent by State and local governments. All Federal payments to persons constitute income which will be largely spent by the recipient on personal consumption items. Payments to businesses, such as subsidies, will be spent by the business sector.

Tracing the employment requirements resulting from Federal purchases is relatively straightforward. The employment effects occur in the direct hiring of Federal employees and in the employment required in the private sector by the production of goods and services actually purchased. These employment requirements are embodied in the factors for the Federal government programs. Grants-in-aid present a somewhat more complicated path of effect. In these programs, some employment is generated by administrative purchases at the Federal level. Most of the employment effects occur, however, from the expenditure of the grant funds by the State or local government. In many cases, a Federal grant will trigger State or local contributions according to some matching formula. The employment requirements generated by these matching funds should be considered part of the program's impact. Grant funds will create employment in the direct hiring of State and local employees and, when they are spent on purchases of goods and services, will create employment in the private sector. Outlays in the form of transfer payments will create some direct Federal employment for program administration, but will principally create employment in the private sector as recipients use the money for personal consumption purchases. Similarly, subsidies to businesses will create some Federal employment but will mainly affect the private sector.

Selection of factor programs

After a program's economic effects have been considered and outlays have been traced to the sector which finally spends the funds, the next step is to select the factor program which most closely represents the Federal action being studied. As indicated, a program may be directly represented in the Federal purchases sector, or in some other sector which spends program funds. In some cases factors may not be available for all of the component parts of a program and other factors which reasonably approximate the remaining purchasing sectors may be substituted. In other cases no factor program will adequately describe the Federal program under consideration. Since the factors apply only to outlays, no attempt to use them should be made unless Federal outlays are a significant part of a program. And, since outlays may in part be spent through other sectors of the economy, decisions on factor selection must be postponed until program funds have been traced to the various purchasing sectors.

Selecting appropriate program factors requires a basic understanding of both the Federal program under consideration and of the factor programs available. Factor programs are organized first by the components of demand, or the sectors which ultimately spend the Federal funds. These demand categories include the Federal Government, State and local governments, personal consumption expenditures, exports, and gross private domestic fixed investment. Within these sectors, programs are further broken down by the functional types of purchases made by the sector. In a separate category, construction programs are listed by type of construction, such as residential, industrial, educational, or local transit facilities.

Table 1 lists the programs and demand sectors for which factors are currently available.

The total public sector encompasses Federal, State, and local government sectors. Within the Federal sector, defense purchases consist of Department of Defense military outlays and Atomic Energy Commission expenditures. The nondefense category includes all other Federal spending, with National Aeronautics and Space Administration (NASA) requirements given separately.

State and local government programs are grouped into three functional areas: education, which consists largely of elementary and secondary education requirements; health, welfare, and sanitation; and "other" functions, which include highways, parks and recreation, natural resources, civilian safety, general government, and the capital purchases of government enterprises. Each of the three functions, as well as total State and local government purchases, is separated into new

Table 1. Factor programs

Program	Program
BY COMPONENT OF DEMAND	Services
Total, public sector	Medical
Federal Government	Exports
Defense	Merchandise and services
Nondefense	Merchandise only
Except NASA	Gross private domestic fixed investment
NASA	Producers' durable equipment
State and local government	Private new construction
Except structures	**BY TYPE OF CONSTRUCTION**
New construction	Residential buildings
Education	Single-family
Except structures	Multifamily
New construction	Nonresidential buildings
Health, welfare, and sanitation	Industrial
Except structures	Office and commercial
New construction	Educational
Other functions	Hospital and institutional
Except structures	Public utility structures
New construction	Telephone and telegraph
Total, private sector	Electric
Personal consumption expenditures	Water
Durable goods	Sewer
Nondurable goods	Local transit
Food	Highways and streets

construction and all spending excluding structures. State and local construction categories differ from the types of construction listed separately in table 1. State and local programs represent construction purchased by these levels of government in total and for each functional area, regardless of whether a type of construction is primary to the function. Construction programs classified by type refer more strictly to the construction or renovation of the particular residential, nonresidential, or public utility facility itself. Demand for these structures may be generated by any or all of the components of demand—Federal Government, State and local government, or business investment.

For example, State and local new educational construction includes such facilities as dormitories, apartments, and administrative offices in addition to educational buildings themselves. Where construction programs are listed by type of building, educational construction includes only educational buildings—primarily schools, but also museums and art galleries.

Among the private sector programs, personal consumption encompasses all spending by households on durable goods, such as automobiles, furniture, and household equipment; on nondurable goods, such as food and clothing; and on services, which include housing expenses, medical care, transportation, and recreation.

Within the exports sector, merchandise exports are composed of all exported goods and the trade and transportation costs incurred in their export. This is by far the most important component of exports in terms of manpower requirements. Nonmerchandise exports consist largely of income flows from foreign investments, and have relatively minor manpower implications in the context of this study.

In the gross private domestic fixed investment sector, producers' durable equipment includes machinery and all other capital goods except structures.

Factor selection, then, is mainly a process of matching the outlay components of a Federal action to the sector of the economy actually using the Federal funds, and then matching the type of expenditure by function. The tracing procedure of the preceding section will have determined the sectors affected so that the remaining problem at this stage is to determine which functional category, if any, adequately describes the program being considered.

Since only a few direct Federal purchasing functions have been studied and have manpower factors readily available, occasions for their use will be obvious but not frequent. In other cases of Federal purchases of goods and services, the employment requirements may be best approximated by using the total "nondefense except NASA" category. However, where program purchases are known to be highly specialized, as in the case of hospital operations or air traffic control electronics and communication equipment, this residual program category would not be satisfactory.

Federal grant programs will generally have a portion of their outlays spent on administration, which will result in some direct Federal employment and in some private employment from direct overhead purchases. The employment requirements created as States spend grant funds may be approximated by selecting one or more sets of factors from the State and local government programs. If the grant is for education or for health, welfare and sanitation, manpower factors are available in the State and local government sector. If the grant is for construction, State and local manpower factors include construction for education, health, welfare, and sanitation and all other functions. In addition, factors for some specific types of construction are listed separately in the factor tables. The effects of grants for purposes other than those listed may be approximated by using factors for "other" State and local government functions. Factors for the total of State and local government activities can be used to estimate the requirements of general purpose grants such as general revenue sharing. In all cases, the program should be examined to see if matching State grants are required which would generate additional employment requirements. State and local contributions should be added to Federal grant outlays to determine the total amount of money spent by State and local governments.

The impact of transfer payments to persons can be approximated by selecting the manpower factors for one or more categories of personal consumption expenditures. For example, the effects of social security payments on employment requirements could be roughly estimated by using factors for the total of personal consumption expenditures. Medicare payments would be best handled at this time by using factors for personal consumption expenditures on medical services, although the results would not be expected to be more than a broad approximation.

Since subsidies represent grants to businesses, their requirements may be approximated by using some factor for business expenditures. This would be true for loan guarantee programs also. However, where a subsidy is given to a particular industry, such as agriculture or shipbuilding, the program areas given for the business sector will probably be too broad to use. And, if subsidy or loan funds are granted to single firms within an industry, the factors available will not provide suitable representation for estimating employment requirements.

In all cases where factor programs provide only an approximate representation of the Federal action being studied, an agency will have to determine their adequacy in first describing the activity and then in estimating employment effects. This, of course, will depend upon how the employment requirements estimates will be used. In some cases only a rough approximation will be required while in others a more exact representation will be needed.

Data adjustment

The only data required in order to use manpower factors are the aggregate program expenditures. These expenditures must be classified or distributed in the same way in which the factor programs are organized—by purchasing sector and by type of purchase. These outlays must then be adjusted for price change to make them compatible with the manpower factors.

Expenditures may be readily available in the form required or an agency may have to estimate some of the components. This task will probably have been accomplished earlier in the course of tracing program money flows. An additional problem is that data for some Federal programs may be available only as obligational authority and not as expenditures. Since obligational authority represents only potential expenditures, some timing adjustments will have to be made to convert obligations to anticipated expenditures in a particular year. In some of these cases, expenditures may be easily estimated since Federal money is required to be spent in the same year in which it is obligated. In other cases, obligated money may be spent over several years, presenting substantial timing problems. Whether expenditures for a program are obtained directly or are estimated, they must be calculated for a 1-year period since all factors are based on annual employment requirements.

Once expenditures have been properly determined and classified, the only adjustment needed is for price changes. Annual program expenditures, as distributed by spender and function, must be converted to 1972 dollars, the same base year for prices that was used for the manpower factors. When factors are applied to program expenditures for years other than 1972, employment requirements will be distorted to the extent that prices are different from the base period. When expenditures for a future year are being considered, price deflators must be estimated on the basis of historical price behavior and other pertinent information. Price deflators should be representative of the purchasing sector and type of purchase. For example, Federal highway grants would be adjusted by the national income deflator for public structures, highways, and streets. Price adjustment then, simply consists of dividing expenditures for a year other than 1972 by an adjustment factor which eliminates the effects of price change since 1972.

Table 2. Adjustments for price change

Program	Average annual percentage change in prices, calendar years 1958-72	Annual price adjustment	Program	Average annual percentage change in prices, calendar years 1958-72	Annual price adjustment
BY COMPONENT OF DEMAND					
Total, public sector	4.2	1.042	Exports, merchandise and services	1.9	1.019
Federal defense	4.2	1.042	Merchandise only	2.0	1.020
Federal nondefense	4.2	1.042	Gross private domestic fixed investment	2.7	1.027
Except NASA	4.2	1.042	Producers' durable equipment	1.7	1.017
NASA	4.2	1.042	Private new construction	3.9	1.039
State and local government	4.4	1.044	**BY TYPE OF CONSTRUCTION**		
Except structures	4.3	1.043	Residential buildings:		
New construction	4.5	1.045	Single-family	2.6	1.026
Education	5.2	1.052	Multifamily	2.8	1.028
Except structures	5.1	1.051	Nonresidential buildings:		
New construction	5.2	1.052	Industrial	4.2	1.042
Health, welfare, and sanitation	4.3	1.043	Office and commercial	4.4	1.044
Except structures	5.2	1.052	Educational	4.4	1.044
New construction	4.3	1.043	Hospital and institutional	4.4	1.044
Other functions	4.5	1.045	Public utility structures:		
Except structures	4.4	1.044	Telephone and telegraph	4.5	1.045
New construction	4.6	1.046	Electric	3.1	1.031
Total, private sector	2.4	1.024	Water	4.6	1.046
Personal consumption expenditures	2.3	1.023	Sewer	4.8	1.048
Durable goods	.8	1.008	Local transit	4.1	1.041
Nondurable goods	2.2	1.022	Highways and streets	3.5	1.035
Food	2.3	1.023			
Services	3.1	1.031			
Medical	4.7	1.047			

Most agencies have had considerable experience in estimating price changes in their programs over the near future. Data on past and relatively recent changes by overall program can be found for most programs in the national income series of implicit deflators.[2] Price changes in programs dealing with types of construction can be found in Bureau of the Census construction data.[3] For guidance, the average annual changes in program prices for 1958 to 1972 are given in table 2. Other information on price changes in a particular program should also be considered. In periods of rapid change in prices an estimated rate of current or future change may differ significantly from the rates shown.

Factor adjustment

Since the manpower factors in this *Factbook* are based upon industry productivity relationships in 1972, the factors themselves should be adjusted when applied to other years. If productivity or output per employee were to increase from 1972 to a future year, fewer employees would be required than are indicated by these factors. If productivity were to drop, more employees would be needed to produce the same amount as was produced in 1972. Factor distortion due to productivity changes will generally be greater the more the program period departs in time from the base period.

Industry manpower factors. Table 3 provides the average annual changes in productivity that occurred between 1958 and 1970 for the total economy and in selected major sectors.

Information on productivity change is available for the total economy and for most industry sectors. While it is obtainable for some individual industries, it is not available for many others. Productivity changes are not available by type of occupation. As a result, factor adjustment for productivity change must occur first in the industry factors, with the derived changes being used to adjust the occupational factors. Also, although industry factors are provided at three levels of aggregation—total economy, industry sector, and individual industry—productivity adjustments are recommended

[2] This series is compiled by the Bureau of Economic Analysis, U.S. Department of Commerce, and is published annually in the July issue of the *Survey of Current Business.*

[3] Presented in *Construction Review*, various issues (U.S. Department of Commerce).

Table 3. Adjustments for productivity change

Sector	Average annual percentage change in output per man-hour, calendar years 1958-70	Annual productivity adjustment
Total public and private sectors	2.7	1.027
Agriculture	5.9	1.059
Private nonfarm	2.8	1.028
Mining	3.8	1.038
Construction	(1)	(1)
Manufacturing	3.2	1.032
Transportation	4.1	1.041
Communication	5.4	1.054
Public utilities	4.7	1.047
Trade	3.3	1.033
Finance, insurance, and real estate	(1)	(1)
Other services	(1)	(1)
Government enterprises	2.6	1.026

1/ Since estimates of productivity change are generally not published for these sectors, it is suggested that the private nonfarm adjustment (1.028) be used.

only at the first two levels. Where industry detail is desired, the individual industry factors can be adjusted by the change in total sector productivity. In some few cases, if data on individual productivity changes are available, these industries may be separately adjusted, with the remaining industry factors adjusted by the expected change in total sector productivity.

Since short-term productivity forecasts are usually not available, the rates given in table 3 should generally be used to estimate productivity changes that might occur in the next few years. Of course, where individual industry detail is desired, these rates can be applied, but with less reliability, to each of the industries within the sector. For example, the rate of change in manufacturing productivity has averaged 3.2 percent over the 12 years from 1958 to 1970. This rate could be applied to each of the manufacturing industries. While it is not likely that productivity will change at the same rate in different industries such as electronics, food processing, or automobile production, this adjustment would probably minimize distortion due to productivity changes where more than 1 year is involved.

The productivity adjustment of industry manpower factors simply involves dividing each of the factors by the appropriate productivity adjustment figure given in table 3. For example, manpower factors for manufacturing would be adjusted to calendar year 1973 by dividing by 1.032. If the factors are used for calendar year 1974, they would be divided by 1.065 (1.032 x 1.032). On the other hand, if the program is for fiscal year 1973 the adjustment amount would reflect half the annual rate of

Table 4. Total program manpower factors

(Employment requirements per billion dollars of expenditures, calendar year 1972)

Program	Factor	Program	Factor
BY COMPONENT OF DEMAND			
Total, public sector	90,054	Exports, merchandise and services	49,865
Federal Government:		Merchandise only	57,474
Defense	74,193	Gross private domestic fixed investment	67,571
Nondefense	66,592	Producers' durable equipment	62,207
Except NASA	68,846	Private new construction	69,309
NASA	62,411		
State and local government	101,283	**BY TYPE OF CONSTRUCTION**	
Except structures	112,265		
New construction	59,908	Residential buildings:	
Education	108,803	Single-family	77,223
Except structures	114,957	Multifamily	75,860
New construction	63,541		
Health, welfare,and sanitation	94,966	Nonresidential buildings:	
Except structures	95,313	Industrial	62,488
New construction	56,620	Office and commercial	61,394
Other functions	90,028	Educational	62,407
Except functions	116,789	Hospital and institutional	60,703
New construction	59,049		
Total, private sector	69,009	Public utility structures:	
Personal consumption expenditures	70,310	Telephone and telegraph	53,749
Durable goods	71,248	Electric	60,266
Nondurable goods	76,630	Water	59,871
Food	77,529	Sewer	53,992
Services	63,811	Local transit	44,772
Medical	81,678	Highways and streets	57,802

Table 5. Industry manpower factors

(Employment requirements per billion dollars of expenditures, by major industry sector, calendar year 1972)

Program	Total	Agriculture	Mining	Construction	Manufacturing	Transportation, communication, and public utilities	Trade	Finance, insurance, and real estate	Other services	Government enterprises	General government
BY COMPONENT OF DEMAND											
Total, public sector	90,054	585	624	3,567	13,261	2,754	2,765	876	5,754	841	59,027
Federal defense	74,193	560	382	1,126	15,566	3,212	1,802	515	4,076	516	46,438
Federal nondefense	66,592	193	393	2,742	10,596	2,729	2,559	742	8,692	1,268	36,678
Except NASA	68,846	191	427	3,088	8,513	2,639	2,581	785	8,998	1,380	40,244
NASA	62,411	318	349	1,281	30,167	4,880	3,795	852	11,387	1,200	8,182
State and local government	101,283	622	834	5,038	10,774	3,480	3,201	1,116	5,731	895	69,592
Except structures	112,265	679	640	2,392	9,830	3,472	2,778	1,171	6,039	1,014	84,250
New construction	59,908	503	1,622	22,234	17,915	4,359	5,993	1,118	5,625	539	–
Education	108,803	428	491	2,896	9,219	3,336	2,044	775	1,411	875	87,328
Except structures	114,957	415	435	1,225	8,008	3,265	1,489	759	2,326	924	96,111
New construction	63,541	595	1,049	22,466	21,185	4,445	7,220	1,038	4,997	546	–
Health, welfare, and sanitation	94,966	1,438	570	3,133	13,191	3,316	3,430	1,076	12,192	1,060	55,560
Except structures	95,313	1,573	484	1,025	12,268	3,255	3,265	1,089	13,256	1,139	57,959
New construction	56,620	483	1,199	19,713	20,273	3,824	4,653	1,024	4,947	504	–
Other functions	90,028	523	969	6,765	10,382	3,300	3,726	1,278	6,122	788	56,175
Except structures	116,789	636	864	3,856	10,447	3,567	3,786	1,553	7,304	1,014	83,762
New construction	59,049	479	1,887	22,556	16,329	4,395	5,735	1,160	5,965	543	–
Total, private sector	69,009	4,153	646	3,504	18,607	5,525	17,777	3,199	14,378	1,220	–
Personal consumption expenditures	70,310	4,430	554	874	15,439	5,523	20,575	3,812	17,704	1,399	–
Durable goods	71,248	591	417	330	28,903	3,782	32,531	1,129	2,730	835	–
Nondurable goods	76,630	9,041	767	462	22,196	4,014	34,235	1,580	3,430	905	–
Food	77,529	16,149	365	475	16,907	4,520	32,860	1,626	3,760	867	–
Services	63,811	1,234	392	1,498	3,472	7,742	2,200	7,095	38,060	2,118	–
Medical	81,678	695	194	407	7,096	2,334	13,413	4,758	51,857	924	-
Exports, merchandise and services	49,865	5,978	1,194	435	23,472	6,724	5,204	1,325	4,780	753	
Merchandise only	57,474	7,997	1,560	454	30,831	5,246	6,347	1,229	3,215	595	
Gross private domestic fixed investment	67,571	705	775	15,684	30,079	3,996	10,698	1,292	3,741	601	
Producers' durable equipment	62,207	400	499	302	39,406	4,017	13,102	1,095	2,765	621	
Private new construction	69,309	1,007	1,083	28,310	20,098	4,457	8,164	1,081	4,554	555	
BY TYPE OF CONSTRUCTION											
Residential buildings:											
Single-family	77,223	1,889	992	33,980	19,284	4,469	10,419	1,085	4,527	578	
Multifamily	75,860	1,466	1,049	33,969	19,266	4,333	8,987	1,095	5,112	583	
Nonresidential buildings:											
Industrial	62,488	395	929	21,303	20,546	5,147	7,340	1,174	5,062	592	
Office and commercial	61,394	452	1,041	21,277	20,586	4,654	6,837	1,031	4,969	547	
Educational	62,407	575	1,050	21,276	21,327	4,427	7,178	1,043	4,987	544	
Hospital and institutional	60,703	491	1,048	21,266	19,675	4,174	7,232	1,059	5,197	561	
Public utility structures:											
Telephone and telegraph	53,749	449	1,429	18,410	18,694	3,722	5,137	976	4,433	499	
Electric	60,266	613	1,051	18,422	24,214	4,475	5,283	1,046	4,642	520	
Water	59,871	248	1,031	18,403	25,283	3,771	4,851	1,049	4,741	494	
Sewer	53,992	465	1,274	18,393	20,428	3,681	3,330	1,054	4,883	484	–
Local transit	44,772	224	747	18,310	13,850	2,421	3,425	843	4,444	508	–
Highways and streets	57,802	384	2,538	22,970	13,584	4,581	5,257	1,236	6,695	557	–

NOTE: These data are summarized from requirements for 134 industry sectors shown in appendix D.

Table 6. Occupational manpower factors

(Employment requirements per billion dollars of expenditures, by major occupational group, calendar year 1972)

Program	Total	Professional and technical	Managers and administrators	Clerical workers	Sales-workers	Craft and kindred workers	Operatives	Service workers	Laborers, except farm and mine	Farmers and farm workers	Armed Forces
BY COMPONENT OF DEMAND											
Total, public sector	90,050	17,000	4,200	10,400	900	7,200	6,550	7,500	2,500	400	33,400
Federal defense	74,200	7,550	3,500	7,850	950	7,550	8,850	2,050	2,000	500	33,400
Federal nondefense	66,600	15,750	4,550	21,550	1,050	7,950	7,300	6,250	1,800	400	–
Except NASA	68,850	15,400	4,750	22,700	1,050	8,150	7,550	6,900	1,900	400	–
NASA	62,400	19,600	4,950	12,150	1,600	8,850	10,700	2,700	1,650	200	–
State and local government	101,250	34,150	7,150	16,500	1,450	11,500	9,250	16,150	4,450	650	–
Except structures	112,250	42,950	7,350	19,350	1,400	8,150	8,350	20,750	3,200	750	–
New construction	59,850	5,550	5,400	7,500	2,000	17,550	13,500	1,050	7,050	300	–
Education	108,800	58,950	4,800	14,250	1,100	7,350	7,500	12,150	2,350	300	–
Except structures	114,950	64,550	4,150	15,400	1,050	6,700	7,250	13,450	2,000	350	–
New construction	63,550	5,550	6,250	8,200	2,350	18,550	14,200	1,100	7,000	300	–
Health, welfare, and sanitation	94,950	24,000	4,950	16,000	1,550	7,550	10,350	25,700	3,750	1,150	–
Except structures	95,300	25,000	4,700	16,350	1,500	6,300	9,650	27,100	3,400	1,250	–
New construction	56,600	5,450	5,550	7,150	1,700	16,150	13,950	1,000	5,350	300	–
Other functions	90,050	10,450	10,050	18,250	1,550	16,750	9,700	15,750	6,600	850	–
Except structures	116,800	15,700	13,650	29,300	1,700	11,350	9,100	29,600	5,000	1,350	–
New construction	59,050	5,450	5,000	7,250	1,850	16,950	14,150	1,000	7,100	300	–
Total private sector	69,000	6,050	7,900	11,400	5,150	9,550	13,700	8,300	3,550	3,400	–
Personal consumption expenditures	70,300	6,300	8,400	12,000	5,800	7,600	13,050	10,450	3,000	3,700	–
Durable goods	71,250	3,650	10,450	11,400	8,650	13,850	18,000	1,600	3,250	400	–
Nondurable goods	76,650	3,650	10,600	11,350	8,050	6,200	19,450	6,350	3,500	7,500	–
Food	77,550	2,700	10,100	11,100	5,550	5,400	15,050	10,200	4,150	13,300	–
Services	63,800	10,150	5,400	12,950	2,350	6,750	4,800	18,050	2,350	1,000	–
Medical	81,650	22,300	4,650	15,300	5,600	3,800	5,500	22,650	1,300	550	–
Exports, merchandise and services	49,850	4,500	4,650	7,950	2,050	7,550	13,250	2,300	2,850	4,750	-
Merchandise only	57,500	5,200	4,750	8,700	2,350	9,150	16,600	1,500	2,900	6,350	-
Gross private domestic fixed investment	67,650	5,550	6,650	9,200	3,300	18,200	16,700	1,300	6,300	450	
Producers' durable equipment	62,200	5,900	6,400	10,400	3,950	12,400	18,800	1,400	2,700	250	
Private new construction	69,300	4,950	6,300	7,800	2,250	22,450	14,600	1,100	9,250	600	
BY TYPE OF CONSTRUCTION											
Residential buildings:											
Single-family	77,200	4,300	7,300	8,200	3,000	26,650	13,050	1,150	12,450	1,100	-
Multifamily	75,850	5,100	6,900	9,500	2,750	26,450	11,800	1,150	11,200	950	–
Nonresidential buildings:											
Industrial	62,500	5,500	6,500	8,550	2,400	18,050	13,550	1,150	6,550	250	–
Office and commercial	61,400	5,700	6,100	8,200	2,250	18,000	13,350	1,150	6,350	300	–
Educational	62,400	5,700	6,150	8,150	2,200	17,800	14,500	1,100	6,450	350	–
Hospital and institutional	60,700	6,600	6,050	8,500	2,100	17,650	12,050	1,100	6,300	350	–
Public utility structures:											
Telephone and telegraph	53,750	5,350	5,100	7,050	1,700	15,050	14,050	1,000	4,050	250	–
Electric	60,200	6,050	5,700	7,750	1,850	16,200	16,450	1,100	4,800	300	–
Water	59,650	5,650	5,500	7,700	1,750	17,500	15,800	1,000	4,600	150	–
Sewer	54,000	5,450	5,200	6,700	1,500	15,050	14,200	1,000	4,650	250	–
Local transit	44,750	5,350	4,150	5,600	1,250	13,450	11,000	750	3,050	150	–
Highways and streets	57,750	5,550	4,300	7,000	1,850	16,600	13,950	1,000	7,250	250	–

NOTE: These data are summarized from the full occupational detail shown in appendix D. Occupational factors have been rounded to nearest 50.

change, and would be 1.016.

