

TOMORROW'S MANPOWER NEEDS

Research Report on
Manpower Projection Methods
Bulletin 1769



U.S. DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

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U.S. DEPARTMENT OF LABOR
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Introduction

The *Tomorrow's Manpower Needs* (TMN) series is designed to assist those responsible for making State and area manpower projections which are used in planning education, training, and vocational guidance. This series has been revised to provide up-to-date information on national projections of manpower requirements and indicate the results of the Bureau's research to improve methods of developing projections. The full series of reports are as follows:

Tomorrow's Manpower Needs; National Manpower Projections and a Guide to their Use as a Tool in Developing State and Area Manpower Projections, BLS Bulletin 1606:

Vol. I – Developing 91 Area Manpower Projections, February 1969

Vol. II – National Trends and Outlook: Industry Employment and Occupational Structure, February 1969

Vol. III – National Trends and Outlook: Occupational Employment

Vol. IV – The National Industry-Occupational Matrix and Other Manpower Data, 1969

Supplement No. 1 – Revised Employment Projections for the Construction Industry, April 1970

Supplement No. 2 – New and Revised National Industry Projections and Procedures for Adjusting Wage and Salary Employment to Total Employment, 1970

Vol. IV – Revised 1971–The National Industry-occupational Matrix and Other Manpower Data, BLS Bulletin 1737, 1972

Chapter I. Testing the Effectiveness of the National Occupation-by-Industry Matrix for Projecting Occupational Employment Changes in States and Metropolitan Areas

Volume I of the TMN presented two methods by which the National matrix could be used to translate projections of State or area employment into projections of occupational employment. In the absence of information on the occupational composition of industries in the State, the bulletin recommended the use of the National I-O matrix, but concern was expressed about possible differences between the National average composition of each industry and the composition of the industry in the State. Two methods are suggested to deal with this problem:

In "Method A", the industry staffing patterns of the national matrix were applied directly to their corresponding estimates of base year (1960) and projected (1975) industry employment for the State. The results in each industry then were added to all-industry totals in each year and used to compute change factors (1975 employment/1960 employment) for each occupation. Projections for the State would then be made by applying the change factor to the State's base (1960) occupational employment level, derived from the Census of Population for that year.¹ In effect, this method applies to the actual number of workers in each occupation in the State in 1960, a change factor reflecting the projected growth of each industry employing that occupation in the State weighted by the incidence of that occupation in each industry *nationally*. "Method A," a relatively simple mechanical process, was used to project preliminary occupational employment for over 160 specific occupations. Because many of the industries in the National I-O matrix are broadly defined and contain sub-industries

with varying occupations, the plants in an I-O industry within a State may differ in composition from the national average for the industry—in