Occupational manpower factors. Since changes in productivity are only available by major sector, productivity adjustments must first be made to the industry manpower factors to provide a basis for adjusting occupational factors. For any given program, adjusting the industry manpower factors will provide a new total of the employment required per billion dollars. This adjusted total employment should be compared to the unadjusted total for the program. The ratio of the adjusted employment to the unadjusted total may be viewed as a percent or scaling factor which is simply multiplied by each of the occupational manpower factors for the program. Each program would, of course, have different scaling factors, which will produce adjusted totals of the occupational employment required per billion dollars.

Employment calculations

Estimating employment requirements is now simply a matter of multiplying the price-adjusted expenditures, expressed in billions of 1972 dollars, by the productivity-adjusted set of factors. Five different factor tables are provided which give varying degrees of employment detail. These tables provide three different levels of employment aggregation. If only the total amount of job opportunities generated by a Federal program is desired, it can be obtained by using table 4. In this case the price-adjusted program total would be multiplied by a single productivity-adjusted factor representing that program. If employment requirements are desired by major industry sector, such as agriculture, mining, or manufacturing, table 5 should be used. In this case, the total of price-adjusted expenditures would be multiplied by 10 adjusted factors representing the employment requirements in each industry sector for that program. Similarly, in order to estimate employment requirements by occupational group, one would multiply total program expenditures in 1972 dollars by nine adjusted occupational factors from table 6. If full industry and occupational detail is desired it can be obtained by using factor tables D-1 and D-3 in appendix D. Use of these tables, as with tables 4-6, involves simply multiplying a program total, in billions of 1972 dollars, by factors in that program which have been adjusted for productivity changes.

Examples of how the factors can be used with different types of programs are provided in the next chapter.

Total employment requirements per billion dollars of program expenditures, 1972. Table 4 shows the total employment requirements per billion dollars of expenditures for various purchasing sectors or factor programs. These requirements are based upon a cross-section of the expenditures that each purchasing sector made in 1970 and therefore assume that expenditure patterns will be largely maintained in the period in which the factors are used. The factors reflect 1972 prices and productivity levels.

Manpower factors by major industry sector. Table 5 provides a breakdown by major industry sector of the total employment requirements per billion dollars of expenditures for each program. This employment includes both the direct jobs required in producing the final product and the indirect employment required in supporting industries which produce the raw materials, fuels, transportation, trade, and other services embodied in the final product. The factors are stated in 1972 price and productivity levels.

Manpower requirements by occupational group. Table 6 shows the employment requirements per billion dollars of expenditures by major occupational groups, stated in 1972 prices and productivity levels. These occupational requirements include both the direct and indirect jobs required for a program.

Chapter 3. Illustrations of Uses of Manpower Factors

This chapter presents three different applications of manpower factors to proposed programs to demonstrate how the factors can be used. These include a case where a Federal program has already been studied and factors are directly available, one where a program has not been covered but where other factors may be reasonably substituted, and, third, a case where none of the factors currently available would be considered suitable. Military expenditures were selected to illustrate the first case since defense program factors principally describe this program's outlays. Education revenue sharing outlays were selected for the second case, and occupational safety and health regulations for the third. In the examples given, factors are applied by main industry sector and occupational group (tables 5 and 6). If a total employment estimate for a program is desired, table 4 factors would be used. Detailed industry and occupational estimates would require using appendix D-1 and D-3 tables.

Military expenditures, fiscal year 1974 budget proposal

Program analysis

This program is defined to cover all Department of Defense (DOD) military outlays planned for fiscal year (FY) 1974, including civil defense, housing provided for military families, and deliveries under foreign military aid. Expenditures for DOD civil functions, such as the development of water resources by the Corps of Engineers, are excluded. Also excluded are Atomic Energy Commission outlays, frequently defined as part of national defense.

The analysis of economic effects was confined to outlays. While the impact of defense programs on the supply of manpower in certain age groups and on manpower training is obviously substantial, it is beyond the scope of the *Factbook*. The first step in this analysis was to examine military expenditure aggregates in the FY 1974 Federal budget to determine which DOD accounting adjustments, if any, would have the effect of overstating or understating employment requirements. DOD military expenditures were estimated at a total of $78,200,000,000 in the 1974 budget proposal. However, miscellaneous receipts of $95 million were used to offset total expenditures in this estimate. Since this subtraction reduces total outlays, it has the effect of causing actual employment requirements to be understated. This amount was therefore added back to the total. Other accounting adjustments were not judged to be substantial, so no further changes were made.

A total of $78,295,000,000 of military expenditures in FY 1974 was accepted for the calculation of employment requirements. This total was examined to determine the amounts to be spent by various sectors of the economy or, in our analysis, the amounts to be used with different factor programs. Military outlays can be divided into three different expenditure groups: 1) direct purchases of goods and services by DOD, 2) personal consumption purchases resulting from transfer payments to persons, which consist almost completely of retirement pay, and 3) the spending of grants-in-aid to State and local government institutions. Military outlays for FY 1974 were estimated to be distributed among these economic sectors as follows (in millions of dollars):

Total	$78,295
Purchases of goods and services	73,195
Transfer payments	4,900
Grants-in-aid	200

Factor selection

The next step was to select the most appropriate factor programs to use in estimating the employment effects of each of the three expenditure groups. The direct purchases, transfers, and grants were examined to determine if it would be desirable and possible to further distribute these amounts to various programs within the Federal, State and local, and personal consumption demand categories. In the case of direct military purchases, factors for the total of national defense outlays are available. As previously noted, these factors are based upon 1970 purchasing patterns. While these distributions tend to be relatively stable over a few years, some moderate distortion would occur in this case. The use of total defense program factors to estimate 1974 defense employment requirements would tend to understate requirements in such industries as

shipbuilding and to overstate them in others such as ammunition. Also, these factors include the employment requirements of Atomic Energy Commission purchases as well as those of DOD, while the program being considered is only DOD. Use of these factors would result in some overstatement of employment requirements in a few industries, including chemicals and electric power generation, but not to a significant degree. However, since DOD employment represented by far the largest weight in constructing these factors, it was decided that the defense program factors would provide a good measure of the DOD impact.

In the case of transfer payments, which consist primarily of retirement pay, overall personal consumption purchases were selected as most representative. It was assumed, for simplicity, that all transfer payments would be spent on consumption. More realistically, a somewhat smaller amount would be spent, and a program that was more closely oriented toward the purchases of older or retired persons would be more appropriate than overall consumption expenditures. At this time such a program is not available.

Grants consist largely of research contracts with State and local universities. Although the program factors selected should approximate the purchasing patterns of these institutions in fulfilling DOD contracts, there is no State or local program that adequately describes this activity. Since the factors given for State and local education are weighted heavily by the employment requirements for elementary and secondary public education, these factors were rejected. The total purchases for all State and local government functions were ultimately selected as providing the best available approximation of DOD grant effects at this time. While this choice was not entirely satisfactory, the amount of grant funds is relatively small and would not significantly distort DOD employment requirements.

Data adjustment

At this point the three expenditure groups were examined to determine their relationship to calendar year (CY) 1972 prices. The FY 1974 budget proposal includes expected pay increases as well as estimated increases in most program costs. This budget amount was, therefore, assumed to be in FY 1974 dollars. In order to use these amounts with the factors provided, the expenditures had to be deflated to CY 1972 dollars. Separate price deflators were estimated for Federal purchases, transfers, and grants. The historical implicit price deflators were considered and rejected as understating price increases in recent months. Rough estimates were made for changes from CY 1972 to FY 1974. The price increases for the three sectors for this 1½-year period were estimated as follows:

	Percent
Federal Government purchases	10.1
Personal consumption expenditures	8.0
State and local government purchases	8.7

It should be noted that the GNP implicit deflators are more comprehensive than the program being considered. Separate deflators are not available for the defense and nondefense portions of Federal purchases, so the total was used. While more detailed deflators are available for compensation, construction, and the total of other purchases of the Federal government, they were not used. Defense factors, like other program factors, are based on total outlays which include construction and government compensation. In the cases of consumption expenditures and State and local government purchases, the total program factors were being used so that overall deflators were appropriate. When these deflators were applied to the three expenditure groups, they adjusted expenditures to the following, in millions of CY 1972 dollars:

Total	$71,201
Purchases of goods and services	66,480
Transfer payments	4,537
Grants-in-aid	184

Factor adjustment

The next step was to adjust the industry and occupational manpower factors given by major industry sector for estimated productivity changes from CY 1972 to FY 1974. Table 7 illustrates the adjustment for productivity change of the industry manpower factors. As indicated, this adjustment is carried over to the occupational manpower factors since productivity estimates are not available by occupation.

Industry manpower factors. Since productivity projections were not available, estimates of the productivity changes that were likely to occur from CY 1972 to FY 1974 were obtained by assuming that past rates of increase in each industry sector would continue. These annual adjustments, given by industry sector in table 3, were converted to a 1½-year period, as shown in the first column of table 7. The manpower factors for each of the three program areas (defense, total personal consumption, and total State and local government) were obtained from table 5 and were then divided by these productivity adjustments. Government employment was not adjusted since, by national income definition, government is assumed to have a fixed productivity over

Table 7. Military expenditures: Industry manpower factors adjusted for productivity change, fiscal year 1974

Sector	Productivity adjustment CY1972–FY 1974	Adjusted factors (employment requirements per billion dollars)		
		Defense purchases	Consumption purchases	State and local government purchases
Total	–	72,848	66,886	99,784
Private employment	–	26,410	66,886	30,192
Agriculture	1.090	514	4,064	571
Mining	1.058	361	524	788
Construction	1.042	1,081	839	4,835
Manufacturing	1.049	14,839	14,718	10,271
Transportation, communication, and public utilities	1.072	2,996	5,152	3,246
Trade	1.050	1,716	19,595	3,049
Finance, insurance, and real estate	1.042	494	3,658	1,071
Other services	1.042	3,912	16,990	5,500
Government enterprises	1.039	497	1,346	861
Public employment	–	46,438	–	69,592
Military	1.000	33,390	–	–
Civilian	1.000	13,048	–	69,592

time. The rate of change in the total private nonfarm economy was used to estimate productivity changes in construction, finance, and services. The productivity adjustments used and the adjusted manpower factors are given in table 7.

Occupational manpower factors. At this stage the adjusted total employment per billion dollars of expenditures in each program was compared with the unadjusted total. The ratio of the adjusted to the unadjusted total provided the basis for adjusting the occupational factors for productivity change. For example, the total employment per billion dollars in defense was adjusted from 74,193 to 72,848, forming a ratio of 98.19 percent. The ratios for personal consumption and State and local government were 95.13 and 98.52 respectively.

The factors for the occupational groups given in table 6 were then scaled by these ratios. That is, the factors given for defense were multiplied by 98.19 percent or by 0.9819; those for consumption were multiplied by 0.9513; and those for State and local government were multiplied by 0.9852. The adjusted occupational factors are given in table 8.

Employment calculations

The next step was to multiply the adjusted program expenditures, expressed in billions of 1972 dollars, by their respective columns of adjusted factors given in tables 7 and 8. The program amounts in billions of dollars were:

Defense purchases	$66.480
Consumption purchases	4.537
State and local government purchases	0.184

Industry employment requirements. The results of multiplying these dollar amounts by their respective

Table 8. Military expenditures: Occupational manpower factors adjusted for productivity change, fiscal year 1974

(Employment requirements per billion dollars)

Occupational group	Adjusted factors		
	Defense purchases	Consumption purchases	State and local government purchases
Total	72,857	66,877	99,752
Professional and technical workers	7,413	5,993	33,645
Managers and administrators	3,437	7,991	7,044
Clerical workers	7,708	11,416	16,256
Sales workers	933	5,518	1,429
Craft and kindred workers	7,413	7,230	11,330
Operatives	8,690	12,414	9,113
Service workers	2,013	9,941	15,911
Nonfarm laborers	1,964	2,854	4,384
Farmers	491	3,520	640
Armed Forces	32,795	–	–

columns of adjusted factors in table 7 are given in table 9.

These figures may be used as estimates of the employment required by the FY 1974 military budget. However, an additional adjustment could be made. Since the budget contains planned levels for military and civilian manpower at the end of the fiscal year, average levels could be derived directly and substituted for the calculated amounts in the public sector. The levels that were estimated directly from budget manpower figures amount to an average of about 925,000 for civilian employees in the United States and 2,300,000 for military forces. When these estimates were substituted for the calculated amounts the final estimates of

Table 9. Military expenditures: Calculated employment requirements by sector, fiscal year 1974

(In thousands)

Sector	Total	Defense purchases	Consumption purchases	State and local government purchases
Total	5,164.9	4,843.0	303.5	18.4
Private employment	2,064.9	1,755.8	303.5	5.6
Agriculture	52.7	34.2	18.4	.1
Mining	26.5	24.0	2.4	.1
Construction	76.6	71.9	3.8	.9
Manufacturing	1,055.2	986.5	66.8	1.9
Transportation, communication, and public utilities	223.2	199.2	23.4	.6
Trade	203.6	114.1	88.9	.6
Finance, insurance, and real estate	49.6	32.8	16.6	.2
Other services	338.2	260.1	77.1	1.0
Government enterprises	39.3	33.0	6.1	.2
Public employment	3,100.0	3,087.2	—	12.8
Military	2,219.8	2,219.8	—	—
Civilian	880.2	867.4	—	12.8

Table 10. Military expenditures: Calculated employment requirements by occupational group, fiscal year 1974

(In thousands)

Occupational group	Total	Defense purchases	Consumption purchases	State and local government purchases
Total	5,285.0	4,963.2	303.4	18.4
Professional and technical workers	526.2	492.8	27.2	6.2
Managers and administrators	266.1	228.5	36.3	1.3
Clerical workers	567.2	512.4	51.8	3.0
Sales workers	87.3	62.0	25.0	.3
Craft and kindred workers	527.7	492.8	32.8	2.1
Operatives	635.7	577.7	56.3	1.7
Service workers	181.8	133.8	45.1	2.9
Nonfarm laborers	144.3	130.6	12.9	.8
Farmers	48.7	32.6	16.0	.1
Armed Forces[1]	2,300.0	2,300.0	—	—

[1] Planned level has been substituted for calculated level.

employment requirements became (in thousands):

	Total	Defense purchases	Consumption purchases	State and local government purchases
	5,304	4,981	304	19
Private	2,066	1,756	304	6
Public	3,238	3,225	—	13
Military	2,300	2,300	—	—
Civilian	938	925	—	13

Occupational employment requirements. When the same program expenditures were multiplied by the adjusted occupational factors from table 8, the results were as shown in table 10.

Differences in the employment estimates calculated with the industry and occupational factors result from rounding the occupational factors to the nearest 50, and excluding all amounts under 50.

Education revenue sharing, fiscal year 1974 budget proposal

Program analysis

The FY 1974 budget contains a special revenue sharing proposal intended to replace approximately 30 separate educational programs with flexible funding for the following major purposes: elementary and secondary education, school assistance in federally affected areas, education for the handicapped, vocational and adult education, and the basic school lunch program. This proposal is designed to permit some flexibility in transferring funds among these functions, while allowing considerable freedom in the way in which funds for a particular function are spent.

The total outlays proposed for education revenue sharing in FY 1974[4] are estimated to be $1.9 billion, with funds earmarked in six categories to insure that minimum levels of spending are maintained for certain purposes. The amounts specified, in thousands of dollars, are as follows:

Total	$1,936,699
Elementary and secondary education	1,190,639
Education for the handicapped	15,759
School assistance in federally affected areas	192,500
Vocational and adult education	238,770
Other (education)	55,031
Basic school lunch program	244,000

The proposal is designed to encompass existing programs, so that local education agencies do not suffer from a shortage of grant funds before passage.

Factor selection

Since this proposal is new and provides greater flexibility and freedom to local education agencies in their disbursement of Federal funds for education, no existing set of factors specifically covers this program. However, it is likely that this funding, if approved, will be spent largely as designated since it replaces other funds for these purposes. It is also likely that the ways in which this money is spent will, for the most part, approximate past expenditure patterns for these functions. It was, therefore, decided that actual expenditures stemming from education revenue sharing would probably resemble the usual patterns of State and local government spending for education.

Existing program factors for education were then compared with the proposed allocations for education revenue sharing. An examination of the amounts in the six revenue sharing categories indicated a somewhat different distribution of funds than had occurred previously in overall State and local spending for education. This appeared to be a significant problem only in the case of school lunch assistance, to which a relatively higher proportion of funds was allocated, compared to the previous overall pattern. Use of the current factors for State and local education would therefore somewhat understate requirements for farmers, food manufacturing employees, and cafeteria workers, while slightly overstating requirements for teachers and other educational employees. However, since both the revenue sharing proposal and the factor program for education would generate requirements predominantly for educational personnel, it was felt that these factors provided a reasonable approximation of the proposal's employment effects.

In addition, since the Elementary and Secondary Education Act, which the program primarily replaces, has included only very small amounts of new construction in recent years, it seemed reasonable to further refine factor selection and use the factor for State and local education except structures. This decision was reinforced by the current decline in public school enrollments on a nationwide basis, which has resulted in a significant decline in construction of educational facilities.

[4] *Department of Labor and Health, Education, and Welfare Appropriations for 1974,* Hearings, 93d Congress, (1973) pt. 1, pp. 66-67.

It was, therefore, decided that the planned functional distribution of educational revenue sharing outlays could best be considered as a single program (the total outlays) and that this amount could be adequately represented by the program factors for State and local education minus structures.

Data adjustment

Because the revenue sharing proposal was expected to cover FY 1974 outlays for previously existing programs, it was necessary to adjust program outlays to reflect 1972 prices. To match the factors being used, an estimated deflator was required for State and local government purchases for education, except structures. After examining historical implicit price deflators for State and local government, an estimated deflator was developed on the basis of past patterns of price behavior in this area coupled with anticipated price changes between 1972 and FY 1974. The adjustment for FY 1974 outlays is shown below:

Combined total in FY 1974 prices (thousands of dollars)	$1,936,699
Implicit price deflator (1972 = 100)	109.6
Combined total in CY 1972 prices (thousands of dollars)	1,767,061

Factor adjustment

Before the factors could be applied to the adjusted outlays, they also had to be adjusted to reflect the productivity changes expected between 1972 and FY 1974. Table 11 shows the productivity adjustments of the industry manpower factors which are described below.

Industry manpower factors. As in the previous example of defense purchases, the productivity adjustment from 1972 to FY 1974 was accomplished by assuming that past rates of increase in each industry sector would continue in this 18-month period. The productivity rate for the private nonfarm sector was used for construction, finance, and services. It should be noted again that, by national income conventions, direct government employment is assumed to have no productivity change from year to year. Table 11 shows the 1972 factors by major sector, the estimated productivity adjustments between 1972 and FY 1974, and the adjusted 1974 factors.

Occupational manpower factors. The occupational factors were adjusted by using the ratio of adjusted total employment to the total employment unadjusted for

Table 11. Education revenue sharing: Industry manpower factors adjusted for productivity change, fiscal year 1974

Sector	1972 factors (employment requirements per billion dollars)	Productivity adjustment CY 1972–FY 1974	Adjusted 1974 factors (employment requirements per billion dollars)
Total	114,957	–	114,026
Private employment:			
Agriculture	415	1.090	381
Mining	435	1.058	411
Construction	1,225	1.042	1,176
Manufacturing	8,008	1.049	7,634
Transportation, communcation, and public utilities	3,265	1.072	3,046
Trade	1,489	1.050	1,418
Finance, insurance, and real estate	759	1.042	728
Other services	2,326	1.042	2,232
Government enterprises	924	1.039	889
Public employment:			
State and local government	96,111	1.000	96,111

Table 12. Education revenue sharing: Occupational manpower factors adjusted for productivity change, fiscal year 1974

Occupational group	Employment requirements per billion dollars	
	1972 factors	Adjusted 1974 factors
Total	114,950	114,026
Professional and technical workers	64,550	64,031
Managers and administrators	4,150	4,117
Clerical workers	15,400	15,276
Salesworkers	1,050	1,042
Craft and kindred workers	6,700	6,646
Operatives	7,250	7,192
Service workers	13,450	13,342
Nonfarm laborers	2,000	1,984
Farmers	350	347

productivity change. The total employment per billion dollars for State and local education, except structures, was adjusted from 114,957 to 114,026, forming a ratio of 99.2 percent. The factors for the occupational groups in table 6 were then scaled by this ratio, with the adjusted factors shown in table 12.[5]

Employment calculations

At this point, the manpower requirements of this program could be estimated for FY 1974. Proposed program outlays for FY 1974, deflated into 1972 dollars, were multiplied by the adjusted factors. The total employment requirements estimated for this program in FY 1974 were 201,490 employees of all types. However, it is likely that little or no new employment will be required by this proposal since revenue sharing funds primarily represent a substitute for grants provided in the past to local education agencies.

Industry employment requirements. Following the procedure outlined above, the employment requirements by major sector were estimated as shown in table 13.

Occupational employment requirements. The calculated occupational employment requirements are given in table 14.

Table 13. Education revenue sharing: Calculated employment requirements by sector, fiscal year 1974

Sector	Employment requirements
Total	201,490
Private employment:	
Agriculture	673
Mining	726
Construction	2,078
Manufacturing	13,490
Transportation	5,382
Trade	2,506
Finance	1,286
Services	3,944
Government enterprises	1,571
Public employment:	
State and local government	169,834

[5] Differences in totals in tables 11 and 12, and 13 and 14, arise from rounding of occupational factors.

Table 14. Education revenue sharing: Calculated employment requirements by occupational group, fiscal year 1974

Occupational group	Employment requirements
Total	201,495
Professional and technical workers	113,149
Managers and administrators	7,275
Clerical workers	26,994
Sales workers	1,841
Craft and kindred workers	11,744
Operatives	12,709
Service workers	23,577
Nonfarm laborers	3,506
Farmers	613

Occupational safety and health, fiscal year 1974 budget proposal

Program analysis

The Federal occupational safety and health program is presented as an example of one whose activities are not reasonably approximated by an existing factor program. This program is administered by the Occupational Safety and Health Administration (OSHA) in the Department of Labor with support from the National Institute for Occupational Safety and Health (NIOSH) in the Department of Health, Education and Welfare, and from the Occupational Safety and Health Review Commission. OSHA is responsible for setting workplace safety and health standards, and for enforcing them by inspecting plants, issuing citations, and assessing penalties for violations. OSHA also grants funds to

States according to matching formulas for the development and operation of State safety and health programs. NIOSH conducts background research to identify health hazards in the workplace and develops criteria for standards. Both agencies offer safety and health training programs for public and private personnel. Private firms are required to take necessary actions to meet specified safety and health standards or face penalties for noncompliance.

In FY 1974, OSHA is budgeted for outlays of $64 million, NIOSH for about $25 million, and the Review Commission for about $5 million, for a total outlay of about $94 million. Since NIOSH is funded through the appropriation for "Preventive Health Services", its outlays were not separately obtainable but were estimated from obligations. Almost half of the Federal funds for the program are to be transferred to States as grants while most of the remainder will be used for Federal salaries and administrative expenses.

The areas of direct manpower impact resulting from these expenditures would be the Federal sector, which hires researchers, inspectors, and program administrators, and the State governments which will spend the Federal grant money, plus matching funds, to employ State inspectors and administrators. However, the principal manpower impact of the program would occur in the private sector which will be required to spend additional amounts of money for safety and health improvements. These outlays would vary by industry and by the safety conditions of each establishment affected by OSHA standards.

Factor selection

In attempting to find factor programs to represent this activity, it is obvious that the employment requirements of these private purchases cannot be covered. Although private expenditures represent the area of greatest employment impact, there is no comprehensive information available on the kinds of purchases required under this program in the past, and it does not appear that any existing factor program would approximate these purchases. Information on the private purchases stimulated or required by OSHA standards could only be obtained through extensive and time-consuming surveys. While some approximation might be made of the employment effects of Federal and State outlays for administration, they represent a relatively small part of this program's overall employment requirements. We would, therefore, conclude that employment requirements estimates cannot be made for this program through the use of existing manpower factors.

Appendix A. Methods Used to Derive Manpower Factors

Industry manpower factors for each program were developed initially from an interindustry employment model system. An interindustry model takes the final purchases of a particular Federal program, such as defense, or an economic demand category, such as personal consumption expenditures, and translates these into industry-by-industry production requirements which are necessary to produce the final product. For example, the purchase of single-family housing requires employment, not only in the construction industry, but in all major building component industries such as lumber, heating and plumbing products, stone, clay, and glass products and in all supplying industries such as metals and basic mining activities. The interindustry model, through its input coefficients, provides a mathematical solution of the material and service inputs required through all stages of production of a final product. The only information needed to use this model is a list of final purchases made to carry out a particular program. These purchases are then converted by the model into the production required through all stages in all industries. Employment-output ratios or productivity factors are used to convert these gross industry outputs into the employment required in each industry. The manpower factors calculated through this model include the direct employment required in the producing industry and the indirect employment required in all supporting industries providing material or service inputs to the producing industry.

The industry manpower factors in this study were derived in the following manner. First, lists of final purchases, or "bills of goods" were prepared for each program or demand category. Compiling these bills of goods frequently involved very detailed analyses of the program sectors. These purchases were used with an interindustry model for 1970 in which the sector relationships had been developed in 1963 dollars. Program purchases for 1970 were, therefore, deflated to 1963 dollars to be compatible with the model. The bills of goods were then applied as inputs to the model to produce the output requirements of all industries through all stages of production. Output requirements were next converted to the total employment required in each industry. To make this generated employment comparable for all programs, it was put on a "per billion dollar" basis by dividing generated employment by total expenditures for each program or demand component. The factors for each program, therefore, implicitly assume that a billion dollars is spent on a weighted cross-section of all purchases for that program in 1970.

At this stage, the manpower factors represented the employment, given 1970 productivity levels, that would be generated by a billion dollars of purchases for each program or demand category, stated in 1963 dollars. The factors were divided by price changes from 1963 to 1972 in each industry sector and by estimates of industry productivity changes from 1970 to 1972 in order to convert them to 1972 price and productivity levels. The factors for public employment were not generated by the model but were derived through study of the particular program or by using directly available data on employment in the particular government agency.

The industry employment requirements for each program were next used as inputs to the industry-occupational matrix, which distributed these requirements into 160 occupational categories. The results were then summed for each occupation. This distribution was based on the estimated 1970 occupational patterns given in the occupational model. The occupational levels obtained were then used to create the occupational manpower factors, or the occupational requirements for each billion dollars of program expenditures in 1972.

Appendix B. Limitations of Manpower Factors

The development of manpower factors for Federal programs is just getting underway, and there are major limitations and gaps in the current estimating system which are discussed below. These problem areas are grouped into the following broad categories: limitations of coverage, limitations of the model system, and limitations of the employment requirements estimates themselves.

Limitations of coverage

Limited coverage of Federal programs. As already noted, one of the major gaps in this presentation of manpower factors is the limited number of Federal programs studied to date. Past work has dealt with major demand components of the economy, with subsectors, or with programs covered only as special needs arose. Lists of purchases, or bills of goods, were developed for broad categories of demand such as Federal Government purchases, State and local government purchases, personal consumption expenditures, exports, and business expenditures for producers' durable equipment. Federal Government coverage was limited to defense, space, and all other nondefense programs combined. Work is now underway, with the financial sponsorship of the National Science Foundation, on the manpower requirements related to Federal grants for pollution control. A few special studies have examined sectors of the economy other than the Federal Government. These include State and local government purchases for education, health, welfare, and sanitation, and other State and local functions. Also, for a number of years, the BLS has worked on a program of construction labor requirements, which has developed employment estimates for various types of construction, such as highways, housing, and sewers.

Inability to estimate the effects on manpower supply. The existing system for analyzing manpower effects, as indicated, is demand oriented. Current factors accordingly represent just a basis for estimating requirements for labor and do not provide supply effects. Adequate coverage, therefore, is not possible for some Federal actions, such as immigration policies, where supply effects are predominant. And, more importantly, lack of supply data precludes a full assessment of the employment impact of any Federal program.

Manpower factors do not specifically identify the groups affected. Manpower factors are calculated on a national basis and do not identify employment requirements by region or by demographic characteristic such as age, sex, or race. In many cases, Federal actions do not affect manpower uniformly in different regions. For example, defense and space program cutbacks affected employment most severely on the West Coast due to the relative importance of defense industries in that region. And, in many cases, Federal policies or programs are designed to affect disadvantaged groups. Thus, with the current system of manpower analysis, the effects can be shown by industry and occupation but not by particular age or socioeconomic group.

Limitations of the model system

Aggregate industry classification. The analytical framework used to derive manpower factors divides all purchases into 134 industry sectors. Most sectors include more than one kind of product or service and the inputs to these sectors reflect the production and employment requirements of all of these products. However, the interindustry model can not differentiate between the products or services within a particular sector, and a specific purchase will create requirements for employment in all industries supporting the overall sector, even though some of the requirements may not be related to the product purchased. The average requirements for each sector will generally be close to the actual requirements for a single purchase since the industry sectors are defined to include related or homogeneous products. Problems will exist, however, where program purchases are specialized. For example, the food products sector in the interindustry framework consists of all of the food products industries. Consequently, using the interindustry model to determine the manpower requirements of purchases of canned or frozen goods will

generate employment in all food products industries including meatpacking, soft drinks, and dairy products.

Manpower factors do not include multiplier and accelerator effects. Manpower factors presented here include the primary employment required in the industries producing the goods or services actually purchased for a particular program and the supporting labor required to produce the materials, parts, services, and other items embodied in these final products. They do not include the multiplier effect, which generates additional jobs as workers spend their earnings for consumer goods and services. Also excluded is the accelerator effect, which would increase jobs when businesses expand their investment in plant and equipment in response to the increased demand for output.

Manpower factors describe average and not incremental employment requirements. Manpower factors reflect the average employment required to produce the total annual output of each industry. They are based upon overall or average interindustry relationships, productivity ratios, and occupational distributions for a particular year. As such, they would be most appropriately applied to estimation of the employment requirements of the total purchases from an industry. In most instances, however, these factors will be used to determine the employment requirements of a change in a given program or of an increment in purchases from a particular industry. For this purpose, marginal or incremental manpower factors would be more appropriate. Average manpower factors imply that employment will increase in proportion to the increase in output.

At any given time, average and marginal employment requirements are likely to be different. This is true because the level of operation of the economy and of the industries involved will affect employment requirements. If productive resources were not fully utilized, output could be intially expanded with little or no increase in employment. If the economy were operating at a high level, employment requirements would increase up to the point where plant capacity was fully utilized.

Occupational estimates would be further distorted by marginal changes in occupational requirements. Firms do not normally change the level of employment of each occupation equally when changing the level of output. The level of employment of nonproduction workers generally responds less to changes in the level of output than does the level of employment of production workers. Thus, the use of average occupational patterns in these applications tends to overstate the impact on employment of nonproduction workers while underestimating the impact on production workers.

Limitations of the employment requirements estimates

Timing problem. Estimates of employment requirements do not deal with the timing of employment reduction or growth. In the case of shifts in spending priorities or other policy changes, the time gap between reduction in employment in one area and growth in another is important. But the lag between program changes and the resulting production and employment changes is not currently considered in these estimates. The consideration of many policy questions would benefit from good estimates of the timing of any employment effects.

Comparability problems. Program factors are not completely comparable and therefore comparisons of job requirements for different programs must be made with caution. As developed by the model system, manpower estimates refer to the total number of jobs required without distinction between full- and part-time jobs. Since full- and part-time jobs have equal weight, programs with more part-time jobs will appear to have greater job requirements. Programs that draw heavily on the retail trade and personal services sectors, where part-time jobs are concentrated, would be most affected. Also, programs in which average pay levels are high will employ fewer people, all else being equal, than programs having lower pay levels. Further, manpower factors include the jobs required in both the private and public sectors. In general, programs with a high proportion of their outlays going directly to public employment will show greater employment requirements than those whose expenditures are concentrated in the private sector. This occurs because purchases from the private sector embody not only wages, but taxes, depreciation, and profits. While these factors also generate jobs, they are not included in the program estimates.

1970 pattern of distribution of purchases. The 1972 manpower factors were constructed by adjusting the 1970 industry requirements of each program for productivity and price changes to 1972. As such, the relative distribution of purchases in 1970 is implicitly embodied in the 1972 factors. Utilization of these factors for other years assumes that the pattern of program purchases remains fairly stable. Purchasing patterns, given the levels of industry aggregation used, are relatively stable over a few years. However, when factors are applied to longer periods or when the relative distribution of program purchases is expected to change substantially, distortions in the employment estimates will occur in some industries.[1]

Variation in number of recipients. Another problem in

estimating employment requirements is the variation in the number of recipients of a Federal expenditure. Expenditures for a particular program may be concentrated in a few establishments or they may be dispersed among many, with different resulting manpower effects. For example, if a billion dollars of purchases by the Federal Government is spread over many individual establishments, the increased output required in each establishment may be absorbed with little or no increase in employment, the only effect being an increase in total hours worked or in output per man-hour. However, an equal amount spent in the same industries but in fewer establishments is likely to require more new employment. Since the existing analytical framework is national in scope and treats each industry in total, differences of this type cannot be determined.

[1] An extreme case which has been examined was the change in defense purchases from mid-1965, just prior to the Vietnam buildup, to the peak in 1968. Even with defense purchases greatly expanded, many industries, including electronics and communications equipment and shipbuilding and repair, continued to receive about the same proportion of defense funds. However, the proportion of ordnance purchases doubled and relative requirements for transportation services increased substantially. While most programs will not change this drastically in a short-run period, all programs should be reexamined after 3 to 5 years and the factors used should be adjusted or recalculated if necessary.

Substitution effects. A particularly severe problem in manpower assessment arises from the difficulty of determining whether a proposed expenditure by the Federal Government is really a net addition to an existing level of expenditures or whether it is offset by a reduction in expenditures by the recipient. This problem affects programs where final purchases are made, not by the Federal Government, but by other sectors of the economy. For example, grants to State or local governments may, in part, be substituted for expenditures normally made by the State or local government. Or, in the case of transfer payments to persons, the use of this income may be offset by reductions in normal expenditures by the recipient. Thus, Medicare payments may, at least in part, substitute for purchases that otherwise would have been made by individuals from their own funds.

Use of manpower factors in these cases requires further analysis to assess the extent to which a program's outlays are likely to affect total expenditures. An agency may either make a rough estimate of the degree to which Federal funds might be substituted for other funds and adjust total program expenditures accordingly, or it may ignore these substitution effects in its calculations of employment requirements. If potential substitution of funds is not accounted for, however, an agency should qualify its employment estimates for possible overstatement.

Appendix C. Outline of Procedures for Using Manpower Factors

The purpose of this appendix is to further illustrate the technique of estimating employment requirements using manpower factors. While an explanation of the calculation procedures is presented in some detail in the body of this report, the intention here is to simplify the presentation by giving the steps in outline form.

Two general stages can be distinguished in the use of manpower factors: program analysis and factor selection; and actual employment calculations. In the first phase, the Federal program being considered is analyzed to determine in which sectors of the economy Federal program funds are spent. The nature of these sector expenditures is then examined to establish which factor programs, if any, reasonably approximate the outlays. The second phase involves the actual calculation of employment requirements once factor programs have been selected to represent the Federal program or subprograms. While these calculations may be carried out at any of three different levels of factor aggregation, the procedures are basically the same: Total outlays for the Federal program or subprograms must be put in terms of 1972 dollars; manpower factors must be adjusted for productivity change from the 1972 base; and the adjusted outlays must be multiplied by the adjusted factors.

A. Program analysis and factor selection

1. Identify precisely the Federal program area to be studied.
2. Determine total program outlays, ignoring offsetting receipts or other accounting adjustments that would change actual program expenditures.
3. Separate program outlays into direct Federal purchases of goods and services, grants, transfer payments, and subsidies.
4. Trace outlay aggregates to the sectors of the economy which actually spend them.
5. Determine the general nature of the expenditures ultimately made by a sector.
6. Examine available factor programs to determine which, if any, is suitable for a sector's expenditures.
7. Match program or subprogram outlay amounts with the corresponding factor program.
8. In cases of generalized program outlays it may be appropriate to match them to an overall or nonspecific factor program.
9. Where no match is suitable, that part of the program must be dropped from the analysis.

For guidance, table C-1 suggests matching factor programs for different types of Federal outlays.

B. Adjustment and employment requirements calculations

I. Data adjustments

1. Estimate the price change in each program sector from the base year 1972 to the year being studied. Use table 2 on page 9 and other data.
2. Divide program and subprogram outlay amounts by their respective price change adjustment to convert to 1972 dollars.

Table C-1. Types of Federal outlays and matching factor programs

Type of Federal outlay	Probable matching factor program
Direct Federal purchases	Federal Government, total
	Defense
	Nondefense except NASA
	NASA
Grants	State and local government, total
	Except structures
	New construction
	Education
	Except structure
	New construction
	Health, welfare, and sanitation
	Except structures
	New construction
	Other functions
	Except structures
	New construction
Transfers to persons . .	Personal consumption expenditures
	Durable goods
	Nondurable goods
	Food
	Services
	Medical

3. Divide outlays in 1972 dollars by $1 billion to put them in terms of outlays per billion dollars.

II. Factor adjustment

1. Decide the level of aggregation desired: total program only; major industry sector and occupational group; or individual industry and occupation estimates.

2. If just the *total employment requirements estimate* of the program is desired, only one factor is adjusted for each subprogram.
   a. Select the factor given in table 4, p. 11, for each program or subprogram.
   b. Consult table 3 on page 10 giving annual productivity adjustments, 1958-70.
   c. Select the annual productivity adjustment for the total public and private economy (1.027) as most representative of total program employment.
   d. Convert this annual figure for the time period being considered, that is, the number of years from calendar year 1972 to the year needed.
   e. Divide the selected program factor or factors by this adjustment to take into account the effects of productivity change.
   f. No adjustment is made of occupational factors at this level of estimation.

3. If the employment requirements estimate is desired by *industry sector and occupational group* the factor program should be selected from table 5, p. 12.
   a. List the program factors for the 10 industry sectors given in table 5.
   b. Consult table 3 on page 10 giving annual productivity adjustments by sector.
   c. Select the adjustment for each sector. In the three sectors where figures are not provided, use the private nonfarm figure (1.028).
   d. Multiply each adjustment by itself for the number of years needed from the base year 1972. For example, in the case of the services sector use the private nonfarm figure. To adjust this to 1974 multiply 1.028 x 1.028, = 1.057.
   e. Divide each industry sector factor in table 5 by its adjustment for productivity change. Using the "other services" sector as an example, the unadjusted 1972 factor for the total public sector in the first row of table 5 is 6,947. Dividing by an estimated 2-year productivity change of 1.057 gives a factor adjusted to 1974 of 6,574.
   f. The total of adjusted factors is then used as a basis for adjusting the occupational factors in table 6. Divide the new total of industry factors by the old total (table 5) to obtain a percentage of change. This percentage is then used to scale the corresponding program row of occupational factors in table 6.

4. If the employment requirements estimate is desired by *individual industry and occupation,* tables D-1 and D-3 in appendix D would be used.
   a. Obtain estimates of annual change in productivity for each industry where available.
   b. Where productivity change data are not available for particular industries, use the figure given in table 3 for the overall industry sector.
   c. Convert annual productivity adjustments to cover the time period between 1972 and the program year being studied.
   d. Divide each industry factor for the program, as given in table D-1, by the productivity adjustment developed for each industry.
   e. The result of this is a list of industry factors for the program which have been adjusted for estimated productivity change from 1972 to the year being studied.
   f. Again, obtaining the total of these factors for the program, and dividing this total by the 1972 program total (table D-1 program total) provides a measure of total program productivity change. This rate is used to adjust the occupational factors in table D-3 by simply multiplying down the column of program factors in the table.

III. Employment calculations

1. The calculation of employment requirements, for all three levels of aggregation, simply involves multiplying program outlays in billions of 1972 dollars by the already adjusted program factors.

Appendix D. Factor Detail by Industry and Occupation

Industry manpower factors

Table D-1 shows the full industry detail for the data summarized in the text in tables 4 and 5. Industry manpower factors, which include both the direct and indirect employment requirements, are given for 134 industry sectors, including Federal, State, and local governments and for employment of domestic workers in households. Table D-2 lists the individual industries constituting each sector, as numbered in the inter-industry model of BLS and in the Standard Industrial Classification (SIC) of the Bureau of the Budget (now the Office of Management and Budget).

Occupational manpower factors

Table D-3 shows the occupational requirements per billion dollars, given 1972 productivity and price levels. Here the industry employment totals from table D-1 are distributed over 160 occupations in the private sector. The manpower factors given in table D-1 for the Federal Government and for State and local government are also disaggregated in this table into occupational groups, except for the Armed Forces. These data provide the full occupational detail of the data summarized in table 6 of the text.

Table D-1. Industry manpower factors

(Employment requirements per billion dollars of expenditures, by industry, calendar year 1972)

Industry number and title	Component of demand																
	Public sector																
	Total public sector	Federal				State and local											
		Defense	Nondefense			Total State and local	Except structures	New construction	Education			Health, welfare, and sanitation			Other functions		
			Total	Except NASA	NASA				Total	Except structures	New construction	Total	Except structures	New construction	Total	Except structures	New construction
Agriculture, forestry, and fisheries:																	
1. Livestock and livestock products	188	198	146	167	92	171	199	82	119	124	95	442	499	80	133	174	82
2. Crops and other agricultural products	303	270	29	12	153	352	388	263	213	204	315	795	871	240	322	407	243
3. Forestry and fisheries	34	16	9	6	16	48	44	76	36	30	91	48	41	87	51	55	74
4. Agriculture, forestry, and fishery services	60	76	9	6	57	51	48	82	60	57	94	153	162	76	17	–	80
Mining:																	
5. Iron ore mining	23	16	9	6	20	29	23	64	17	14	53	24	21	62	37	33	74
6. Copper ore mining	30	26	33	35	39	28	23	59	24	16	106	32	31	35	28	28	44
7. Other nonferrous metal ore mining	39	42	75	81	58	24	30	53	19	13	65	32	25	46	24	24	41
8. Coal mining	88	61	47	46	59	164	106	135	109	110	119	88	87	153	98	102	145
9. Crude petroleum	205	180	145	161	105	214	207	298	174	178	164	185	182	164	231	233	364
10. Stone and clay mining and quarry	216	41	75	86	55	347	229	995	136	93	522	177	105	720	514	393	1,200
11. Chemical and fertilizer mining	23	16	9	12	13	28	32	18	12	11	20	32	33	19	37	51	19
Construction:																	
12. New residential building construction	160	80	–	–	–	242	–	1,714	256	–	3,186	95	–	836	248	–	1,334
13. New nonresidential building construction	700	157	222	233	250	1,082	–	7,678	1,527	–	18,990	762	–	6,731	713	–	3,839
14. New public utilities construction	247	–	–	–	–	425	–	3,015	–	–	–	1,344	–	11,877	494	–	2,659
15. New highway construction	742	23	138	159	–	1,227	–	8,715	–	–	–	–	–	–	2,447	–	13,189
16. All other new construction	310	381	1,122	1,282	125	113	–	806	–	–	–	–	–	–	227	–	1,221
17. Maintenance and repair construction	1,408	485	1,260	1,414	906	1,949	2,392	306	1,113	1,225	290	932	1,025	269	2,636	3,856	314
Manufacturing:																	
18. Guided missiles and space vehicles	356	645	887	185	6,085	3	3	–	3	2	4	8	7	3	2	3	3
19. Other ordnance	522	1,309	29	23	91	7	6	12	4	3	16	8	7	9	7	9	8
20. Food products	261	235	334	393	132	238	280	94	160	169	103	643	730	90	181	242	94
21. Tobacco manufacturing	1	–	–	–	2	1	1	–	–	1	2		1	2	2	2	2
22. Fabric, yarn, and thread mills	123	136	94	104	71	105	114	88	70	65	119	297	347	82	77	92	80
23. Miscellaneous textiles and floor coverings	36	33	14	12	25	39	35	64	36	29	92	48	48	58	35	37	56
24. Hosiery and knit goods	25	26	23	29	15	22	23	18	10	7	17	80	89	16	15	18	15
25. Apparel	128	106	178	208	77	121	137	70	39	35	77	522	589	84	79	97	72
26. Miscellaneous fabricated textile products	39	44	38	46	14	32	37	18	19	19	33	56	69	22	33	44	18
27. Logging, sawmills, and planning mills	205	79	127	144	91	288	254	521	204	162	595	257	210	572	332	346	482
28. Millwork, plywood and other wood products	192	74	118	133	79	272	216	609	204	148	723	386	223	1,536	273	272	437
29. Household furniture	41	16	47	52	17	52	54	59	75	76	66	32	33	17	35	32	64
30. Other furniture	137	25	127	150	31	225	242	76	373	407	126	72	86	10	89	112	68
31. Paper products	230	140	202	220	194	275	293	258	267	259	365	410	428	256	225	269	215
32. Paperboard	102	74	66	69	89	118	128	105	119	119	139	273	307	97	72	78	92
33. Publishing	298	132	51	35	198	435	510	187	727	798	199	313	328	167	201	243	182
34. Printing	378	240	80	41	405	499	583	217	407	435	232	594	652	189	500	683	209
35. Chemical products	368	419	225	231	296	322	332	351	221	207	365	723	784	314	276	305	347
36. Agricultural chemicals	32	12	14	17	10	46	55	18	24	26	14	24	32	12	65	90	16
37. Plastic materials and synthetic rubber	70	61	47	46	91	73	71	99	68	55	184	104	109	87	63	72	67

Table D-1. Industry manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by industry, calendar year 1972)

Industry number and title	Component of demand																
	Public sector																
	Total public sector	Federal				State and local											
		Defense	Nondefense			Total State and local	Except structures	New construction	Education			Health, welfare, and sanitation			Other functions		
			Total	Except NASA	NASA				Total	Except structures	New construction	Total	Except structures	New construction	Total	Except structures	New construction
Manufacturing — Continued																	
38. Synthetic fibers	26	30	19	17	18	22	22	23	17	17	42	48	58	28	17	24	27
39. Drugs	75	25	80	98	9	102	128	6	12	12	8	755	865	6	11	15	7
40. Cleaning and toilet preparations	34	12	19	17	23	50	59	18	88	97	13	40	50	14	19	21	14
41. Paint	66	30	47	52	44	89	92	94	58	57	78	56	53	82	111	132	103
42. Petroleum products	127	119	89	98	63	127	121	187	95	97	97	96	105	94	147	148	240
43. Rubber products	142	140	80	81	127	142	141	181	92	84	172	217	224	162	149	167	187
44. Plastic products	248	209	193	185	360	262	254	363	289	227	879	402	412	354	185	220	187
45. Leather, footwear, and leather products	22	50	9	12	8	2	—	12	3	—	12	—	—	11	2	—	10
46. Glass	89	61	75	81	94	102	103	123	112	102	212	169	175	111	70	78	85
47. Cement, clay, and concrete products	531	90	202	231	127	857	549	2,534	458	291	2,003	771	294	4,129	1,099	857	2,507
48. Miscellaneous stone and clay products	174	94	85	81	142	232	179	538	206	150	713	273	181	878	219	198	425
49. Blast furnaces and basic steel products	547	346	324	329	445	679	524	1,586	388	300	1,199	538	408	1,423	870	756	1,745
50. Iron and steel foundries and forgings	221	230	127	110	292	211	147	568	112	93	293	161	141	330	278	197	698
51. Primary copper metals	12	10	19	17	17	11	8	23	10	6	46	8	11	12	11	11	15
52. Primary aluminum	36	41	29	23	70	29	22	70	24	18	94	24	23	93	31	28	63
53. Other primary and secondary nonferrous metal	41	33	113	127	59	26	22	53	20	15	78	32	29	44	28	26	44
54. Copper rolling and drawing	28	26	14	12	34	29	25	59	27	19	104	32	25	34	28	27	43
55. Aluminum rolling and drawing	73	83	42	29	138	65	48	217	53	36	211	64	46	207	67	57	131
56. Other nonferrous rolling and drawing	92	71	23	6	145	112	91	240	106	45	683	153	162	56	96	112	104
57. Miscellaneous nonferrous metal products	72	113	80	57	255	34	32	53	32	27	74	32	25	47	33	37	48
58. Metal containers	25	22	14	17	16	26	28	23	19	20	22	48	53	21	24	28	26
59. Heating apparatus and plumbing fixtures	91	33	33	35	43	135	101	334	165	100	745	80	59	273	113	109	190
60. Fabricated structural metal	728	184	282	306	288	1,131	734	3,301	747	483	3,189	1,108	607	4,686	1,322	989	3,163
61. Screw machine products	221	269	188	162	471	170	158	269	177	146	456	153	144	224	153	164	211
62. Other fabricated metal products	325	256	249	236	450	357	292	755	286	219	927	313	246	771	387	362	689
63. Engines, turbines, and generators	63	90	61	63	83	38	35	64	22	20	43	40	34	49	46	46	67
64. Farm machinery	12	7	5	6	8	15	17	6	19	22	6	8	8	7	11	14	9
65. Construction, mining, and oilfield machinery	94	59	75	87	34	113	89	252	32	25	88	72	43	232	173	162	304
66. Material handling equipment	60	57	33	35	34	62	55	111	56	54	69	56	35	189	63	58	113
67. Metalworking machinery	165	240	127	81	502	101	98	140	109	98	227	72	62	119	92	104	118
68. Special industry machinery	33	31	38	41	43	30	30	41	32	30	39	40	34	36	24	25	36
69. General industrial machinery	149	183	103	92	222	118	104	267	97	79	272	104	79	239	127	131	194
70. Machine shop products	288	464	188	92	945	154	159	164	198	212	113	72	61	98	123	127	183
71. Computers and peripheral equipment	118	123	347	381	327	55	66	18	89	98	19	32	38	17	29	40	17
72. Typewriters and other office machines	38	14	29	29	54	54	66	6	92	105	8	24	32	7	26	35	7
73. Service industry machines	84	48	42	46	56	111	110	140	151	134	270	88	94	90	79	88	105
74. Electric transmission equipment	200	195	136	110	380	195	139	515	244	95	1,581	145	143	106	151	172	173
75. Electrical industrial apparatus	161	185	169	150	397	127	119	193	119	101	286	112	101	192	123	135	160
76. Household appliances	30	23	23	23	32	33	35	29	36	36	59	32	38	20	28	33	24
77. Electric lighting and wiring	212	109	183	185	265	268	224	544	243	212	563	193	172	301	280	239	572
78. Radio and television sets	26	38	23	17	82	16	17	12	24	25	15	8	14	9	9	12	9
79. Telephone and telegraph apparatus	59	99	61	52	160	23	23	29	19	17	39	24	31	21	24	28	23

Table D-1. Industry manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by industry, calendar year 1972)

Industry number and title	Component of demand																
	Public sector																
	Total public sector	Federal				State and local											
		Defense	Nondefense			Total State and local	Except structures	New construction	Education			Health, welfare, and sanitation			Other functions		
			Total	Except NASA	NASA				Total	Except structures	New construction	Total	Except structures	New construction	Total	Except structures	New construction
Manufacturing — Continued																	
80. Other electronic communication equipment	831	1,614	1,235	964	3,613	99	106	88	60	57	108	321	358	47	68	76	92
81. Electronic components	543	1,031	625	485	1,893	122	121	152	126	110	296	177	194	93	94	106	117
82. Other electrical machinery	57	70	38	35	78	46	45	58	29	28	60	64	62	47	50	54	61
83. Motor vehicles	198	140	103	122	22	238	295	17	162	181	15	96	113	11	304	452	17
84. Aircraft	1,419	3,227	1,165	231	8,041	33	31	53	27	22	62	40	38	50	33	35	45
85. Ship and boatbuilding and repair	256	559	98	116	57	46	38	94	27	20	104	32	23	122	59	60	89
86. Railroad and other transportation equipment	14	12	9	6	18	16	18	6	4	6	11	8	6	10	24	33	9
87. Miscellaneous transportation equipment	2	4	—	—	11	2	1	6	—	1	4	—	1	4	4	4	10
88. Scientific and controlling instruments	229	277	267	254	496	163	144	293	240	176	840	209	190	313	79	92	88
89. Medical and dental instruments	53	34	61	57	100	60	73	12	14	14	16	394	454	13	11	13	12
90. Optical and ophthalmic equipment	52	100	47	29	210	15	17	6	22	25	9	24	27	7	5	6	6
91. Photographic equipment and supplies	89	95	98	92	174	73	85	35	70	74	37	161	181	25	48	62	31
92. Miscellaneous manufactured products	136	55	71	75	79	193	216	70	230	248	105	120	127	86	163	196	149
Transportation, communication, and public utilities:																	
93. Railroad transportation	427	348	319	352	265	462	411	819	325	278	788	466	434	709	522	518	842
94. Local transit and intercity bus transportation	298	60	61	63	93	485	593	88	865	967	93	273	303	85	199	272	85
95. Truck transportation	778	638	605	664	534	831	713	1,598	609	505	1,609	803	745	1,259	929	878	1,640
96. Water transportation	226	469	38	35	87	68	65	99	51	50	76	64	63	73	75	77	110
97. Air transportation	393	477	409	421	546	289	293	339	177	160	367	353	356	324	331	393	330
98. Other transportation	86	86	66	75	57	81	80	105	60	60	77	80	79	71	89	94	126
99. Communications, except radio and TV	82	877	1,043	843	2,956	644	623	901	422	360	1,016	755	739	879	727	818	861
100. Radio and TV broadcasting	51	31	38	41	48	62	66	59	70	72	64	72	76	53	48	55	56
101. Electric utilities	270	147	33	12	189	379	436	199	475	512	213	313	335	207	286	368	197
102. Gas utilities	95	50	75	87	57	121	129	105	151	158	101	129	125	121	85	94	108
103. Water and sanitary services	48	29	42	46	48	58	63	47	131	143	41	8	—	43	9	—	40
Wholesale and retail trade:																	
104. Wholesale trade	1,765	1,261	1,695	1,686	2,686	1,951	1,843	2,938	1,639	1,489	3,193	2,193	2,182	2,355	1,949	2,000	2,932
105. Retail trade	1,000	541	864	895	1,109	1,250	935	3,055	405	—	4,027	1,237	1,083	2,298	1,777	1,786	2,803
Finance, insurance, and real estate:																	
106. Finance	256	124	188	196	224	338	363	298	172	156	330	249	251	280	452	586	289
107. Insurance	362	243	267	283	301	477	490	527	441	451	415	490	490	487	456	504	571
108. Owner-occupied dwellings	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
109. Other real estate	258	148	287	306	327	301	318	293	162	152	293	337	348	257	370	463	300
Services:																	
110. Hotels and lodging places	935	795	1,343	1,559	633	851	1,028	211	22	—	228	1,237	1,385	208	1,313	1,903	209
111. Other personal services	181	121	254	283	196	189	220	82	114	117	94	490	553	92	159	212	81
112. Miscellaneous	1,747	1,442	1,906	1,813	3,549	1,746	1,907	1,399	128	1,285	1,382	1,968	2,048	1,404	1,888	2,391	1,404
113. Advertising	48	34	38	41	53	55	55	64	39	36	73	80	86	60	55	63	64

Table D-1. Industry manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by industry, calendar year 1972)

Industry number and title	Component of demand																
	Public sector																
	Total public sector	Federal				State and local											
		Defense	Nondefense			Total State and local	Except structures	New construction	Education			Health, welfare, and sanitation			Other functions		
			Total	Except NASA	NASA				Total	Except structures	New construction	Total	Except structures	New construction	Total	Except structures	New construction
Services — Continued																	
114. Miscellaneous professional services	1,096	454	921	820	2,105	1,473	1,154	3,354	754	550	2,664	964	728	2,684	1,999	1,833	3,708
115. Automobile repair	156	89	108	110	166	197	197	246	128	116	264	193	181	232	233	273	234
116. Motion pictures	64	80	61	35	274	46	51	29	68	73	34	32	39	29	28	32	31
117. Other amusements	60	112	9	6	52	26	23	47	4	—	51	40	41	44	37	42	45
118. Health services except hospitals	345	78	272	323	71	516	642	35	53	57	28	3,486	3,980	30	137	193	35
119. Hospitals	307	76	423	514	38	416	523	—	3	3	4	3,413	3,901	4	4	6	4
120. Educational services	404	285	2,282	2,593	1,417	57	70	12	3	—	13	48	55	12	96	141	12
121. Nonprofit organizations	411	510	1,075	901	2,833	159	169	146	95	89	162	241	259	148	173	215	138
Government enterprises:																	
122. Post Office	468	337	385	358	757	529	610	269	296	302	279	972	1,077	239	555	749	266
123. Commodity Credit Corporation	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
124. Other Federal enterprises	55	34	33	6	244	68	73	59	68	68	65	64	62	52	63	78	55
125. State and local government enterprises	318	145	850	1,016	199	298	331	211	511	554	202	24	—	213	170	187	222
Imports:																	
126. Transferred imports	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
127. Transferred imports	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dummy industries:																	
128. Business travel, entertainment, and gifts	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
129. Office supplies	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
130. Scrap, used and secondhand goods	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Special industries:																	
131. Government industry	59,027	46,438	36,678	40,244	8,182	69,592	84,250	—	87,328	96,111	—	55,560	57,959	—	56,175	83,762	—
132. Rest of the world industry	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
133. Households	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
134. Inventory valuation adjustment	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table D-1. Industry manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by industry, calendar year 1972)

Industry number and title	Component of demand											
	Private sector											
	Total private sector	Personal consumption expenditures						Exports		Gross private domestic investment		
		Total	Durable goods	Nondurable goods		Services		Total merchandise and services	Merchandise only	Total	Producers' durable equipment	New construction
				Total	Food	Total	Medical					
Agriculture, forestry, and fisheries:												
1. Livestock and livestock products	1,405	1,662	132	3,514	6,851	374	224	829	946	108	91	121
2. Crops and other agricultural products	2,267	2,291	293	4,597	7,773	722	370	4,400	6,037	361	182	531
3. Forestry and fisheries	76	60	62	106	162	14	16	103	141	115	35	206
4. Agriculture, forestry, and fishery services	405	417	104	824	1,363	124	85	646	873	121	92	149
Mining:												
5. Iron ore mining	26	13	41	11	12	4	5	95	123	63	66	62
6. Copper ore mining	31	13	41	10	8	6	5	105	146	76	67	91
7. Other nonferrous metal ore mining	26	14	40	14	11	6	8	75	104	56	58	55
8. Coal mining	126	102	96	93	67	113	50	359	500	122	116	132
9. Crude petroleum	314	339	126	546	179	212	91	309	342	165	122	208
10. Stone and clay mining and quarrying	94	51	51	61	56	40	22	143	196	274	53	514
11. Chemical and fertilizer mining	29	22	22	32	32	11	13	108	149	19	17	21
Construction:												
12. New residential building construction	1,888	–	–	–	–	–	–	–	–	10,548	–	19,234
13. New nonresidential building construction	519	–	–	–	–	–	–	–	–	2,904	–	5,296
14. New public utilities construction	247	–	–	–	–	–	–	–	–	1,378	–	2,514
15. New highway construction	–	–	–	–	–	–	–	–	–	–	–	–
16. All other new construction	94	–	–	–	–	–	–	–	–	523	–	954
17. Maintenance and repair construction	756	874	330	462	475	1,498	407	435	454	331	302	312
Manufacturing:												
18. Guided missiles and space vehicles	8	4	7	4	4	2	2	38	52	19	34	4
19. Other ordnance	35	19	55	23	2	1	6	217	313	21	30	11
20. Food products	1,853	2,273	101	5,221	10,327	123	329	1,000	1,046	111	109	111
21. Tobacco manufacturing	85	101	1	236	1	1	21	99	141	2	2	2
22. Fabric, yarn, and thread mills	693	802	690	1,579	121	60	91	551	621	187	228	136
23. Miscellaneous textiles and floor coverings	158	163	583	151	50	16	21	117	147	123	128	117
24. Hosiery and knit goods	299	375	38	862	28	10	10	103	88	21	24	18
25. Apparel	1,344	1,696	74	3,952	52	35	25	457	241	79	85	74
26. Miscellaneous fabricated textile products	224	260	358	448	92	34	42	123	158	84	132	32
27. Logging, sawmills, and planing mills	293	172	398	177	146	80	72	479	668	756	217	1,376

Table D-1. Industry manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by industry, calendar year 1972)

Industry number and title	Component of demand											
	Private sector											
	Total private sector	Personal consumption expenditures						Exports		Gross private domestic investment		
		Total	Durable goods	Nondurable goods		Services		Total merchandise and services	Merchandise only	Total	Producers' durable equipment	New construction
				Total	Food	Total	Medical					
Manufacturing — Continued												
28. Millwork, plywood, and other wood products	284	154	504	135	151	39	35	175	234	935	267	1,707
29. Household furniture	351	387	2,384	12	10	4	7	42	55	279	215	349
30. Other furniture	119	21	115	4	4	2	25	25	34	638	1,132	114
31. Paper products	467	469	435	779	635	169	363	670	888	291	271	311
32. Paperboard	231	242	258	432	495	44	138	208	264	158	187	128
33. Publishing	603	686	1,076	943	527	278	372	417	506	242	278	197
34. Printing	547	609	531	835	774	410	387	395	466	269	303	225
35. Chemical products	446	368	508	536	338	145	290	1,217	1,658	368	366	376
36. Agricultural chemicals	67	63	16	95	148	49	17	159	216	16	13	19
37. Plastic materials and synthetic rubber	136	110	277	123	86	33	66	340	464	143	161	124
38. Synthetic fibers	145	156	225	271	31	14	19	179	225	56	62	49
39. Drugs	167	193	11	344	74	110	2,246	176	242	11	13	8
40. Cleaning and toilet preparations	142	175	23	386	18	19	48	66	72	13	13	14
41. Paint	64	50	95	38	37	45	17	66	86	117	90	153
42. Petroleum products	184	196	73	371	110	66	50	195	214	99	71	129
43. Rubber products	302	309	1,173	213	105	77	138	283	357	250	336	154
44. Plastic products	428	382	1,023	412	281	107	235	481	625	567	673	443
45. Leather, footwear, and leather products	319	410	122	924	16	—	6	100	111	33	50	14
46. Glass	161	150	281	210	315	39	131	204	259	156	173	136
47. Cement, clay, and concrete products	229	54	55	52	44	56	26	92	119	1,137	58	2,257
48. Miscellaneous stone and clay products	152	78	199	60	44	51	34	186	274	462	187	753
49. Blast furnaces and basic steel products	534	276	948	215	253	82	88	1,055	1,452	1,462	1,559	1,436
50. Iron and steel foundries and forgings	237	114	509	49	47	30	21	470	652	704	1,017	298
51. Primary copper metals	11	5	16	3	2	2	1	33	46	31	27	38
52. Primary aluminum	32	15	52	12	13	5	4	93	130	76	77	75
53. Other primary and secondary nonferrous metal	30	16	48	13	11	7	9	79	108	68	74	66
54. Copper rolling and drawing	27	12	43	7	5	5	3	39	54	87	72	108
55. Aluminum rolling and drawing	59	30	100	26	32	8	8	109	150	152	143	162
56. Other nonferrous rolling and drawing	74	25	78	15	10	15	7	111	150	278	158	443
57. Miscellaneous nonferrous metal products	63	36	167	13	9	8	8	123	169	159	252	59
58. Metal containers	91	103	24	222	375	14	37	73	86	27	27	29

Table D-1. Industry manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by industry, calendar year 1972)

Industry number and title	Component of demand											
	Private sector											
	Total private sector	Personal consumption expenditures						Exports		Gross private domestic investment		
		Total	Durable goods	Nondurable goods		Services		Total merchandise and services	Merchandise only	Total	Producers' durable equipment	New construction
				Total	Food	Total	Medical					
Manufacturing — Continued												
59. Heating apparatus and plumbing fixtures	80	31	95	11	10	27	7	61	82	320	88	564
60. Fabricated structural metal	373	70	182	53	48	45	23	300	398	1,849	904	2,834
61. Screw machine products	297	205	793	130	157	56	54	547	756	572	837	286
62. Other fabricated metal products	418	272	883	230	195	80	68	642	861	958	1,035	892
63. Engines, turbines, and generators	101	40	162	17	17	16	8	243	340	320	558	68
64. Farm machinery	136	10	24	11	17	4	3	140	198	732	1,407	7
65. Construction, mining, and oilfield machinery	185	20	37	18	15	15	8	689	980	716	1,244	155
66. Material handling equipment	83	16	31	15	13	11	6	117	165	387	585	194
67. Metalworking machinery	297	81	369	31	29	21	16	581	816	1,169	2,141	121
68. Special industry machinery	183	35	62	43	34	16	15	476	674	747	1,403	43
69. General industrial machinery	262	62	228	38	32	22	15	590	830	1,045	1,775	272
70. Machine shop products	173	97	360	39	42	56	22	377	515	418	700	113
71. Computers and peripheral equipment	231	22	33	20	20	19	14	751	1,075	1,116	2,137	18
72. Typewriters and other office machines	45	14	58	7	6	5	4	65	97	178	337	7
73. Service industry machines	142	63	299	15	15	20	12	191	269	490	765	202
74. Electric transmission equipment	189	47	139	31	22	28	17	350	491	778	1,178	291
75. Electrical industrial apparatus	203	93	357	47	35	39	22	400	550	605	989	191
76. Household appliances	247	263	1,480	43	9	20	16	155	157	134	179	90
77. Electric lighting and wiring	164	95	300	73	32	39	26	198	275	466	306	647
78. Radio and television sets	172	193	1,176	6	6	6	6	94	125	75	135	10
79. Telephone and telegraph apparatus	161	38	44	18	18	56	18	102	137	797	1,511	32
80. Other electronic communication equipment	143	29	120	12	9	11	14	356	497	574	1,038	77
81. Electronic components	405	240	854	56	42	191	66	1,131	1,596	820	1,456	132
82. Other electrical machinery	106	79	304	35	32	36	18	151	207	206	336	68
83. Motor vehicles	674	575	3,545	8	10	15	4	803	1,096	1,248	2,400	14
84. Aircraft	250	46	109	34	30	35	24	1,422	1,926	496	910	50
85. Ship and boatbuilding and repair	98	42	186	22	23	8	4	170	144	345	574	99
86. Railroad and other transportation equipment	80	21	106	5	5	5	2	49	61	379	722	10
87. Miscellaneous transportation equipment	105	104	648	1	2	1	*	19	26	134	255	5
89. Scientific and controlling instruments	181	88	444	22	16	20	26	485	676	455	674	186
89. Medical and dental instruments	85	59	53	52	17	69	576	110	153	187	347	15

Table D-1. Industry manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by industry, calendar year 1972)

Industry number and title	Component of demand											
	Private sector											
	Total private sector	Personal consumption expenditures						Exports		Gross private domestic investment		
		Total	Durable goods	Nondurable goods		Services		Total merchandise and services	Merchandise only	Total	Producers' durable equipment	New construction
				Total	Food	Total	Medical					
Manufacturing — Continued												
90. Optical and ophthalmic equipment	52	37	184	14	6	5	361	67	93	118	220	8
91. Photographic equipment and supplies	109	83	115	80	40	73	117	208	250	180	320	30
92. Miscellaneous manufactured products	483	510	1,449	556	80	105	72	387	479	378	626	112
Transportation, communication, and public utilities:												
93. Railroad transportation	626	520	722	703	919	258	189	1,171	1,554	805	685	956
94. Local transit and intercity bus transportation	242	293	68	67	64	607	97	67	80	86	84	88
95. Truck transportation	976	870	1,006	1,340	1,826	344	433	1,280	1,692	1,245	1,061	1,473
96. Water transportation	278	148	135	228	183	72	24	1,903	232	88	81	98
97. Air transportation	508	494	295	293	277	772	380	916	346	362	376	342
98. Other transportation	146	138	67	212	88	90	45	337	304	77	64	90
99. Communications, except radio and TV	1,926	2,117	1,000	609	618	4,067	661	606	545	910	1,246	986
100. Radio and TV broadcasting	126	135	137	194	186	75	120	109	102	81	96	64
101. Electric utilities	402	464	228	219	216	809	239	192	225	209	206	213
102. Gas utilities	203	236	85	95	89	436	74	100	118	94	83	104
103. Water and sanitary services	92	108	39	54	54	212	72	43	48	39	35	43
Wholesale and retail trade:												
104. Wholesale trade	3,953	3,826	4,514	6,447	6,073	914	2,116	3,963	5,296	4,319	5,299	3,276
105. Retail trade	13,824	16,749	28,017	27,788	26,787	1,286	11,297	1,241	1,051	6,379	7,808	4,888
Finance, insurance, and real estate:												
106. Finance	1,077	1,300	362	532	525	2,435	395	385	421	447	432	344
107. Insurance	1,275	1,540	363	489	558	3,052	3,803	457	430	427	370	439
108. Owner-occupied dwellings	—	—	—	—	—	—	—	—	—	—	—	—
109. Other real estate	847	972	404	559	543	1,608	560	483	378	418	293	298
Services:												
110. Hotels and lodging places	807	886	177	185	175	2,084	259	1,248	195	220	207	214
111. Other personal services	2,184	2,828	167	243	285	6,457	463	233	271	113	131	90
112. Miscellaneous	1,421	1,425	1,160	1,427	1,542	1,525	1,104	1,357	1,570	1,356	1,308	1,367
113. Advertising	141	153	158	223	213	80	137	104	117	93	110	73
114. Miscellaneous professional services	941	874	513	600	609	1,288	575	672	526	1,422	513	2,253
115. Automobile repair	518	612	240	233	282	1,137	132	179	220	238	216	259

Table D-1. Industry manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by industry, calendar year 1972)

Industry number and title	Component of demand											
	Private sector											
	Total private sector	Personal consumption expenditures						Exports		Gross private domestic investment		
		Total	Durable goods	Nondurable goods		Services		Total merchandise and services	Merchandise only	Total	Producers' durable equipment	New construction
				Total	Food	Total	Medical					
Services — Continued												
116. Motion pictures	161	160	67	94	90	263	62	394	52	43	49	34
117. Other amusements	535	664	90	106	101	1,506	78	272	52	57	60	50
118. Health services except hospitals	1,455	1,900	30	158	279	4,375	23,792	66	60	31	25	30
119. Hospitals	1,388	1,826	5	7	7	4,361	25,078	6	5	6	4	4
120. Educational services	1,056	1,375	11	14	15	3,298	15	128	12	13	11	13
121. Nonprofit organizations	1,529	1,969	112	140	162	4,528	162	121	135	149	131	167
Government enterprises:												
122. Post Office	550	620	398	432	399	894	544	321	330	320	351	281
123. Commodity Credit Corporation	–	–	–	–	–	–	–	–	–	–	–	–
124. Other Federal enterprises	207	239	202	207	202	285	110	157	59	80	85	70
125. State and local government enterprises	463	540	235	266	266	939	270	275	206	201	180	204
Imports:												
126. Directly allocated imports	–	–	–	–	–	–	–	–	–	–	–	–
127. Transferred imports	–	–	–	–	–	–	–	–	–	–	–	
Dummy industries:												
128. Business travel, entertainment, and gifts	–	–	–	–	–	–	–	–	–	–	–	
129. Office supplies	–	–	–	–	–	–	–	–	–	–	–	
130. Scrap, used and secondhand goods	–	–	–	–	–	–	–	–	–	–	–	–
Special industries:												
131. Government industry	–	–	–	–	–	–	–	–	–	–	–	–
132. Rest of the world industry	–	–	–	–	–	–	–	–	–	–	–	–
133. Households	2,242	3,032	–	–	–	7,158	–	–	–	–	–	–
134. Inventory valuation adjustment	–	–	–	–	–	–	–	–	–	–	–	–

Table D-1. Industry manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by industry, calendar year 1972)

Industry number and title	Type of construction											
	Residential buildings		Nonresidential buildings				Public utility structures					Highways and streets
	Single-family	Multi-family	Industrial	Office and commercial	Educational	Hospital and institutional	Telephone and telegraph	Electric	Water	Sewer	Local transit	
Agriculture, forestry, and fisheries:												
1. Livestock and livestock products	176	156	90	89	93	93	79	89	63	73	52	75
2. Crops and other agricultural products	1,044	886	197	228	302	272	201	232	116	217	100	176
3. Forestry and fisheries	413	221	35	57	88	47	88	190	18	103	28	64
4. Agriculture, forestry, and fishery services	256	203	73	78	92	79	81	102	51	72	44	69
Mining:												
5. Iron ore mining	38	51	56	63	51	76	34	75	105	56	52	80
6. Copper ore mining	53	70	80	72	114	50	565	101	52	25	31	26
7. Other nonferrous metal ore mining	33	43	52	54	67	57	207	70	63	41	39	33
8. Coal mining	115	126	119	129	116	141	87	132	191	160	84	156
9. Crude petroleum	187	198	157	207	165	169	233	201	131	155	209	465
10. Stone and clay mining and quarrying	546	541	444	495	517	533	278	446	472	820	308	1,761
11. Chemical and fertilizer mining	20	20	21	21	20	22	25	26	17	17	24	17
Construction:												
12. New residential building construction	33,648	33,648	–	–	–	–		–	–	–	–	
13. New nonresidential building construction	–	–	20,987	20,987	20,987	20,987	–	–	–	–	–	–
14. New public utilities construction	–	–	–	–	–	–	18,130	18,130,	18,130	18,130	18,130	22,636
15. New highway construction	–	–	–	–	–	–	–	–	–	–	–	–
16. All other new construction	–	–	–	–	–	–	–	–	–	–	–	–
17. Maintenance and repair construction	332	321	316	290	289	279	280	292	273	263	180	334
Manufacturing:												
18. Guided missiles and space vehicles	3	3	3	3	4	5	3	7	3	2	12	3
19. Other ordnance	6	9	12	11	17	10	6	18	15	8	9	5
20. Food products	140	113	114	104	102	107	88	92	86	82	69	92
21. Tobacco manufacturing	2	2	2	2	2	2	1	1	1	1	1	2
22. Fabric, yarn, and thread mills	121	245	95	121	120	116	142	99	48	56	53	54
23. Miscellaneous textiles and floor coverings	91	314	70	100	89	106	81	53	20	28	31	25
24. Hosiery and knit goods	18	23	17	17	17	17	16	16	12	10	11	14
25. Apparel	75	69	76	71	78	72	73	79	61	47	48	71
26. Miscellaneous fabricated textile products	25	40	30	32	33	40	19	32	14	19	14	12
27. Logging, sawmills, and planing mills	2,779	1,481	219	372	575	298	580	1,270	108	686	307	419
28. Millwork, plywood and other wood products	3,321	1,207	279	490	666	544	1,077	1,852	128	2,002	215	231
29. Household furniture	598	819	17	22	56	16	16	22	9	17	14	9

Table D-1. Industry manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by industry, calendar year 1972)

Industry number and title	Type of construction											
	Residential buildings		Nonresidential buildings				Public utility structures					Highways and streets
	Single-family	Multi-family	Industrial	Office and commercial	Educational	Hospital and institutional	Telephone and telegraph	Electric	Water	Sewer	Local transit	
Manufacturing — Continued												
30. Other furniture	93	45	197	300	138	27	81	35	12	10	36	6
31. Paper products	314	341	331	370	371	338	256	242	175	207	177	177
32. Paperboard	121	127	130	156	141	134	114	126	90	77	64	71
33. Publishing	199	201	206	196	196	195	185	183	170	149	115	180
34. Printing	229	231	239	223	232	218	202	212	193	173	137	206
35. Chemical products	341	336	391	362	374	420	502	367	257	257	605	342
36. Agricultural chemicals	27	24	12	12	14	13	13	12	37	11	11	11
37. Plastic materials and synthetic rubber	103	108	149	115	198	154	291	126	47	56	50	52
38. Synthetic fibers	40	108	34	43	42	45	44	29	14	16	14	16
39. Drugs	8	8	8	8	8	8	8	7	6	6	8	7
40. Cleaning and toilet preparations	14	15	17	17	13	13	12	12	13	15	10	14
41. Paint	154	147	379	101	74	93	50	78	82	78	42	113
42. Petroleum products	113	121	151	128	98	101	147	125	68	88	137	311
43. Rubber products	109	175	171	188	175	153	138	185	129	181	167	195
44. Plastic products	424	396	624	444	960	835	266	324	134	126	118	113
45. Leather, footwear, and leather products	13	12	10	12	12	40	11	14	12	10	7	9
46. Glass	155	134	162	150	214	154	59	121	101	86	75	58
47. Cement, clay, and concrete products	2,872	2,682	3,194	2,035	1,939	1,849	820	1,361	2,761	5,212	525	2,930
48. Miscellaneous stone and clay products	552	686	571	973	671	678	392	1,978	146	961	155	157
49. Blast furnaces and basic steel products	860	1,156	1,278	1,444	1,146	1,785	670	1,736	2,518	1,274	1,216	1,908
50. Iron and steel foundries and forgings	213	277	394	308	292	345	214	365	7,072	339	451	201
51. Primary copper metals	22	29	33	29	48	18	253	42	19	8	10	7
52. Primary aluminum	44	62	86	94	94	105	159	105	113	87	64	46
53. Other primary and secondary nonferrous metal	39	49	56	58	82	57	318	82	65	37	38	35
54. Copper rolling and drawing	79	106	127	103	104	42	453	90	26	19	22	15
55. Aluminum rolling and drawing	95	130	180	199	212	244	373	224	219	189	138	97
56. Other nonferrous rolling and drawing	118	173	159	173	774	111	5,408	664	52	42	88	33
57. Miscellaneous nonferrous metal products	43	54	84	75	75	79	39	72	104	33	43	31
58. Metal containers	29	27	45	25	22	23	21	24	21	21	20	27
59. Heating apparatus and plumbing fixtures	702	731	904	537	762	710	146	89	57	78	33	28
60. Fabricated structural metal	1,113	2,571	4,254	4,634	3,010	2,956	1,350	4,736	5,999	5,441	3,573	2,459
61. Screw machine products	172	238	277	349	486	270	386	499	216	163	192	140
62. Other fabricated metal products	764	820	618	905	917	1,428	772	814	668	468	626	571
63. Engines, turbines, and generators	33	40	59	53	42	49	42	328	57	50	59	56

Table D-1. Industry manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by industry, calendar year 1972)

Industry number and title	Type of construction											
	Residential buildings		Nonresidential buildings				Public utility structures					Highways and streets
	Single-family	Multi-family	Industrial	Office and commercial	Educational	Hospital and institutional	Telephone and telegraph	Electric	Water	Sewer	Local transit	
Manufacturing — Continued												
64. Farm machinery	6	7	8	7	6	7	6	9	25	8	17	71
65. Construction, mining, and oilfield machinery	58	76	138	113	86	104	159	243	244	308	1,228	328
66. Material handling equipment	30	76	728	439	42	507	120	60	49	49	41	43
67. Metalworking machinery	81	105	149	147	240	153	104	164	294	104	155	86
68. Special industry machinery	44	41	47	45	38	45	34	44	101	32	34	25
69. General industrial machinery	188	182	468	406	267	401	155	436	367	192	193	114
70. Machine shop products	77	95	147	121	114	131	192	150	602	86	108	176
71. Computers and peripheral equipment	18	18	20	20	19	19	15	19	19	16	18	16
72. Typewriters and other office machines	6	7	8	9	8	8	6	7	7	6	8	6
73. Service industry machines	71	214	328	523	272	195	120	70	34	30	24	22
74. Electric transmission equipment	113	158	180	217	1,814	188	104	1,557	92	48	87	58
75. Electrical industrial apparatus	120	169	241	259	300	314	117	278	332	126	134	107
76. Household appliances	181	79	46	66	63	37	32	40	17	11	13	11
77. Electric lighting and wiring	323	617	666	1,133	550	870	474	854	375	26	224	332
78. Radio and television sets	7	9	10	10	15	12	11	23	8	7	15	8
79. Telephone and telegraph apparatus	23	32	39	36	40	34	37	41	23	15	38	18
80. Other electronic communication equipment	21	24	32	30	115	149	52	358	18	13	838	71
81. Electronic components	71	96	127	134	323	222	105	344	84	50	539	76
82. Other electrical machinery	53	64	52	67	62	52	195	86	39	46	26	53
83. Motor vehicles	10	12	16	16	15	14	25	18	19	10	11	16
84. Aircraft	38	46	58	60	63	64	36	71	52	44	59	38
85. Ship and boat building and repair	74	96	133	129	101	98	52	129	145	132	100	69
86. Railroad and other transportation equipment	7	9	11	14	11	11	7	14	13	10	9	8
87. Miscellaneous transportation equipment	4	6	5	8	3	4	2	5	5	5	4	14
88. Scientific and controlling instruments	121	179	284	212	895	868	90	87	47	31	37	29
89. Medical and dental instruments	14	15	14	14	16	16	13	15	15	12	13	10
90. Optical and ophthalmic equipment	7	7	8	8	10	8	8	9	8	7	5	5
91. Photographic equipment and supplies	26	27	34	33	38	30	23	41	25	23	23	31
92. Miscellaneous manufactured products	106	115	85	146	106	91	103	94	66	55	39	184
Transportation, communication, and public utilities:												
93. Railroad transportation	1,129	976	844	795	774	723	731	939	671	714	357	912

Table D-1. Industry manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by industry, calendar year 1972)

Industry number and title	Type of construction											
	Residential buildings		Nonresidential buildings				Public utility structures					Highways and streets
	Single-family	Multi-family	Industrial	Office and commercial	Educational	Hospital and institutional	Telephone and telegraph	Electric	Water	Sewer	Local transit	
Transportation, communication, and public utilities — Continued												
94. Local transit and intercity bus transportation	90	95	95	92	93	100	72	80	82	79	59	85
95. Truck transportation	1,275	1,247	2,133	1,812	1,620	1,372	1,056	1,664	1,133	1,205	735	1,777
96. Water transportation	103	88	81	80	75	69	198	92	75	75	49	131
97. Air transportation	349	368	362	355	367	382	297	321	311	301	229	328
98. Other transportation	83	83	109	93	77	76	81	85	63	68	63	148
99. Communications, except radio and TV	1,013	1,043	1,070	1,009	1,007	1,025	863	902	976	838	695	801
100. Radio and TV broadcasting	65	65	67	63	63	63	60	59	54	46	34	54
101. Electric utilities	213	216	223	209	210	214	217	202	242	207	117	192
102. Gas utilities	103	105	116	103	100	102	103	97	131	118	63	111
103. Water and sanitary services	46	47	47	43	41	48	44	34	33	30	20	42
Wholesale and retail trade:												
104. Wholesale trade	3,368	3,388	3,403	3,164	3,186	2,975	3,227	2,858	2,703	2,030	2,055	2,818
105. Retail trade	7,051	5,599	3,937	3,673	3,992	4,257	1,910	2,425	2,148	1,300	1,370	2,439
Finance, insurance, and real estate:												
106. Finance	344	343	443	319	334	332	280	289	297	274	156	276
107. Insurance	422	435	419	417	417	428	438	494	506	544	481	645
108. Owner-occupied dwellings	—	—	—	—	—	—	—	—	—	—	—	—
109. Other real estate	319	317	312	295	292	299	258	263	246	236	206	315
Services:												
110. Hotels and lodging places	218	232	233	224	227	246	177	195	200	193	149	210
111. Other personal services	79	90	106	103	93	92	68	100	109	91	69	72
112. Miscellaneous	1,373	1,404	1,394	1,376	1,379	1,389	1,242	1,363	1,382	1,441	1,301	1,418
113. Advertising	75	74	76	72	72	72	69	67	62	53	39	62
114. Miscellaneous professional services	2,184	2,705	2,650	2,639	2,662	2,802	2,448	2,456	2,582	2,610	2,568	4,444
115. Automobile repair	285	282	282	262	260	286	184	207	200	204	166	232
116. Motion pictures	35	35	36	34	34	34	32	31	29	26	19	30
117. Other amusements	54	54	52	50	51	53	41	43	42	39	30	45
118. Health services except hospitals	32	32	29	28	28	29	28	31	30	32	28	38
119. Hospitals	4	4	4	4	4	4	4	4	3	3	3	4
120. Educational services	14	15	15	13	13	14	11	11	8	13	6	11
121. Nonprofit organizations	174	185	185	164	164	176	129	134	94	178	66	129
Government enterprises:												
122. Post office	285	292	307	287	279	292	240	270	252	232	248	264
123. Commodity Credit Corporation	—	—	—	—	—	—	—	—	—	—	—	—
124. Other Federal enterprises	83	75	68	62	64	66	54	54	57	46	55	53

Table D-1. Industry manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by industry, calendar year 1972)

Industry number and title	Type of construction											
	Residential buildings		Nonresidential buildings				Public utility structures					High-ways and streets
	Single-family	Multi-family	Industrial	Office and commercial	Educational	Hospital and institutional	Telephone and telegraph	Electric	Water	Sewer	Local transit	
Government enterprises — Continued												
125. State and local government enterprises	210	216	217	198	201	203	205	196	185	206	205	240
Imports:												
126. Directly allocated imports	—	—	—	—	—	—	—	—	—	—	—	
127. Transferred imports	—	—	—	—	—	—	—	—	—	—	—	
Dummy industries:												
128. Business travel, entertainment, and gifts	—	—	—	—	—	—	—	—	—	—	—	
129. Office supplies	—	—	—	—	—	—	—	—	—	—	—	
130. Scrap, used and secondhand goods	—	—	—	—	—	—	—	—	—	—	—	
Special industries:												
131. Government industry	—	—	—	—	—	—	—	—	—	—	—	
132. Rest of the world industry	—	—	—	—	—	—	—	—	—	—	—	
133. Households	—	—	—	—	—	—	—	—	—	—	—	—
134. Inventory valuation adjustment	—	—	—	—	—	—	—	—	—	—	—	—

Table D-2. Interindustry model sectoring plan

Sector number	Sector name	1963 Input-output number	SIC code[1]
Agriculture, forestry, and fisheries:			
1	Livestock and livestock products	1.01-1.03	01
2	Crops and other agricultural products	2.01-2.07	01
3	Forestry and fisheries	3	0.74, 08, and 091
4	Agriculture, forestry, and fishery services	4	071, 0723, pt. 0729, 073, 085, and 098
Mining:			
5	Iron ore mining	5	101, 106
6	Copper ore mining	6.01	102
7	Other nonferrous metal ore mining	6.02	103-109, except 106
8	Coal mining	7	11, 12
9	Crude petroleum	8	1311, 1321, 138
10	Stone and clay mining and quarrying	9	141-145, 148, and 149
11	Chemical and fertilizer mining	10	147
Construction:			
12	New residential building construction (excludes equipment and land development costs)	11.01	15, 16, and 17
13	New nonresidential building construction	11.02	
14	New public utilities construction	11.03	
15	New highway construction	11.04	
16	All other new construction	11.05	
17	Maintenance and repair construction	12.01-12.02	
Manufacturing:			
18	Guided missiles and space vehicles	13.01	1925
19	Other ordnance	13.02-13.07	19 except 1925
20	Food products	14.01-14.32	20
21	Tobacco manufacturing	15.01-15.02	21
22	Fabric, yarn, and thread mills	16.01-16.04	221, 222, 223, 224, 226 and 228
23	Miscellaneous textiles and floor coverings	17.01-17.10	227 and 229
24	Hosiery and knit goods	18.01-18.03	225
25	Apparel	18.04	23 (except 239), 3992
26	Miscellaneous fabricated textile products	19.01-19.03	239
27	Logging, sawmills, and planing mills	20.01-20.04	241 and 242
28	Millwork, plywood, and other wood products	20.05-20.09 and 21	243, 244, and 249
29	Household furniture	22.01-22.04	251
30	Other furniture	23.01-23.07	25 except 251
31	Paper products	24.01-24.07	26 except 265
Manufacturing — Continued			
32	Paperboard	25	265
33	Publishing	26.01-26.04	271, 272, 273, and 274
34	Printing	26.05-26.08	275, 276, 277, 278, and 279
35	Chemical products	27.01 and 27.04	281, 286, and 289 (except 28195)
36	Agricultural chemicals	27.02-27.03	287
37	Plastic materials and synthetic rubber	28.01-28.02	2821, 2822
38	Synthetic fibers	28.03-28.04	2823, 2824
39	Drugs	29.01	283
40	Cleaning and toilet preparations	29.02-29.03	284
41	Paint	30	285
42	Petroleum products	31.01-31.03	29
43	Rubber products	32.01-32.03	30 except 307
44	Plastic products	32.04	307
45	Leather, footwear, and leather products	33 and 34.01 34.03	31
46	Glass	35.01-35.02	321, 322, and 323
47	Cement, clay, and concrete products	36.01-36.05 and 36.10-36.14	324, 325, and 327
48	Miscellaneous stone and clay products	36.06-36.09 and 36.15-36.22	326, 328, and 329
49	Blast furnaces and basic steel products	37.01	331
50	Iron and steel foundries, and forgings	37.02-37.04	332, 3391, and 3399
51	Primary copper metals	38.01	3331
52	Primary aluminum	38.04	3334 and 28195
53	Other primary and secondary nonferrous metal	38.02-38.03, 38.05, and 38.06	3332, 3333, 3339, and 334
54	Copper rolling and drawing	38.07	3351
55	Aluminum rolling and drawing	38.08	3352
56	Other nonferrous rolling and drawing	38.09-38.10	3356 and 3357
57	Miscellaneous nonferrous metal products	38.11-38.14	336 and 3392
58	Metal containers	39.01-39.02	341 and 3491
59	Heating apparatus and plumbing fixtures	40.01-40.03	343
60	Fabricated structural metal	40.04-40.09	344
61	Screw machine products	41.04-41.02	345 and 346
62	Other fabricated metal products	42.01-42.11	342, 347, 348 and 349 except 3491
63	Engines, turbines, and generators	43.01-43.02	351
64	Farm machinery	44	352

See footnotes at end of table.

Table D-2. Interindustry model sectoring plan—Continued

Sector number	Sector name	1963 Input-output number	SIC code[1]
Manufacturing – Continued			
65	Construction, mining, and oilfield machinery	45.01-45.03	3531, 3532, and 3533
66	Material handling equipment	46.01-46.04	3534, 3535, 3536, and 3537
67	Metalworking machinery	47.01-47.04	354
68	Special industry machinery	48.01-48.06	355
69	General industrial machinery	49.01-49.07	356
70	Machine shop products	50	359
71	Computers and peripheral equipment	51.01	3573, 3574
72	Typewriters and other office machines	51.02-51.04	357, except 3573 and 3574
73	Service industry machines	52.01-52.05	358
74	Electric transmission equipment	53.01-53.03	361
75	Electrical industrial apparatus	53.04-53.08	362
76	Household appliances	54.01-54.07	363
77	Electric lighting and wiring	55.01-55.03	364
78	Radio and television sets	56.01-56.02	365
79	Telephone and telegraph apparatus	56.03	3661
80	Other electronic communication equipment	56.04	3662
81	Electronic components	57.01-57.03	367
82	Other electrical machinery	58.01-58.05	369
83	Motor vehicles	59.01-59.03	371
84	Aircraft	60.01-60.04	372
85	Ship and boat building and repair	61.01-61.02	373
86	Railroad and other transportation equipment	61.03-61.05	374 and 375
87	Transportation equipment	61.06-61.07	379
88	Scientific and controlling instruments	62.01-62.03 and 62.07	381, 382, and 387
89	Medical and dental instruments	62.04-62.06	384
90	Optical and ophthalmic equipment	63.01-63.02	383 and 385
91	Photographic and equipment and supplies	63.03	386
92	Miscellaneous manufactured products	64.01-64.12	39 (except 3992)
Transportation, communication, and public utilities:			
93	Railroad transportation	65.01	40 and 474
94	Local transit and intercity bus	65.02	41
95	Truck transportation	65.03	42 and 473
96	Water transportation	65.04	44
97	Air transportation	65.05	45
98	Other transportation	65.06-65.07	46, 47 (except 473 and 474)
99	Communications, except radio and TV	66	48 except 483
100	Radio and TV broadcasting	67	483
101	Electric utilities	68.01	491 and part 493
102	Gas utilities	68.02	492 and part 493
Transportation, communication and public utilities – Continued			
103	Water and sanitary services	68.03	494, 495, 496, 497, and part 493
Wholesale and retail trade:			
104	Wholesale trade	69.01	50
105	Retail trade	69.02	52, 53, 54, 55, 56, 57, 58, and 59
Finance, insurance and real estate:			
106	Finance	70.01-70.03	60, 61, 62, and 67
107	Insurance	70.04-70.05	63 and 64
108	Owner-occupied dwellings	70.01	(2)
109	Other real estate	71.02	65 and 66
Services:			
110	Hotels and lodging places	72.01	70
111	Other personal services	72.02-72.03	72 and 76
112	Miscellaneous business services	73.01	73 except 731
113	Advertising	73.02	731
114	Miscellaneous professional services	73.03 and 74	81 and 89 except 892, nonprofit research
115	Automobile repair	75	75
116	Motion pictures	76.01	78
117	Other amusements	76.02	79
118	Health services except hospitals	77.01 and 77.03	80 (except 806), 0722
119	Hospitals	77.02	806
120	Educational services	77.04	82
121	Nonprofit organizations	77.05	84, 86, and 892
Government enterprises:			
122	Post Office	78.01	(2)
123	Commodity Credit Corporation	78.03	(2)
124	Other Federal enterprises	78.02 and 78.04	(2)
125	State and local government enterprises	79.01-79.03	(2)
Imports:			
126	Directly allocated imports	80.01	(2)
127	Transferred imports	80.02	(2)
Dummy industries:			
128	Business travel, entertainment, and gifts	81	(2)
129	Office supplies	82	(2)
130	Scrap, used and secondhand goods	83	(2)
Special industries:			
131	Government industry	84	(2)
132	Rest of the world industry	85	(2)
133	Households	86	(2)
134	Inventory valuation adjustment	87	(2)

[1] *Standard Industrial Classification Manual*, 1967 edition, Bureau of the Budget (now Office of Management and Budget).

[2] No comparable industry.

Table D-3. Occupational manpower factors

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand										
	Public sector										
	Total public sector	Federal				State and local					
		Defense	Nondefense			Total State and local	Except structures	New construction	Education		
			Total	Except NASA	NASA				Total	Except structures	New construction
Total	90,050	74,200	66,600	68,850	62,400	101,250	112,250	59,850	108,800	114,950	63,550
Professional and technical workers	17,000	7,550	15,750	15,400	19,600	34,150	42,950	5,550	58,950	64,550	5,550
Engineers	1,100	2,500	1,900	1,100	8,550	1,050	950	1,250	700	700	1,400
Aeronautical	100	350	350	100	2,500	*	*	*	*	*	*
Chemical	*	100	50	*	200	*	*	50	*	*	*
Civil	200	200	200	200	300	400	300	400	150	100	450
Electrical	250	750	500	300	2,000	150	150	150	200	200	250
Industrial	100	200	150	100	500	100	50	100	*	*	100
Mechanical	200	550	300	150	1,550	150	150	250	150	150	200
Metallurgical	*	50	*	*	150	*	*	*	*	*	*
Mining	*	*	*	*	*	*	*	*	*	*	*
Sales	*	100	50	*	200	*	*	100	*	*	100
Other	100	200	200	150	900	100	100	200	100	100	200
Medical and health workers	1,650	200	2,350	2,650	100	3,450	4,450	*	900	950	*
Dentists	*	*	50	50	*	100	100	*	*	*	*
Dietitians and nutritionists	*	*	50	50	*	100	100	*	50	100	*
Professional nurses	800	100	1,050	1,200	*	1,650	2,100	*	300	350	*
Optometrists	*	*	*	*	*	*	*	*	—	—	*
Osteopaths	*	*	*	*	*	*	*	*	—	—	*
Pharmacists	*	*	50	50	*	50	100	*	*	*	*
Physicians and surgeons	150	*	250	250	*	350	450	*	50	50	*
Psychologists	50	*	*	*	*	150	200	*	250	300	*
Medical and dental technicians	250	*	400	450	*	550	700	*	100	100	*
Veterinarians	*	*	100	100	*	*	*	*	*	*	*
Other	250	*	350	400	*	500	650	*	50	50	*
Teachers	7,850	300	1,400	1,600	150	18,550	24,200	*	42,950	47,250	*
Elementary	3,250	100	600	650	—	7,700	10,000	*	17,850	19,650	*
Secondary	2,600	50	500	550	—	6,200	8,100	*	14,400	15,850	*
College	1,400	*	250	300	150	3,400	4,400	*	7,850	8,650	*
Other	550	150	100	100	—	1,300	1,650	*	2,800	3,100	—
Natural scientists	500	450	1,300	1,200	2,200	700	850	150	1,050	1,150	150
Chemists	100	100	150	150	200	150	150	50	150	200	100
Agricultural scientists	100	*	450	500	*	100	150	*	150	150	*
Biological scientists	100	*	200	200	50	150	200	*	200	250	*
Geologists and geophysicists	*	*	50	100	*	*	*	*	50	50	*
Mathematicians	50	100	100	100	300	*	50	*	100	100	*

See note at end of table.

Table D-3. Occupational manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand										
	Public sector										
	Total public sector	Federal				State and local					
		Defense	Nondefense			Total State and local	Except structures	New construction	Education		
			Total	Except NASA	NASA				Total	Except structures	New construction
Natural scientists — Continued											
Physicists	50	100	50	50	200	50	100	*	150	150	*
Other	100	50	200	50	1,400	150	150	*	250	300	*
Social scientists	50	50	350	350	50	50	100	*	50	50	*
Economists	*	*	200	200	*	*	*	*	*	*	—
Statisticians and actuaries	*	*	150	150	*	*	*	*	*	*	—
Other	*	*	*	*	*	*	*	*	*	*	—
Technicians, except medical and dental	1,100	1,650	2,750	2,600	4,400	1,200	1,150	1,550	1,100	1,100	1,600
Drafters	200	350	300	250	850	350	250	650	200	150	750
Surveyors	50	*	*	*	50	100	50	300	*	*	100
Air traffic controllers	50	*	650	750	—	—	—	*	—	—	*
Radio operators	*	*	*	*	*	50	50	*	*	*	*
Electrical and electronic technicians	200	500	500	400	1,300	150	150	150	150	150	100
Other engineering and physical science technicians	300	550	850	750	1,800	250	200	350	200	200	450
Other	200	150	400	400	350	300	400	100	550	600	50
Other professional and technical workers	4,750	2,400	5,750	5,950	4,150	9,100	11,300	1,500	12,200	13,400	2,400
Accountants and auditors	400	300	1,150	1,200	650	650	650	750	300	250	700
Airplane pilots and navigators	*	100	150	150	100	50	50	*	*	*	50
Architects	*	*	*	*	50	50	*	100	*	*	100
Clergy	*	100	250	250	—	50	50	*	*	50	*
Designers, except drafters	*	50	100	100	100	50	150	100	*	*	100
Editors and reporters	50	100	100	50	100	100	100	*	100	100	*
Lawyers and judges	300	100	650	700	500	550	550	750	200	150	600
Librarians	300	*	100	100	*	700	900	*	1,550	1,700	*
Personnel and labor relations workers	200	150	300	300	200	350	400	100	100	100	100
Photographers	*	50	50	50	100	*	50	*	50	50	*
Social and welfare workers	400	*	150	150	50	900	1,150	*	150	200	*
Workers and teachers in the arts and entertainment	1,200	200	750	800	-	2,600	3,400	100	5,600	6,200	
Professional and technical workers not elsewhere classified	1,750	1,150	1,950	1,950	2,250	3,050	3,800	550	3,950	4,350	700

See note at end of table.

Table D-3. Occupational manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand										
	Public sector										
	Total public sector	Federal				State and local					
		Defense	Nondefense			Total State and local	Except structures	New construction	Education		
			Total	Except NASA	NASA				Total	Except structures	New construction
Managers and administrators	4,200	3,500	4,550	4,750	4,950	7,150	7,350	5,400	4,800	4,150	6,250
Railroad conductors	*	*	*	*	*	*	*	50	*	*	100
Ship officers, pilots, and engineers	*	100	*	*	*	*	*	*	*	*	*
Credit and collection managers	*	*	*	*	*	*	*	*	*	*	*
Purchasing agents	100	250	100	50	500	150	150	150	150	150	150
Postmasters and assistants	*	*	*	*	*	*	*	*	*	*	*
Managers and administrators not elsewhere classified	4,000	3,100	4,400	4,600	4,350	6,900	7,100	5,150	4,650	3,950	6,000
Clerical workers	10,400	7,850	21,550	22,700	12,150	16,500	19,350	7,500	14,250	15,400	8,200
Stenographers, typists, and secretaries	3,500	2,300	4,950	5,200	3,850	5,950	7,100	2,250	6,000	6,550	2,350
Office machine operators	350	400	300	300	450	500	550	300	300	300	300
Other clerical workers	6,600	5,150	16,300	17,150	7,850	10,100	11,700	4,950	8,000	8,550	5,550
Accounting clerks	350	300	650	700	350	650	600	350	350	350	400
Bookkeepers	300	300	250	250	500	550	500	700	400	400	900
Bank tellers	*	*	*	*	*	*	50	*	*	*	*
Cashiers	150	100	200	200	200	350	400	100	350	400	100
Mail carriers	100	100	150	150	300	200	200	100	100	100	100
Postal clerks	150	150	150	150	350	250	250	100	150	150	100
Shipping and receiving clerks	150	200	200	200	300	200	200	250	150	150	150
Telephone operators	150	350	450	400	900	450	500	300	350	350	350
Clerical workers not elsewhere classified	5,250	3,600	14,200	15,100	4,900	7,550	8,950	3,000	6,100	650	3,200
Salesworkers	900	950	1,050	1,050	1,600	1,450	1,400	2,000	1,100	1,050	2,350
Insurance agents and brokers	100	50	100	100	100	150	150	150	150	150	150
Real estate agents and brokers	50	50	100	100	100	100	100	100	50	50	100
Other salesworkers not elsewhere classified	750	850	850	850	1,400	1,200	1,150	1,750	900	850	2,100
Craft and kindred workers	7,200	7,550	7,950	8,150	8,850	11,500	8,150	17,550	7,350	6,700	18,550
Construction craftworkers	2,700	1,450	2,600	2,850	1,300	4,950	1,900	9,700	2,000	1,350	10,950
Carpenters	750	300	800	900	250	1,400	450	2,450	550	350	3,050
Brickmasons, stone and tile setters	150	*	100	150	50	350	50	650	150	*	1,250

See note at end of table.

Table D-3. Occupational manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand										
	Public sector										
	Total public sector	Federal				State and local					
		Defense	Nondefense			Total State and local	Except structures	New construction	Education		
			Total	Except NASA	NASA				Total	Except structures	New construction
Construction craftworkers — Continued											
Cement and concrete finishers	50	*	*	*	*	150	*	400	*	*	400
Electricians	450	450	450	450	450	650	400	750	350	300	1,100
Excavating, grade, and road machinery operators	400	100	350	400	100	850	200	3,150	150	100	950
Painters and paperhangers	400	200	400	450	200	750	450	700	400	300	1,500
Plasters	*	*	*	*	*	50	*	150	*	*	300
Plumbers and pipefitters	350	300	250	300	200	550	250	800	250	200	1,300
Roofers and slaters	50	*	*	*	*	100	*	300	50	*	700
Structural metalworkers	100	100	150	150	*	150	*	350	*	*	350
Blue-collar worker supervisors not elsewhere classified	950	1,000	1,450	1,450	1,550	1,400	1,200	2,200	1,050	1,000	1,950
Metalworking craftworkers except mechanics	800	1,650	950	850	2,150	850	650	1,500	650	550	1,850
Machinists	400	850	550	500	1,150	350	300	500	300	300	650
Blacksmiths, forge and hammer operators	*	*	*	*	*	*	*	*	*	*	*
Boilermakers	*	*	*	*	*	*	*	50	*	*	*
Heat treaters, annealers, and temperers	*	*	*	*	*	*	*	*	*	*	*
Millwrights	*	100	*	*	100	50	*	100	*	*	100
Metal molders	*	100	*	*	50	*	*	100	*	*	100
Metal and wood patternmakers	*	100	*	*	100	*	*	*	*	*	*
Rollers and roll hands	*	*	*	*	*	*	*	50	*	*	50
Sheet metal workers	150	300	100	50	300	200	100	400	100	50	600
Toolmakers, diemakers, and setters	100	250	150	150	400	100	100	150	100	100	200
Mechanics and repairers	1,850	2,200	1,750	1,800	2,050	2,700	2,900	2,100	2,300	2,450	1,850
Air conditioning, heating, and refrigeration	100	100	100	100	50	100	50	100	50	*	100
Airplane	200	550	350	300	550	100	100	50	50	50	50
Motor vehicle	200	250	150	150	200	350	400	350	250	250	300
Office machine	*	*	*	*	50	*	*	100	*	*	*
Radio and TV	50	150	*	*	50	*	50	*	*	*	*
Railroad and car shop	*	*	*	*	*	*	*	*	*	*	*
Other	1,250	1,150	1,100	1,100	1,100	2,000	2,200	1,450	1,900	2,000	1,300

See note at end of table.

Table D-3. Occupational manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand										
	Public sector										
	Total public sector	Federal				State and local					
		Defense	Nondefense			Total State and local	Except structures	New construction	Education		
			Total	Except NASA	NASA				Total	Except structures	New construction
Printing trades craftworkers	150	150	150	150	200	250	300	100	300	350	100
Compositors and typesetters	100	50	100	150	100	150	200	50	200	200	50
Electrotypers and stereotypers	*	*	*	—	*	*	*	*	*	*	*
Engravers, except photoengravers	*	*	*	*	*	*	*	*	*	*	*
Photoengravers and lithographers	*	*	*	*	*	*	*	*	*	*	*
Pressmen and plate printers	*	50	*	*	50	50	100	*	100	100	*
Transportation and public utility craftworkers	100	350	350	300	950	350	300	450	200	200	400
Telephone and power installers and repairers	100	350	350	300	950	300	250	350	200	200	350
Locomotive engineers	*	*	*	*	*	*	*	50	*	*	50
Locomotive firemen	*	*	*	*	*	*	*	*	*	*	*
Other craft and kindred workers	650	650	700	750	700	1,050	900	1,500	800	800	1,450
Bakers	*	*	*	*	*	50	100	*	100	100	*
Cabinetmakers	*	*	*	*	*	*	*	*	50	50	100
Crane, derrick, and hoist operators	100	150	50	50	100	200	100	600	100	50	400
Glaziers	*	*	*	*	*	*	*	50	*	*	150
Jewelers and watchmakers	*	*	*	*	*	*	*	*	*	*	*
Loom fixers	*	*	*	*	*	*	*	*	*	*	*
Opticians, lens grinders, and polishers	*	*	*	*	*	*	*	*	*	*	*
Log and lumber inspectors	*	*	*	*	*	*	*	*	*	*	*
Other inspectors	50	50	*	*	50	100	50	200	50	50	200
Upholsterers	*	*	*	*	*	*	*	*	*	*	*
Craft and kindred workers not elsewhere classified	350	350	500	500	400	550	550	500	450	450	500
Operatives	6,550	8,850	7,300	7,550	10,700	9,250	8,350	13,500	7,500	7,250	14,200
Drivers and delivery workers	1,450	1,000	1,150	1,250	1,000	2,600	2,350	4,000	2,400	2,450	3,050
Bus, truck, and tractor drivers	1,250	800	1,000	1,050	800	2,300	1,950	3,800	2,050	2,000	2,800
Delivery and route workers	200	200	150	150	200	350	350	200	400	450	250
Semiskilled metalworking occupations	1,150	2,250	1,650	1,450	3,600	1,150	900	2,200	950	800	3,050
Metalworking assemblers, class A	100	200	150	100	400	50	50	100	50	50	200

See note at end of table.

Table D-3. Occupational manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand										
	Public sector										
	Total public sector	Federal				State and local					
		Defense	Nondefense			Total State and local	Except structures	New construction	Education		
			Total	Except NASA	NASA				Total	Except structures	New construction
Semiskilled metalworking — Continued											
Metalworking assemblers, class B	350	750	500	450	1,300	300	250	400	250	250	650
Metalworking inspectors, class B	150	350	150	150	550	100	100	200	100	100	300
Machine tool operators, class B	150	350	200	150	650	150	150	250	150	100	300
Electroplaters	*	*	*	*	*	*	*	*	*	*	*
Electroplater helpers	*	*	*	*	*	*	*	*	*	*	*
Furnace tenders, smelters, and pourers, metal	*	50	*	*	50	*	*	100	*	*	100
Metal heaters	*	*	*	*	*	*	*	*	*	*	*
Welders and flame cutters	350	500	550	550	550	500	300	1,100	350	250	1,500
Selected transportation and public utility operatives	100	200	50	50	50	100	100	150	50	50	150
Railroad brake and switch operators and couplers	*	50	*	*	*	50	50	100	*	*	100
Power station operators	*	*	*	*	*	*	*	*	*	*	*
Sailors and deck hands	*	100	*	*	*	*	*	*	*	*	*
Semiskilled textile occupations	100	200	150	150	100	100	150	100	100	100	100
Knitters, loopers, and toppers	*	*	*	*	*	*	*	*	*	*	*
Spinners	*	*	*	*	*	*	*	*	*	*	*
Weavers	*	*	*	*	*	*	*	*	*	*	*
Sewers and stitchers	100	100	100	150	100	100	100	100	50	50	100
Other operatives and kindred workers	3,750	5,250	4,350	4,650	6,150	5,250	4,900	7,050	4,000	3,850	7,800
Asbestos and insulation workers	*	*	*	*	*	*	*	100	*	*	*
Auto attendants	*	*	*	*	50	*	50	*	*	*	*
Blasters	*	*	*	*	*	*	*	*	*	*	*
Laundry and dry-cleaning operatives	150	100	*	*	*	200	300		100	100	*
Mine operatives and laborers not elsewhere classified	150	100	100	150	100	250	200	450	150	150	300
Meat cutters, except meat-packing	*	50	*	*	*	*	*	*	*	*	*
Operatives not elsewhere classified	3,450	4,950	4,100	4,400	5,750	4,700	4,350	6,400	3,650	3,550	7,250

See note at end of table.

Table D-3. Occupational manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand										
	Public sector										
	Total public sector	Federal				State and local					
		Defense	Nondefense			Total State and local	Except structures	New construction	Education		
			Total	Except NASA	NASA				Total	Except structures	New construction
Service workers	7,500	2,050	6,250	6,900	2,700	16,150	20,750	1,050	12,150	13,450	1,100
Private household workers	—	*	—	—	—	—	—	*	—	—	*
Protective service workers	2,200	350	850	900	350	4,900	6,350	200	300	350	250
Fire fighters	500	100	*	—	*	1,200	1,550	*	—	—	*
Police and detectives	1,150	*	400	450	*	2,700	3,500	*	50	100	*
Guards	500	250	450	450	300	1,000	1,250	200	200	300	200
Food service workers	1,000	350	700	800	400	2,200	2,850	150	3,750	4,100	150
Bartenders	*	*	*	*	*	*	*	*	*	*	*
Cooks, except private household	550	100	300	300	150	1,200	1,550	*	2,050	2,250	
Counter and fountain workers	250	*	150	150	50	600	750	*	1,150	1,250	*
Waiters and waitresses	200	100	250	300	200	450	550	50	550	600	*
Other service workers	4,300	1,350	4,700	5,200	1,900	9,000	11,550	650	8,100	9,000	700
Flight attendants	*	50	*	*	50	*	*	*	*	*	*
Hospital and other institutional attendants	1,000	50	1,550	1,750	50	2,100	2,750	*	200	250	*
Building interior cleaners, not elsewhere classified	200	100	300	350	200	400	450	100	350	400	100
Janitors and sextons	1,100	300	550	550	600	2,400	3,050	200	3,900	4,350	200
Practical nurses	300	50	350	400	*	650	850	*	*	*	*
Other service workers not elsewhere classified	1,700	800	1,900	2,100	950	3,450	4,400	300	3,600	3,950	350
Laborers, except farm and mine	2,500	2,000	1,800	1,900	1,650	4,450	3,200	7,050	2,350	2,000	7,000
Farmers and farm workers	400	500	400	400	200	650	750	300	300	350	350
Armed Forces	33,400	33,400	—	—	—	—	—	—	—	—	—

See note at end of table.

Table D-3. Occupational manpower factors—Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand										
	Public sector						Private sector				
	State and local						Total private sector	Personal consumption expenditures			
	Health, welfare, and sanitation			Other functions				Total	Durable goods	Nondurable goods	
	Total	Except structures	New construction	Total	Except structures	New construction				Total	Food
Total	94,950	95,300	56,600	90,050	116,800	59,050	69,000	70,300	71,250	76,650	77,550
Professional and technical workers	24,000	25,000	5,450	10,450	15,700	5,450	6,050	6,300	3,650	3,650	2,700
Engineers	700	600	1,150	1,450	1,500	1,250	800	550	900	450	350
Aeronautical	*	*	*	*	*	*	*	*	*	*	*
Chemical	50	50	*	*	*	*	*	*	*	50	*
Civil	150	100	400	800	850	350	100	100	*	50	50
Electrical	150	150	150	150	150	150	200	150	250	50	50
Industrial	50	50	100	100	100	100	100	50	150	50	*
Mechanical	100	100	200	150	150	250	150	100	200	100	50
Metallurgical	*	*	*	*	*	*	*	*	*	*	*
Mining	*	*	*	*	*	*	*	*	*	*	*
Sales	*	*	100	*	*	100	*	*	50	*	*
Other	100	100	150	150	150	200	100	50	150	50	50
Medical and health workers	1,600	17,950	*	250	400	*	1,200	1,600	50	800	150
Dentists	400	450	*	*	*	*	*	*	*	*	*
Dietitians and nutritionists	250	300	—	*	*	—	*	*	—	*	*
Professional nurses	7,950	8,400	*	50	100	*	450	600	*	*	*
Optometrists	50	50	—	*	*	—	*	*	*	*	*
Osteopaths	50	50	—	*	*	—	*	*	—	—	*
Pharmacists	250	250	*	*	*	*	250	350	*	750	*
Physicians and surgeons	1,600	1,700	*	*	50	*	100	150	*	*	*
Psychologists	100	100	*	50	100	*	*	*	—	*	*
Medical and dental technicians	2,850	3,000	*	*	*	*	150	200	*	*	*
Veterinarians	*	*	—	*	*	—	*	*	—	*	*
Other	2,500	2,650	*	*	*	*	150	200	*	*	*
Teachers	200	200	*	150	300	*	500	700	*	*	*
Elementary	50	50	*	*	*	*	200	300	*	*	*
Secondary	*	*	*	*	*	*	200	250	*	*	*
College	*	*	*	*	*	*	100	100	*	*	*
Other	100	100	*	100	200	*	50	100	*	*	*
Natural scientists	400	350	150	400	700	150	200	200	150	250	200
Chemists	200	200	100	100	100	50	100	100	100	150	100
Agricultural scientists	*	*	*	150	300	*	*	*	*	*	50
Biological scientists	150	50	*	100	200	*	*	*	*	*	*
Geologists and geophysicists	*	*	*	*	*	*	*	*	*	*	*

See note at end of table.

Table D-3. Occupational manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand										
	Public sector						Private sector				
	State and local						Total private sector	Personal consumption expenditures			
	Health, welfare, and sanitation			Other functions				Total	Durable goods	Nondurable goods	
	Total	Except structures	New construction	Total	Except structures	New construction				Total	Food
Mathematicians	*	*	*	*	*	*	*	*	*	*	*
Physicists	*	*	*	*	*	*	*	*	*	*	*
Other	*	*	*	*	*	*	*	*	*	*	*
Social scientists	*	*	*	100	200	*	*	*	*	*	*
Economists	*	*	*	*	50	*	*	*	*	*	*
Statisticians and actuaries	*	*	*	50	100	*	*	*	*	*	*
Other	—	—	—	*	*	—	*	*	—	*	—
Technicians, except medical and dental	700	550	1,800	1,500	1,650	1,500	750	550	800	450	450
Drafters	250	150	650	450	400	600	250	150	300	100	100
Surveyors	*	*	200	200	200	400	*	*	*	*	*
Air traffic controllers	—	—	—	—	—	—	—	—	—	—	—
Radio operators	*	*	*	150	300	*	*	*	*	*	*
Electrical and electronic technicians	100	100	250	100	150	150	150	100	200	50	50
Other engineering and physical science technicians	200	150	550	150	300	250	200	150	200	100	100
Other	100	100	100	450	300	50	100	100	100	150	150
Other professional and technical workers	6,000	6,300	2,250	6,600	10,950	2,600	2,550	2,700	1,700	1,600	1,550
Accountants and auditors	400	350	700	1,000	1,500	750	400	350	400	300	300
Airplane pilots and navigators	53	50	*	50	100	*	50	50	*	50	50
Architects	*	*	50	50	50	100	*	*	*	*	*
Clergy	200	200	*	*	*	*	150	200	*	*	*
Designers, except drafters	50	50	150	100	50	100	100	50	150	100	*
Editors and reporters	100	100	*	100	100	*	100	100	100	150	100
Lawyers and judges	250	200	600	1,000	1,450	850	200	200	100	150	150
Librarians	100	150	*	*	*	*	*	*	—	*	*
Personnel and labor relations workers	200	200	50	650	1,200	100	100	100	100	100	50
Photographers	50	50	*	*	50	*	50	100	*	*	*
Social and welfare workers	500	550	*	1,950	3,750	*	*	50	*	*	*
Workers and teachers in the arts and entertainment	500	550	100	200	350	50	300	450	*	200	*
Professional and technical workers not elsewhere classified	3,500	3,850	500	1,450	2,200	550	900	950	750	500	750

See note at end of table.

Table D-3. Occupational manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand										
	Public sector						Private sector				
	State and local						Total private sector	Personal consumption expenditures			
	Health, welfare, and sanitation			Other functions				Total	Durable goods	Nondurable goods	
	Total	Except structures	New construction	Total	Except structures	New construction				Total	Food
Managers and administrators	4,950	4,700	5,550	10,050	13,650	5,000	7,900	8,400	10,450	10,600	10,100
Railroad conductors	*	*	*	*	*	50	*	*	*	*	50
Ship officers, pilots, and engineers	*	*	50	*	*	*	*	*	*	*	*
Credit and collection managers	*	*	*	*	*	*	50	50	150	50	*
Purchasing agents	150	150	150	150	200	100	150	100	150	100	100
Postmasters and assistants	*	50	*	*	*	*	*	*	*	*	*
Managers and administrators not elsewhere classified	4,650	4,400	5,150	9,800	13,350	4,750	7,600	8,100	10,050	10,300	9,850
Clerical workers	16,000	16,350	7,150	18,250	29,300	7,250	11,400	12,000	11,400	11,350	11,100
Stenographers, typists, and secretaries	550	5,650	2,100	5,750	9,450	2,150	2,600	2,650	2,450	1,950	1,700
Office machine operators	350	300	250	750	1,250	300	500	500	500	500	450
Other clerical workers	10,150	10,400	4,750	11,800	18,650	4,800	8,300	8,850	8,400	8,850	8,950
Accounting clerks	400	400	350	800	1,250	300	400	400	500	450	400
Bookkeeping	750	700	700	550	450	700	900	950	1,700	950	650
Bank tellers	200	200	*	50	100	*	150	200	50	100	100
Cashiers	150	150	100	300	500	100	900	1,150	250	2,200	3,200
Mail carriers	350	400	100	200	250	100	200	200	150	150	150
Postal clerks	400	450	100	250	300	100	250	250	150	200	150
Shipping and receiving clerks	250	250	250	200	200	250	350	350	550	450	350
Telephone operators	650	650	300	400	550	300	600	650	400	250	250
Clerical workers not elsewhere classified	6,950	7,200	2,850	9,050	15,050	2,950	4,550	4,650	4,700	4,150	3,700
Salesworkers	1,550	1,500	1,700	1,550	1,700	1,850	5,150	5,800	8,650	8,050	5,550
Insurance agents and brokers	150	150	150	150	150	150	400	450	100	150	200
Real estate agents and brokers	100	100	50	100	150	100	250	250	100	150	150
Other salesworkers not elsewhere classified	1,350	1,300	1,500	1,300	1,400	1,600	4,500	5,050	8,400	7,750	5,200
Craft and kindred workers	7,550	6,300	16,150	16,750	11,350	16,950	9,550	7,600	13,850	6,200	5,400
Construction craftworkers	2,000	1,200	8,140	9,100	2,900	9,250	2,250	850	1,050	600	600
Carpenters	500	300	2,150	2,650	600	2,200	850	200	300	150	150
Brickmasons, stone and tile setters	100	*	900	650	100	450	150	*	50	*	*

See note at end of table.

Table D-3. Occupational manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand										
	Public sector						Private sector				
	State and local						Total private sector	Personal consumption expenditures			
	Health, welfare, and sanitation			Other functions				Total	Durable goods	Nondurable goods	
	Total	Except structures	New construction	Total	Except structures	New construction				Total	Food
Construction craftworkers—Continued											
Cement and concrete finishers	*	*	200	250	*	500	*	*	*	*	*
Electricians	400	300	1,100	1,050	600	550	350	200	350	150	150
Excavating, grade, and road machinery operators	200	100	1,000	1,700	450	4,000	150	100	50	50	50
Painters and paperhangers	350	300	650	1,300	650	450	350	150	100	100	100
Plasterers	*	*	100	100	*	100	*	*	*	*	*
Plumbers and pipefitters	300	150	1,150	1,000	350	600	250	100	150	100	50
Roofers and slaters	*	*	250	200	*	150	*	*	*	*	*
Structural metalworkers	50	*	600	250	*	300	50	*	*	*	*
Blue-collar worker supervisors not elsewhere classified	1,150	1,000	2,000	1,800	1,600	2,300	1,400	1,150	1,900	1,450	1,300
Metalworking craftworkers except mechanics	700	550	1,800	1,000	850	1,350	950	550	1,750	400	350
Machinists	300	250	500	350	400	450	500	250	850	200	200
Blacksmiths, forge and hammer operators	*	*	*	*	*	*	*	*	*	*	*
Boilermakers	*	*	150	*	*	50	*	*	*	*	*
Heat treaters, annealers, and temperers	*	*	*	*	*	*	*	*	*	*	*
Millwrights	50	*	150	100	50	100	50	*	100	50	50
Metal molders	*	*	50	*	*	100	*	*	100	*	*
Metal and wood patternmakers	*	*	*	*	*	*	*	*	100	*	*
Rollers and roll hands	*	*	50	*	*	100	*	*	*	*	*
Sheet metal workers	150	50	700	300	150	350	100	*	150	*	*
Toolmakers, diemakers, and setters	100	100	150	100	100	150	150	100	350	50	*
Mechanics and repairers	2,150	2,100	2,000	3,100	4,250	2,000	2,800	2,900	6,250	1,850	1,550
Air conditioning, heating, and refrigeration	100	50	300	50	100	100	50	100	*	*	*
Airplane	50	50	50	150	200	50	100	100	100	50	50
Motor vehicle	250	250	250	500	750	350	950	1,100	3,450	500	300
Office machine	*	*	*	*	*	*	50	50	100	50	*
Radio and TV	*	*	*	100	150	*	250	300	650	50	*
Railroad and car shop	*	*	*	*	*	*	*	*	*	*	*
Other	1,650	1,650	1,250	2,250	2,950	1,400	1,350	1,250	1,900	1,150	1,150

See note at end of table.

Table D-3. Occupational manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand										
	Public sector						Private sector				
	State and local										
	Health, welfare, and sanitation			Other functions			Total private sector	Personal consumption expenditures			
	Total	Except structures	New construction	Total	Except structures	New construction		Total	Durable goods	Nondurable goods	
										Total	Food
Printing trades craftworkers	250	250	100	200	250	100	300	300	400	450	300
Compositors and typesetters	150	150	50	100	150	50	150	200	200	250	200
Electrotypers and stereotypers	*	*	*	*	*	*	*	*	*	*	*
Engravers, except photoengravers	*	*	*	*	*	*	*	*	*	*	*
Photoengravers and lithographers	*	*	*	*	*	*	*	*	*	*	*
Printing press operators	50	50	*	50	50	*	100	100	100	100	100
Transportation and public utility craftworkers	350	300	600	400	400	450	700	750	450	300	300
Telephone and power installers and repairers	300	250	550	350	350	350	650	700	350	200	200
Locomotive engineers	*	*	50	*	*	50	*	*	*	*	50
Locomotive firemen	*	*	*	*	*	*	*	*	*	*	*
Other craft and kindred workers	1,000	900	1,500	1,200	1,100	1,500	1,150	1,150	2,050	1,200	1,000
Bakers	50	50	*	*	*	*	100	100	*	250	250
Cabinetmakers	*	*	*	*	*	*	100	100	450	*	*
Crane, derrick, and hoist operators	100	100	400	300	150	750	100	50	150	50	50
Glaziers	*	*	50	*	*	50	*	*	*	*	*
Jewelers and watchmakers	*	*	*	*	*	*	*	50	100	*	*
Loom fixers	*	*	*	*	*	*	*	*	*	50	*
Opticians, lens grinders, and polishers	*	*	*	*	*	*	*	*	50	*	*
Log and lumber inspectors	*	*	50	*	*	*	*	*	*	*	*
Other inspectors	150	100	200	100	50	150	50	50	50	50	50
Upholsterers	*	*	*	*	*	*	100	100	300	*	*
Craft and kindred workers not elsewhere classified	550	500	700	650	800	500	550	550	850	600	350
Operatives:	10,350	9,650	13,950	9,700	9,100	14,150	13,700	13,050	18,000	19,450	15,050
Drivers and delivery workers	2,150	2,000	2,800	2,750	2,300	4,600	2,400	2,350	2,700	3,400	4,350
Bus, truck, and tractor drivers	1,800	1,650	2,600	2,500	2,000	4,350	1,750	1,650	1,900	2,250	2,800
Delivery and route workers	350	350	200	250	350	250	650	750	750	1,150	1,550
Semiskilled metalworking occupations	1,000	850	2,150	1,300	1,100	2,050	1,650	1,000	3,750	450	400
Metalworking assemblers, class A	100	100	100	50	50	100	100	50	250	*	*
Metalworking assemblers, class B	250	250	350	250	300	350	500	300	1,500	100	100

See note at end of table.

Table D-3. Occupational manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand										
	Public sector						Private sector				
	State and local						Total private sector	Personal consumption expenditures			
	Health, welfare, and sanitation			Other functions				Total	Durable goods	Nondurable goods	
	Total	Except structures	New construction	Total	Except structures	New construction				Total	Food
Operatives — Continued											
Metalworking inspectors, class B	100	100	150	100	100	150	200	100	500	*	*
Machine tool operators, class B	100	100	200	150	150	200	250	150	600	50	50
Electroplaters	*	*	*	*	*	*	*	*	*	*	*
Electroplater helpers	*	*	*	*	*	*	*	*	*	*	*
Furnace tenders, smelters, and pourers, metal	*	*	100	50	50	100	*	*	100	*	*
Metal heaters	*	*	*	*	*	*	*	*	*	*	*
Welders and flame cutters	400	250	1,200	600	400	1,100	450	300	750	200	150
Selected transportation and public utility operatives	100	100	200	100	100	150	150	100	150	150	150
Railroad brake and switch operators and couplers	50	50	100	100	50	100	100	100	100	100	100
Power station operators	*	*	*	*	*	*	*	*	*	*	*
Sailors and deck hands	*	*	50	*	*	*	*	*	*	*	*
Semiskilled textile occupations	400	400	100	100	100	100	1,050	1,300	550	2,850	100
Knitters, loopers, and toppers	*	*	*	*	*	*	50	100	*	150	*
Spinners	*	*	*	*	*	*	50	50	50	150	*
Weavers	*	*	*	*	*	*	50	100	100	150	*
Sewers and stitchers	300	350	50	*	100	50	900	1,100	400	2,400	100
Other operatives and kindred workers	6,700	6,300	8,700	5,500	5,500	7,300	8,450	8,300	10,900	12,600	10,100
Asbestos and insulation workers	*	*	100	50	*	50	*	*	*	*	*
Auto attendants	50	50	*	100	100	*	450	600	150	1,250	50
Blasters	*	*	*	*	*	50	*	*	*	*	*
Laundry and dry cleaning operatives	900	950	*	*	*	*	50	100	*	*	*
Mine operatives and laborers not elsewhere classified	150	150	350	300	250	550	200	150	150	200	100
Meat-cutters, except meat-packing	50	50	*	*	*	*	250	350	*	750	1,300
Operatives not elsewhere classified	5,550	5,150	8,200	5,000	5,050	6,600	7,450	7,100	10,600	10,400	8,600

See note at end of table.

Table D-3. Occupational manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand										
	Public sector						Private sector				
	State and local						Total private sector	Personal consumption expenditures			
	Health, welfare, and sanitation			Other functions				Total	Durable goods	Nondurable goods	
	Total	Except structures	New construction	Total	Except structures	New construction				Total	Food
Service workers	25,700	27,100	1,000	15,750	29,600	1,000	8,300	10,450	1,600	6,350	10,200
Private household workers	—	—	—	—	—	—	1,950	2,650	—	—	—
Protective service workers	400	400	200	12,500	24,200	200	250	200	250	200	200
Fire fighters	*	*	—	3,200	6,300	*	*	*	*	—	—
Police and detectives	*	*	*	7,100	13,900	*	*	*	*	*	*
Guards	350	350	200	2,150	4,050	200	250	200	250	200	200
Food service workers	2,000	2,100	100	550	850	150	1,700	2,150	200	3,950	7,000
Bartenders	*	*	*	*	50	*	150	150	*	350	650
Cooks, except private household	1,150	1,200	*	200	350	*	500	650	*	1,050	2,000
Counter and fountain workers	350	400	*	*	50	*	200	300	*	500	600
Waiters and waitresses	450	500	50	250	400	50	850	1,050	100	2,050	3,750
Other service workers	23,300	24,600	650	2,750	4,500	650	4,400	5,450	1,150	2,200	3,000
Flight attendants	*	*	*	*	*	*	50	50	*	*	*
Hospital and other institutional attendants	10,500	11,100	*	150	250	*	600	800	*	50	100
Building interior cleaners not elsewhere classified	600	650	100	250	400	100	200	250	150	200	200
Janitors and sextons	1,950	2,000	200	800	1,400	200	550	600	300	350	350
Practical nurses	3,400	3,600	*	50	100	*	250	350	*	*	*
Other service workers not elsewhere classified	6,800	7,200	300	1,450	2,300	350	2,750	3,400	650	1,600	2,300
Laborers, except farm and mine	3,750	3,400	5,350	6,600	5,000	7,100	3,550	3,000	3,250	3,500	4,150
Farmers and farm workers	1,150	1,250	300	850	1,350	300	3,400	3,700	400	7,500	13,300

See note at end of table.

Table D-3. Occupational manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand							Type of construction
	Private sector							Residential buildings
	Personal consumption expenditures		Exports		Gross private domestic fixed investment			
	Services		Total merchandise and services	Merchandise only	Total	Producers' durable equipment	New construction	Single-family
	Total	Medical						
Total	63,800	81,650	49,850	57,500	67,650	62,200	69,300	77,200
Professional and technical workers	10,150	22,300	4,500	5,200	5,550	5,900	4,950	4,300
Engineers	500	350	1,250	1,600	1,650	2,000	1,250	1,100
Aeronautical	*	*	100	150	*	50	*	*
Chemical	*	*	100	100	*	50	*	*
Civil	150	50	100	100	300	50	500	550
Electrical	100	100	300	350	400	600	150	100
Industrial	*	*	150	200	200	250	100	50
Mechanical	50	50	300	400	350	500	150	100
Metallurgical	*	*	*	*	*	*	*	*
Mining	*	*	*	*	*	*	*	*
Sales	*	*	100	100	100	150	100	50
Other	50	50	150	150	200	200	150	100
Medical and health workers	3,000	18,650	*	*	*	*	*	*
Dentists	100	550	*	*	*	*	*	*
Dietitians and nutritionists	*	250	—	*	—	*	—	—
Professional nurses	1,400	7,650	*	*	*	*	*	*
Optometrists	*	100	—	*	*	*	—	—
Osteopaths	*	100	—	*	—	*	—	—
Pharmacists	*	2,800	*	*	*	*	*	*
Physicians and surgeons	350	1,900	*	*	*	*	*	*
Psychologists	*	50	*	*	*	*	*	—
Medical and dental technicians	500	2,800	*	*	*	*	*	*
Veterinarians	*	150	—	*	*	*	—	—
Other	450	2,300	*	*	*	*	*	*
Teachers	1,700	100	50	*	*	*	*	*
Elementary	700	*	*	*	*	*	*	*
Secondary	550	*	*	*	*	*	*	*
College	300	*	*	*	*	*	*	*
Other	150	100	*	*	*	*	*	*
Natural scientists	200	550	300	400	200	250	150	150
Chemists	50	200	150	200	100	100	50	50
Agricultural scientists	*	*	*	*	*	*	*	*
Biological scientists	*	200	*	*	*	*	*	*
Geologists and geophysicists	*	*	*	*	*	*	*	*
Mathematicians	*	*	*	50	50	100	*	*

See note at end of table.

Table D-3. Occupational manpower factors—Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand							Type of construction
	Private sector							Residential buildings
	Personal consumption expenditures		Exports		Gross private domestic fixed investment			
	Services		Total merchandise and services	Merchandise only	Total	Producers' durable equipment	New construction	Single-family
	Total	Medical						
Natural scientists — Continued								
Physicists	*	*	*	*	*	*	*	*
Other	*	100	*	*	*	*	*	*
Social scientists	*	*	*	*	*	*	*	*
Economists	*	*	*	*	*	*	*	*
Statisticians and actuaries	*	*	*	*	*	*	*	*
Other	*	*	*	*	—	—	—	—
Technicians, except medical and dental	500	450	1,000	1,250	1,500	1,600	1,300	1,000
Drafters	150	100	300	400	700	650	700	700
Surveyors	*	*	*	*	50	*	100	100
Air traffic controllers	—	—	—	—	—	—	—	—
Radio operators	*	*	*	*	*	*	*	*
Electrical and electronic technicians	100	50	200	300	300	450	150	50
Other engineering and physical science technicians	100	100	250	350	350	400	300	100
Other	100	200	150	200	100	100	50	50
Other professional and technical workers	4,250	2,200	1,800	1,850	2,100	1,950	2,200	2,000
Accountants and auditors	400	300	350	400	500	450	550	450
Airplane pilots and navigators	100	*	100	50	*	50	*	*
Architects	*	*	*	*	50	*	100	100
Clergy	500	*	*	*	*	*	*	*
Designers, except drafters	*	*	100	100	100	150	100	50
Editors and reporters	100	50	50	100	*	50	*	*
Lawyers and judges	300	150	150	150	350	150	500	400
Librarians	100	100	*	*	*	*	*	*
Personnel and labor relations workers	100	150	100	100	100	150	50	50
Photographers	150	50	*	*	*	*	*	*
Social and welfare workers	150	250	*	*	*	*	*	*
Workers and teachers in the arts and entertainment	800	*	250	150	100	150	100	50
Professional and technical workers not elsewhere classified	1,550	950	600	750	750	800	700	750

See note at end of table.

Table D-3. Occupational manpower factors—Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand							Type of construction
	Private sector							Residential buildings
	Personal consumption expenditures		Exports		Gross private domestic fixed investment			
	Services		Total merchandise and services	Merchandise only	Total	Producers' durable equipment	New construction	Single-family
	Total	Medical						
Managers and administrators	5,400	4,650	4,650	4,750	6,650	6,400	6,300	7,300
Railroad conductors	*	*	50	100	50	*	50	50
Ship officers, pilots, and engineers	*	*	250	*	*	*	*	*
Credit and collection managers	*	*	*	*	*	50	*	*
Purchasing agents	50	100	150	200	200	250	150	150
Postmasters and assistants	*	*	*	*	*	*	*	*
Managers and administrators not elsewhere classified	5,250	4,450	4,150	4,350	6,300	6,000	6,050	7,000
Clerical workers	12,950	15,300	7,950	8,700	9,200	10,400	7,800	8,200
Stenographers, typists, and secretaries	3,500	4,350	1,950	2,200	2,400	2,550	2,150	2,150
Office machine operators	450	400	400	450	400	550	300	300
Other clerical workers	9,000	10,550	5,650	6,050	6,350	7,300	5,350	5,700
Accounting clerks	400	400	300	350	400	400	400	450
Bookkeepers	700	750	400	450	850	750	900	1,100
Bank tellers	350	50	100	50	50	100	50	50
Cashiers	400	800	200	150	150	150	100	100
Mail carriers	300	200	100	100	100	150	100	100
Postal clerks	400	250	150	150	150	150	100	100
Shipping and receiving clerks	100	200	400	450	450	550	300	300
Telephone operators	1,200	550	250	250	300	400	300	350
Clerical workers not elsewhere classified	5,200	7,350	3,750	4,100	3,900	4,650	3,050	3,150
Sales workers	2,350	5,600	2,050	2,350	3,300	3,950	2,250	3,000
Insurance agents and brokers	900	1,100	150	150	150	100	150	150
Real estate agents and brokers	450	150	150	100	100	100	100	100
Other sales workers not elsewhere classified	1,000	4,350	1,750	2,100	3,050	3,750	2,000	2,750
Craft and kindred workers	6,750	3,800	7,550	9,150	18,200	12,400	22,450	26,650
Construction craft workers	1,050	700	900	1,000	9,000	1,100	15,400	20,350
Carpenters	250	150	150	200	3,900	250	6,850	10,450

See note at end of table.

Table D-3. Occupational manpower factors—Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand							Type of construction
	Private sector							Residential buildings
	Personal consumption expenditures		Exports		Gross private domestic fixed investment			
	Services		Total merchandise and services	Merchandise only	Total	Producers' durable equipment	New construction	Single-family
	Total	Medical						
Construction craftworkers – Continued								
Brickmasons, stone and tile setters	-	-			850	*	1,550	1,950
Cement and concrete finishers	*	*	*	*	300	*	550	800
Electricians	250	200	300	400	850	350	1,200	1,300
Excavating, grade, and road machinery operators	100	*	100	150	500	50	850	750
Painters and paperhangers	250	200	100	100	1,100	100	1,850	2,500
Plasterers	*	*	*	*	100	*	150	100
Plumbers and pipefitters	150	100	150	150	1,000	200	1,650	2,050
Roofers and slaters	*	*	*	*	150	*	250	150
Structural metalworkers	*	*	*	*	250	*	400	300
Blue-collar worker supervisors not elsewhere classified	550	600	1,550	1,950	2,050	2,150	1,850	1,700
Metalworking craftworkers except mechanics	250	200	1,700	2,350	2,600	3,700	1,450	900
Machinists	100	100	900	1,250	1,300	2,050	550	400
Blacksmiths, forge and hammer operators	*	*	*	*	*	*	*	*
Boilermakers	*	*	*	*	*	*	50	*
Heat treaters, annealers, and temperers	*	–	*	*	*	100	*	*
Millwrights	*	*	100	150	150	150	100	100
Metal molders	*	*	100	100	150	200	100	*
Metal and wood patternmakers	*	*	50	50	100	100	*	*
Rollers and roll hands	*	*	*	50	50	50	50	*
Sheet metal workers	*	*	150	150	300	250	350	150
Toolmakers, diemakers, and setters	*	*	300	400	450	700	150	100
Mechanics and repairers	2,700	1,350	1,950	2,200	2,700	3,550	1,800	1,800
Air conditioning, heating, and refrigeration	100	*	*	*	50	*	100	*
Airplane	150	50	250	150	100	150	50	50
Motor vehicle	750	150	200	300	800	1,250	300	300
Office machine	50	*	100	100	150	250	*	*
Radio and TV	400	*	*	*	*	*	*	*

See note at end of table.

Table D-3. Occupational manpower factors -- Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand							Type of construction
	Private sector							Residential buildings
	Personal consumption expenditures		Exports		Gross private domestic fixed investment			
	Services		Total merchandise and services	Merchandise only	Total	Producers' durable equipment	New construction	Single-family
	Total	Medical						
Mechanics and repairers -- Continued								
Railroad and car shop	*	*	100	100	*	*	*	50
Other	1,200	1,050	1,250	1,500	1,550	1,800	1,250	1,300
Printing trades craftworkers	150	200	200	250	150	150	100	100
Compositors and typesetters	100	100	100	150	100	100	50	50
Electrotypers and stereotypers	*	*	*	*	*	*	*	*
Engravers, except photoengravers	*	*	*	*	*	*	*	*
Photoengravers and lithographers	*	*	*	*	*	*	*	*
Printing press operators	*	50	50	50	*	*	*	*
Transportation and public utility craft workers	1,300	250	350	400	400	500	450	450
Telephone and power installers and repairers	1,300	200	250	250	350	450	400	350
Locomotive engineers	*	*	100	100	50	50	50	50
Locomotive firemen	*	*	*	*	*	*	*	*
Other craft and kindred workers	750	550	900	1,000	1,300	1,200	1,350	1,300
Bakers	*	50	*	*	*	*	*	*
Cabinetmakers	*	*	*	*	150	100	150	250
Crane, derrick, and hoist operators		*	200	250	300	250	300	200
Glaziers	*	*	*	*	50	*	100	100
Jewelers and watchmakers	*	*	*	*	*	*	*	*
Loom fixers	*	*	*	*	*	*	*	*
Opticians, lens grinders and polishers	*	*	*	*	*	*	*	*
Log and lumber inspectors	*	*	*	*	50	*	100	150
Other inspectors	50	100	100	100	100	50	150	100
Upholsterers	100	*	*	*	50	100	*	*
Craft and kindred workers not elsewhere classified	450	300	450	500	550	550	500	400
Operatives	4,800	5,500	13,250	16,600	16,700	18,800	14,600	13,050
Drivers and delivery workers	1,250	1,200	1,900	2,400	2,550	1,800	3,150	3,800
Bus, truck, and tractor drivers	950	600	600	2,000	2,250	1,500	2,950	3,500
Delivery and route workers	350	600	300	350	300	350	200	300

See note at end of table.

Table D-3. Occupational manpower factors—Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand							Type of construction
	Private sector							Residential buildings
	Personal consumption expenditures		Exports		Gross private domestic fixed investment			
	Services		Total merchandise and services	Merchandise only	Total	Producers' durable equipment	New construction	Single-family
	Total	Medical						
Semiskilled metalworking occupations	500	300	2,500	3,650	4,200	6,200	2,050	1,200
Metalworking assemblers, class A	*	50	250	350	350	550	100	50
Metalworking assemblers, class B	100	100	900	1,200	1,300	2,150	400	250
Metalworking inspectors, class B	*	*	350	450	450	700	200	150
Machine tool operators, class B	*	*	500	700	750	1,200	250	150
Electroplaters	*	*	*	*	*	*	*	*
Electroplater helpers	*	*	*	*	*	50	*	*
Furnace tenders, smelters, and pourers, metal	*	*	100	150	150	150	100	50
Metal heaters	*	*	*	*	*	*	*	*
Welders and flame cutters	300	100	550	750	1,150	1,350	950	450
Selected transportation and public utility operatives	100	*	400	250	150	100	150	200
Railroad brake and switch operators and couplers	*	*	150	200	100	100	150	150
Power station operators	*	*	*	*	*	*	*	*
Sailors and deck hands	*	*	200	*	*	*	*	*
Semiskilled textile occupations	50	50	450	400	200	250	150	150
Knitters, loopers, and toppers	*	*	*	*	*	*	*	*
Spinners	*	*	*	50	*	*	*	*
Weavers	*	*	50	50	*	*	*	*
Sewers and stitchers	*	*	350	250	150	200	100	100
Other operatives and kindred workers	2,900	3,850	7,850	9,900	9,550	10,400	9,100	7,750
Asbestos and insulation workers	*	*	*	*	*	*	50	*
Auto attendants	100	50	50	*	50	50	*	*
Blasters	*	—	*	*	*	*	*	*
Laundry and dry cleaning operatives	200	750	*	*	*	*	*	*

See note at end of table.

Table D-3. Occupational manpower factors—Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Component of demand							Type of construction
	Private sector							Residential buildings
	Personal consumption expenditures		Exports		Gross private domestic fixed investment			
	Services		Total merchandise and services	Merchandise only	Total	Producers' durable equipment	New construction	Single-family
	Total	Medical						
Other operatives and kindred workers – Continued								
Mine operatives and laborers not elsewhere classified	100	50	400	500	250	150	350	300
Meatcutters, except meat-packing	*	*	*	*	*	*	*	*
Operatives not elsewhere classified	2,500	2,950	7,350	9,300	9,300	10,100	8,650	7,400
Service workers	18,050	22,650	2,300	1,500	1,300	1,400	1,100	1,150
Private household workers	6,050	–	–	*	–	*	–	–
Protective service workers	250	250	250	300	300	300	250	300
Fire fighters	*	*	*	*	*	*	–	–
Police and detectives	*	*	*	*	*	*	*	*
Guards	200	200	250	300	250	300	250	300
Food service workers	1,100	2,700	450	200	150	200	150	150
Bartenders	50	*	*	*	*	*	*	*
Cooks, except private household	450	1,000	150	100	*	50	*	50
Counter and fountain workers	150	1,000	*	*	*	*	*	*
Waiters and waitresses	450	700	200	100	100	100	50	50
Other service workers	10,400	19,700	1,600	1,000	850	900	650	700
Flight attendants	100	*	100	*	*	*	*	*
Hospital and other institutional attendants	1,850	9,850	*	*	*	*	*	*
Building interior cleaners not elsewhere classified	350	500	150	100	100	100	100	100
Janitors and sextons	1,000	700	250	250	250	300	150	200
Practical nurses	750	3,300	*	*	*	*	*	*
Other service workers not elsewhere classified	6,350	5,300	1,050	550	400	450	350	350
Laborers except farm and mine	2,350	1,300	2,850	2,900	6,300	2,700	9,250	12,450
Farmers and farm workers	1,000	550	4,750	6,350	450	250	600	1,100

See note at end of table.

Table D-3. Occupational manpower factors—Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Type of construction										
	Residential buildings	Nonresidential buildings				Public utilities structures					Highways and streets
	Multi-family	Industrial	Office and commercial	Educational	Hospital and institutional	Telephone and telegraph	Electric	Water	Sewer	Local transit	
Total	75,850	62,500	61,400	62,400	60,700	53,750	60,200	59,900	54,000	44,750	57,750
Professional and technical workers	5,100	5,500	5,700	5,700	6,600	5,500	6,050	5,800	5,450	5,350	5,550
Engineers	1,350	1,300	1,350	1,400	1,450	1,100	1,300	1,200	1,050	1,100	1,200
Aeronautical	*	*	*	*	*	*	*	*	*	*	*
Chemical	*	50	*	*	*	*	50	*	*	*	*
Civil	600	450	450	400	450	300	300	300	300	300	350
Electrical	100	150	150	250	200	150	250	150	100	200	150
Industrial	100	100	100	100	100	100	100	100	100	100	100
Mechanical	150	200	250	200	250	200	250	200	200	200	250
Metallurgical	*	*	*	*	*	50	*	50	*	*	*
Mining	*	*	*	*	*	*	*	*	*	*	*
Sales	50	100	100	*	100	50	100	100	100	100	50
Other	200	200	200	200	250	150	150	150	150	150	200
Medical and health workers	*	*	*	*	*	*	*	*	*	*	*
Dentists	*	*	*	*	*	*	*	—	*	*	*
Dietitians	*	—	—	—	—	*	—	—	—	—	—
Professional nurses	*	*	*	*	*	*	*	—	*	*	*
Optometrists	*	—	—	—	—	*	—	—	—	—	—
Osteopaths	*	—	—	—	—	*	—	—	—	—	—
Pharmacists	*	*	*	*	*	*	*	—	*	*	*
Physicians and surgeons	*	*	*	*	*	*	*	—	*	*	*
Psychologists	*	*	*	*	*	*	*	—	*	*	*
Medical and dental technicians	*	*	*	*	*	*	*	—	*	*	*
Veterinarians	*	—	—	—	—	*	—	—	—	—	—
Other	*	*	*	*	*	*	*	—	*	*	*
Teachers	*	*	*	*	*	*	*	*	*	*	*
Elementary	*	*	*	*	*	*	*	—	*	*	*
Secondary	*	*	*	*	*	*	*	—	*	*	*
College	*	*	*	*	*	*	*	—	*	*	*
Other	*	*	*	*	*	*	*	—	*	*	*
Natural scientists	150	150	150	150	200	200	200	150	150	150	150
Chemists	50	100	50	100	100	100	100	50	50	50	50
Agricultural scientists	*	*	*	*	*	*	*	*	*	*	*
Biological scientists	*	*	*	*	*	*	*	*	*	*	*
Geologists and geophysicists	*	*	*	*	*	*	*	*	*	*	*
Mathematicians	*	*	*	*	*	*	*	*	*	*	*
Physicists	*	*	*	*	*	*	*	*	*	*	*
Other	*	*	*	*	*	*	*	*	*	*	*

See note at end of table.

Table D-3. Occupational manpower factors—Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Type of construction										
	Residential buildings	Nonresidential buildings				Public utilities structures					Highways and streets
	Multi-family	Industrial	Office and commercial	Educational	Hospital and institutional	Telephone and telegraph	Electric	Water	Sewer	Local transit	
Social scientists	*	*	*	*	*	*	*	*	*	*	*
Economists	*	*	*	*	*	*	*	—	*	*	*
Statisticians and actuaries	*	*	*	*	*	*	*	—	*	*	*
Other	*	*	—	—	*	*	—	—	*	—	—
Technicians, except medical and dental	1,200	1,600	1,600	1,650	1,750	1,900	2,150	2,050	1,950	1,950	1,400
Drafters	800	750	750	750	800	550	700	650	600	600	550
Surveyors	100	100	100	100	150	200	200	200	200	200	550
Air traffic controllers	*	—	—	*	—	*	—	*	—	—	—
Radio operators	*	*	*	*	*	*	*	*	*	*	*
Electrical and electronic technicians	100	150	150	200	200	350	400	350	300	400	100
Other engineering and physical science technicians	150	500	500	500	500	700	700	650	650	650	150
Other	50	100	100	100	100	100	100	100	100	100	100
Other professional and technical workers	2,400	2,350	2,500	2,400	3,150	2,250	2,350	2,300	2,250	2,050	2,750
Accountants and auditors	600	700	750	700	950	700	700	700	650	600	850
Airplane pilots and navigators	*	50	50	50	50	*	*	*	*	*	*
Architects	100	100	100	100	150	50	50	50	50	50	100
Clergy	*	*	*	*	*	*	*	*	*	*	*
Designers, except drafters	50	100	100	100	150	150	200	150	150	150	50
Editors and reporters	*	*	*	*	*	*	*	*	*	*	*
Lawyers and judges	600	600	700	600	950	550	550	600	600	600	1,000
Librarians	*	*	*	*	*	*	*	*	*	*	*
Personnel and labor relations workers	50	100	100	100	100	100	100	100	50	50	50
Photographers	*	*	*	*	*	*	*	*	*	*	*
Social and welfare workers	*	*	*	*	*	*	*	*	*	*	*
Workers and teachers in the arts and entertainment	100	100	100	100	200	*	100	—	100	50	50
Professional and technical workers not elsewhere classified	700	550	550	650	600	600	600	600	500	450	550

See note at end of table.

Table D-3. Occupational manpower factors — Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Type of construction										
	Residential buildings	Nonresidential buildings				Public utilities structures					Highways and streets
	Multi-family	Industrial	Office and commercial	Educational	Hospital and institutional	Telephone and telegraph	Electric	Water	Sewer	Local transit	
Managers and administrators	6,900	6,500	6,100	6,150	6,050	5,100	5,700	5,500	5,200	4,150	4,300
Railroad conductors	50	50	50	50	*	50	50	*	*	*	50
Ship officers, pilots, and engineers	*	*	*	*	*	100	50	50	50	50	*
Credit and collection managers	*	*	*	*	*	*	*	*	*	*	*
Purchasing agents	150	150	150	150	150	150	150	150	150	100	100
Postmasters and assistants	*	*	*	*	*	*	*	*	*	*	*
Managers and administrators not elsewhere classified	6,600	6,250	5,850	5,900	5,800	4,800	5,350	5,200	4,950	3,950	4,050
Clerical workers	9,500	8,550	8,200	8,150	8,500	7,050	7,750	7,700	6,700	5,600	7,000
Stenographers, typists, and secretaries	3,400	2,400	2,400	2,350	2,650	2,100	2,250	2,200	2,000	1,800	2,150
Office machine operators	350	350	300	350	350	300	300	300	250	250	250
Other clerical workers	5,800	5,800	5,450	5,500	5,500	4,650	5,150	5,150	4,450	3,550	4,550
Accounting clerks	450	450	400	400	400	350	350	400	300	250	250
Bookkeepers	1,050	850	800	850	900	700	650	600	600	450	600
Bank tellers	50	50	*	50	*	*	*	*	*	*	*
Cashiers	100	100	100	100	100	100	100	50	100	100	100
Mail carriers	100	100	100	100	100	100	100	100	100	50	100
Postal clerks	100	100	100	100	100	100	100	100	100	100	100
Shipping and receiving clerks	300	350	300	350	300	300	350	350	250	200	200
Telephone operators	350	350	350	350	350	300	300	350	300	250	250
Clerical workers not elsewhere classified	3,250	3,350	3,200	3,200	3,150	2,700	3,150	3,200	2,700	2,150	2,900
Salesworkers	2,750	2,400	2,250	2,200	2,100	1,700	1,850	1,750	1,500	1,250	1,850
Insurance agents and brokers	150	150	150	150	150	150	150	150	150	150	200
Real estate agents and brokers	100	100	100	100	100	50	1,050	50	50	50	100
Other sales workers not elsewhere classified	2,500	2,150	2,050	2,000	1,900	1,450	650	1,550	1,250	1,050	1,600

See note at end of table.

Table D-3. Occupational manpower factors—Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Type of construction										
	Residential buildings	Nonresidential buildings				Public utilities structures					Highways and streets
	Multi-family	Industrial	Office and commercial	Educational	Hospital and institutional	Telephone and telegraph	Electric	Water	Sewer	Local transit	
Craft and kindred workers	26,450	18,050	18,000	17,800	17,650	15,050	16,200	17,500	15,050	13,450	16,600
Construction craftworkers	20,050	10,100	10,050	10,050	10,050	6,750	6,850	7,000	6,850	6,450	8,900
Carpenters	10,150	2,350	2,350	2,350	2,350	1,800	1,800	1,800	1,800	1,700	1,750
Brickmasons, stone and tile setters	1,900	1,200	1,200	1,200	1,200	700	700	750	700	700	50
Cement and concrete finishers	750	350	300	350	350	150	100	150	150	150	550
Electricians	1,350	1,100	1,100	1,100	1,100	1,150	1,150	1,200	1,100	1,050	250
Excavating, grade, and road machinery operators	750	1,000	950	950	950	950	950	950	1,000	900	5,850
Painters and paperhangers	2,500	1,400	1,400	1,400	1,400	250	250	300	300	250	100
Plasterers	150	300	300	300	300	*	50	*	*	*	*
Plumbers and pipefitters	1,950	1,250	1,250	1,200	1,250	1,100	1,100	1,100	1,050	1,050	150
Roofers and slaters	150	750	800	800	800	*	*	*	*	*	*
Structural metalworkers	350	400	400	350	350	650	700	700	700	700	150
Blue-collar worker supervisors not elsewhere classified	1,750	1,950	1,950	2,000	1,900	2,150	2,300	2,400	2,050	1,650	2,500
Metalworking craftworkers, except mechanics	1,150	1,950	2,000	1,900	1,900	1,900	2,250	3,200	1,800	1,750	950
Machinists	500	650	650	650	650	550	650	700	400	500	350
Blacksmiths, forge and hammer operators	*	*	*	*	*	*	*	100	*	*	*
Boilermakers	*	50	50	*	*	200	250	250	200	200	*
Heat treaters, annealers and temperers	*	*	*	*	*	*	*	100	*	*	*
Millwrights	100	100	150	150	150	150	150	200	150	100	100
Metal molders	50	100	100	100	100	150	100	550	50	100	50
Metal and wood patternmakers	*	*	*	*	*	*	*	100	*	*	*
Rollers and roll hands	50	50	100	50	100	50	100	150	50	50	50
Sheet metal workers	200	700	700	600	600	450	700	800	750	600	200
Toolmakers, diemakers, and setters	150	200	200	200	200	200	200	250	100	150	100
Mechanics and repairers	1,750	1,950	2,000	1,900	1,850	2,000	2,250	2,300	2,000	1,650	2,200
Air conditioning, heating, and refrigeration	*	100	100	100	100	400	400	400	400	400	*
Airplane	50	50	50	100	50	50	50	50	50	*	50
Motor vehicle	300	350	300	300	300	250	250	250	250	200	400
Office machine	*	*	100	*	*	*	*	*	*	*	100
Radio and TV	*	*	*	*	*	*	*	*	*	*	*
Railroad and car shop	50	*	*	*	*	*	*	*	*	*	*
Other	1,250	1,300	1,350	1,300	1,250	1,200	1,400	1,500	1,250	950	1,550

See note at end of table.

Table D-3. Occupational manpower factors—Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Type of construction										
	Residential buildings	Nonresidential buildings				Public utilities structures					Highways and streets
	Multi-family	Industrial	Office and commercial	Educational	Hospital and institutional	Telephone and telegraph	Electric	Water	Sewer	Local transit	
Printing trades craftworkers	100	100	100	100	100	100	100	100	100	50	100
Compositors and typesetters	50	50	50	50	50	50	50	50	*	*	50
Electrotypers and stereotypers	*	*	*	*	*	*	*	*	*	*	*
Engravers, except photoengravers	*	*	*	*	*	*	*	*	*	*	*
Photoengravers and lithographers	*	*	*	*	*	*	*	*	*	*	*
Printing press operators	*	*	*	*	*	*	*	*	*	*	*
Transportation and public utility craftworkers	450	450	400	400	400	750	750	750	750	700	350
Telephone and power installers and repairers	350	350	350	350	350	650	650	700	700	650	250
Locomotive engineers	50	50	50	50	50	50	50	50	50	*	50
Locomotive firemen	*	*	*	*	*	*	*	*	*	*	*
Other craft and kindred workers	1,200	1,450	1,450	1,400	1,400	1,450	1,650	1,700	1,500	1,250	1,600
Bakers	*	*	*	*	*	*	*	*	*	*	*
Cabinetmakers	200	50	50	50	50	*	*	*	*	*	*
Crane, derrick, and hoist operators	250	500	450	450	450	350	350	600	400	250	900
Glaziers	50	150	150	100	150	*	*	*	*	*	*
Jewelers and watchmakers	*	*	*	*	*	*	*	*	*	*	*
Loom fixers	*	*	*	*	*	*	*	*	*	*	*
Opticians, lens grinders, and polishers	*	*	*	*	*	*	*	*	*	*	*
Log and lumber inspectors	100	*	*	*	*	*	100	*	50	*	*
Other inspectors	100	200	200	200	200	200	200	200	200	150	150
Upholsterers	*	*	*	*	*	*	*	*	*	*	*
Craft and kindred workers not elsewhere classified	400	500	500	500	500	850	900	850	800	800	450
Operatives	11,800	13,550	13,350	14,500	12,050	14,050	16,450	15,800	14,200	11,000	13,950
Drivers and delivery workers	3,550	3,450	2,950	3,000	2,750	2,150	2,650	2,450	2,750	1,550	5,700
Bus, truck, and tractor drivers	3,250	3,150	2,750	2,750	2,550	1,950	2,450	2,250	2,550	1,450	5,500
Delivery and route workers	300	250	200	250	200	200	200	200	200	150	200
Semiskilled metalworking occupations	1,700	3,000	3,150	3,200	2,950	1,850	2,700	3,050	1,800	1,850	1,450
Metalworking assemblers, class A	100	150	150	200	150	100	150	100	50	100	50
Metalworking assemblers, class B	350	450	550	650	550	350	700	450	250	400	250
Metalworking inspectors, class B	150	200	250	300	250	250	300	300	100	150	100

See note at end of table.

Table D-3. Occupational manpower factors—Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Type of construction										
	Residential buildings	Nonresidential buildings				Public utilities structures					Highways and streets
	Multi-family	Industrial	Office and commercial	Educational	Hospital and institutional	Telephone and telegraph	Electric	Water	Sewer	Local transit	
Operatives — Continued											
Machine tool operators, class B	200	300	300	300	300	250	300	350	200	250	150
Electroplaters	*	*	*	*	*	*	*	*	*	*	*
Electroplater helpers	*	*	*	*	*	*	*	*	*	*	*
Furnace tenders, smelters, and pourers, metal	100	100	100	150	100	300	150	350	100	100	100
Metal heaters	*	*	*	*	*	*	*	50	*	*	*
Welders and flame cutters	700	1,700	1,750	1,550	1,500	600	1,100	1,450	1,050	800	750
Selected transportation and public utility operatives	150	150	150	150	100	250	250	250	200	150	100
Railroad brake and switch operators and couplers	150	100	100	100	100	100	150	100	100	50	150
Power station operators	*	*	*	*	*	*	*	*	*	*	*
Sailors and deck hands	*	*	*	*	*	100	100	100	100	200	*
Semiskilled textile occupations	200	100	100	100	100	100	100	50	50	*	50
Knitters, loopers, and toppers	*	*	*	*	*	*	*	*	*	*	*
Spinners	*	*	*	*	*	*	*	*	*	*	*
Weavers	*	*	*	*	*	*	*	*	*	*	*
Sewers and stitchers	100	100	100	100	100	50	100	*	*	*	50
Other operatives and kindred workers	6,350	7,150	7,000	8,100	6,100	9,700	10,750	10,000	9,350	6,800	6,550
Asbestos and insulation workers	*	200	200	200	200	50	50	50	50	50	*
Auto attendants	*	*	*	*	*	*	*	*	*	*	*
Blasters	*	*	*	*	*	*	*	*	*	*	100
Laundry and dry-cleaning operatives				*				*	*	*	*
Mine operatives and laborers not elsewhere classified	300	350	300	300	300	450	300	300	400	200	750
Meatcutters, except meat-packing	*	*	*	*	*	*	*	*	*	*	*
Operatives not elsewhere classified	5,900	6,250	6,450	7,500	5,550	9,150	10,300	9,550	8,850	7,050	5,700
Service workers	1,150	1,150	1,150	1,100	1,100	1,000	1,100	1,000	1,000	750	1,000
Private household workers	—	—	—	—	—	—	—	*	—	—	—
Protective service workers	300	200	200	250	200	250	250	250	250	150	200
Fire fighters	—	—	—	—	*	*	*	*	*	—	—
Police and detectives	*	*	*	*	*	*	*	*	*	*	*
Guards	250	200	200	200	200	200	250	250	200	150	200

See note at end of table.

Table D-3. Occupational manpower factors—Continued

(Employment requirements per billion dollars of expenditures, by occupation, calendar year 1972)

Occupation	Type of construction										
	Residential buildings	Nonresidential buildings				Public utilities structures					Highways and streets
	Multi-family	Industrial	Office and commercial	Educational	Hospital and institutional	Telephone and telegraph	Electric	Water	Sewer	Local transit	
Service workers – Continued											
Food service workers	150	150	250	150	150	100	150	50	150	100	150
Bartenders	*	*	*	*	*	*	*	*	*	*	*
Cooks, except private household	*	*	*	*	*	*	*	*	*	*	*
Counter and fountain workers	*	*	*	*	*	*	*	*	*	*	*
Waiters and waitresses	100	100	150	50	50	100	50	*	50	50	50
Other service workers	750	750	700	700	700	600	700	650	650	500	650
Flight attendants	*	*	*	*	*	*	*	*	*	*	*
Hospital and other institutional attendants	*	*	*	*	*	*	*	*	*	*	*
Building interior cleaners not elsewhere classified	100	100	100	100	100	100	100	100	100	100	100
Janitors and sextons	200	200	200	200	200	200	200	200	150	150	150
Practical nurses	*	*	*	*	*	*	*	*	*	*	*
Other service workers not elsewhere classified	350	350	350	350	350	300	350	300	300	250	300
Laborers except farm and mine	11,200	6,550	6,350	6,450	6,300	4,050	4,800	4,700	4,650	3,050	7,250
Farmers and farm workers	950	250	300	350	350	250	300	150	250	150	250

NOTE: Asterisk (*) = less than 50.

Appendix E. 1970 Interindustry Employment and Industry-Occupational Models

This appendix describes the 1970 interindustry employment model and the national industry-occupational matrix which were used in the basic stages of the development of the manpower factors presented in this bulletin.

Interindustry employment model

The 1970 employment table was constructed from a 1970 interindustry model of 134 industry sectors. Each sector represents a group of industries classified by 4-digit Standard Industrial Classification codes. An interindustry model, in its most basic form, distributes the transaction value of the sales that each industry sector makes to itself, to each of the other industry sectors, and to final purchasers. Intermediate goods are sold to other industries where further fabrication occurs before a finished good is produced. Finished products are sold to the final demand, or product, sectors of the national income accounts—personal consumption expenditures, gross private domestic investment, net exports of goods and services, Federal government purchases, and State and local government purchases. Intermediate sales provide the basic structure of an interindustry model while final sales, or final demand, represent the usual input to a model of this type.

Each of the 134 rows in the interindustry model shows the *sales* made by an industry to itself, to other industries, and to the final demand sectors. Each of the 129 columns shows an industry's *purchases* from each industry, including itself, which were required to produce its own output. The sum of all purchases in a column plus that industry's value added[1] is equal to the total value of production for that industry. When the purchases in a column are divided individually by the total production of that industry, they form ratios that define the amount of input required from each industry in order to produce a unit of output (usually stated in dollar terms) of the purchasing industry. For example, these ratios, or coefficients, would show how much the automobile industry would have to buy from such industries as rubber, textiles, steel, aluminum, advertising, business services, plastics, transportation, and trade in order to produce a value unit of output.

These purchases represent the requirements from the immediate or first tier of supplying industries. Each of these supplying industries would also require inputs in order to manufacture its product. The steel industry would need coal and iron ore to make steel. The coal and iron ore industries, in turn, would need fuel and other products and services to produce their outputs. Each final purchase would require a chain of purchases back through the more basic supplying industries. An interindustry model provides a way of solving simultaneously all of the interrelated requirements created in the economy by purchases of the various final demand sectors or programs.

The elements of this model can be transformed from production requirements to employment requirements by applying employment-output ratios to each industry's total output. The interindustry employment table which results from this process shows the total employment attributable to deliveries to final demand. (Total employment consists of direct employment in the industry producing the final product or service, and indirect employment in all the supporting industries). Total employment can be easily converted to employment *per billion dollars* of delivery to final demand by each industry in the economy.

It should be noted that the resulting table reflects 1970 industry technology and productivity levels and is expressed in 1963 prices. Also, the transactions in 1963 dollars are in terms of producers' values and not purchasers' values. Producers' values are purchasers' values minus trade and transportation costs—put another way, producers' values are values stated at the site of production. The trade margins and transportation costs associated with all of these transactions appear as direct purchases from the trade and transportation industries. Using the data would, therefore, require converting purchases to 1963 producers' prices.

In cases where the manpower factors presented in this bulletin do not satisfactorily match a program, some agencies may wish to make their own calculations using the model described above. Any agency contemplating this approach should contact the Division of Economic

[1] The value added of a sector includes compensation of employees, depreciation, profits, and other payments to the factors of production.

Growth in BLS concerning the feasibility of the project and the data and techniques for undertaking it.

Industry-occupational model

The 1970 industry-occupational matrix is a table which distributes total U.S. employment into 160 occupations cross-classified by 116 industries. Each column shows an industry's occupational structure by giving each of the 160 occupations as a percent of total industry employment. Estimated employment requirements for specific occupations can be obtained by applying each industry's occupational structure to the estimates of total employment in that industry. To arrive at total requirements for each occupation, the estimates by industry are summed across each row in the table.

The data incorporated into the matrix are based on 1970 occupational distributions. Since each industry's occupational structure changes slowly and is relatively stable over short time periods, these distributions were used to estimate occupational requirements for 1972.

Updating the matrix. The BLS is now compiling employment data by industry and occupation from the 1970 Census of Population, which will be used to revise the 1970 matrix. Between decennial censuses, a variety of less comprehensive sources are used to update the model. Estimates of total U.S. employment and employment in broad occupational groups are based on an annual average of the monthly data collected by the Bureau of the Census in its Current Population Survey (CPS). The occupational group estimates provide control totals for estimates of employment in the detailed occupations within each group.

Detailed occupational estimates for the matrix are obtained in two general ways. For a number of occupations, current data sources are available. In addition to CPS employment estimates, the following data are compiled more frequently than census reports and are incorporated directly into the matrix:

- Employment of scientists, engineers, and technicians by industry based on BLS surveys of employers.
- Employment of teachers and librarians based on data collected by the Office of Education of the U.S. Department of Health, Education, and Welfare.
- Occupational employment data collected by regulatory agencies for sectors such as railroads, airlines, and telephone and telegraph communications.
- Employment data collected by professional societies, especially for medical and health occupations.
- Selected data from BLS industry and metropolitan area occupational wage rate surveys.
- Federal Civil Service Commission statistics on employment by occupation in Federal Government agencies.
- Occupational employment information compiled by the Postal Service on its employees.

A second general method is used in those cases where detailed occupational employment data are not available annually, or every few years. For these occupations, data from the *Occupation by Industry* tables of the Bureau of the Census are adjusted alternately to current industry employment control totals, and to occupational group control totals. This iterative adjustment procedure is repeated until the census estimates are consistent with both sets of controls.

Estimates from sources other than the census account for roughly 60 percent of all professional and technical workers and for about 20 percent of all nonagricultural employment. Data from noncensus sources are poor, however, for blue-collar occupations, which make up about 75 percent of the model-derived employment estimates. Recently the BLS has developed industry surveys as part of an occupational employment statistics program that will provide data on employment in many blue-collar occupations as well as additional detail on various white-collar occupations. It is expected that these data will eventually fill many of the existing gaps in occupational employment statistics.

Adjustments to the matrix. A number of adjustments had to be made to the occupational matrix in order to use it in conjunction with the interindustry model system since the industry classifications differ in the two systems. The restructuring of industries in the occupational matrix (116 industries) to conform to the industries in the interindustry model (134 industries) was accomplished by comparing the industries in terms of Standard Industrial Classification (SIC) codes and making necessary adjustments. While many of the industries in both models matched exactly by SIC codes there were various differences that had to be reconciled.

In some areas, there was greater industry detail in the occupational matrix than in the interindustry model. In these cases, the matrix industries were simply aggregated, with the exception of the wholesale and retail trade sectors, where the matrix contains detail on seven wholesale and eleven retail industries. The employment generated by the interindustry model for wholesale and retail trade was allocated to each of the matrix trade industries in proportion to the trade margins associated with each bill of goods. The corresponding occupational trade pattern was then applied to each trade industry.

Where the matrix industries were less detailed than those in the interindustry model, three methods were used to construct occupational patterns for the interindustry sectors. First, the occupational patterns of some 2-digit SIC industries were adjusted by a series of factors to produce the desired 3-digit SIC industry detail. These factors were based on the ratios of production and nonproduction workers in each 3-digit SIC industry and on the different employment ratios of scientists, engineers, and technicians in each industry. Second, aggregate occupational patterns were used in cases where additional industry detail was not available in the matrix. For example, the total metal mining pattern was used for iron ore mining and nonferrous metal ores mining. Finally, when a matrix industry classification differed greatly from a particular interindustry sector, data were obtained from outside sources and a new occupational pattern was constructed. Special handling was required for the government enterprise sector in the interindustry model. Since employment in government enterprises in the occupational matrix is allocated to the corresponding private industry, no occupational pattern exists for this sector. Based on an examination of each program, the occupational pattern for government enterprise was developed by determining the most appropriate private industry counterpart(s) and by using the private industry occupational pattern(s).

New occupational patterns were also developed for specific programs which were not adequately represented by existing matrix patterns. For example, the occupational distribution of the Federal public employment sector for the National Aeronautics and Space Administration (NASA) was based on employment data obtained from NASA rather than on the pattern for all Federal public employment. A new pattern was similarly developed for highway construction.

Agencies wishing additional information on occupational employment patterns and on the methodology used to generate these estimates may consult *Tomorrow's Manpower Needs*, Volume IV, Revised 1971, Bulletin 1737 (Bureau of Labor Statistics) for the complete 1970 industry-occupational matrix. Inquiries concerning the development of the 1972 occupational requirements factors should be directed to the Division of Manpower and Occupational Outlook in BLS.

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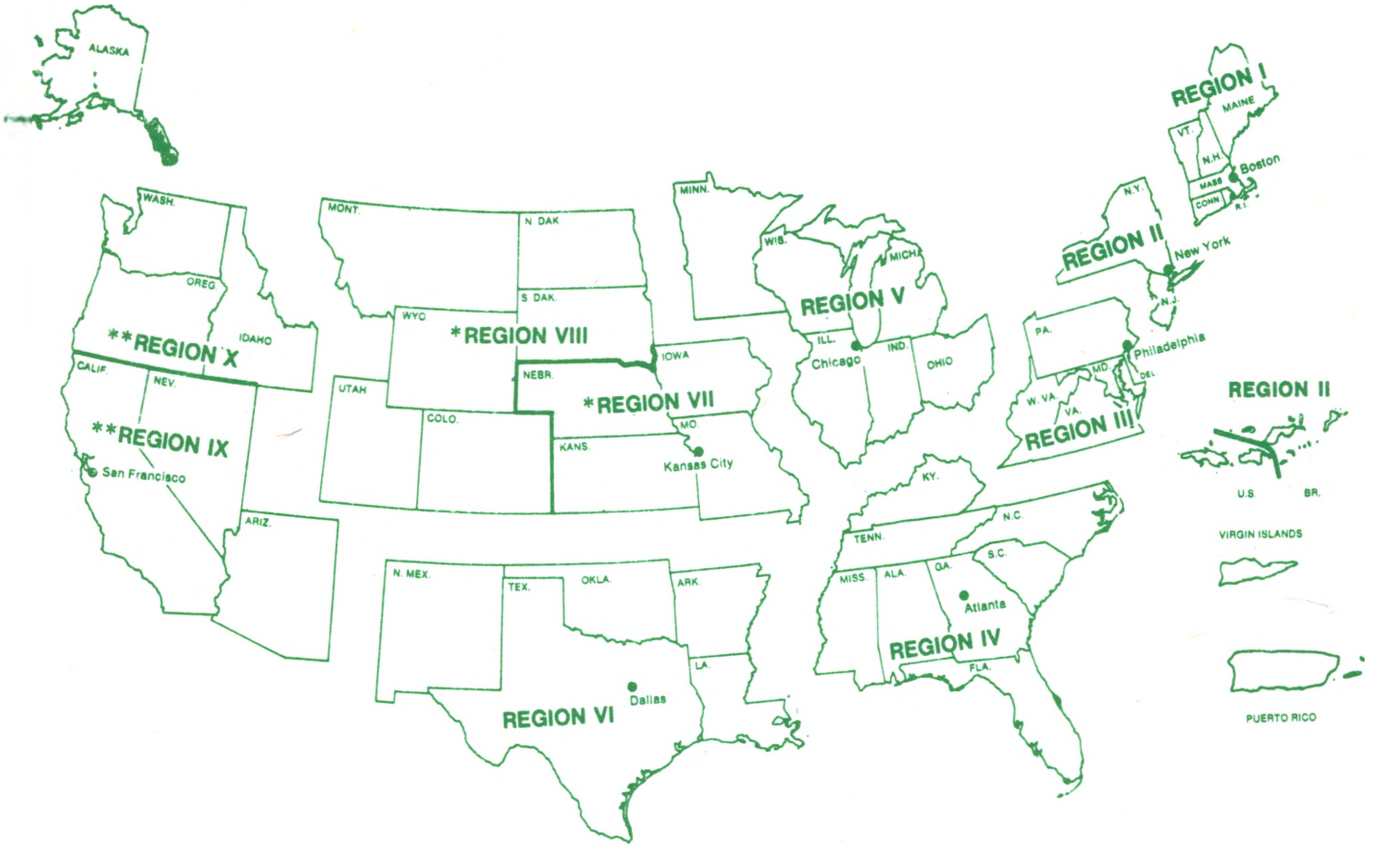

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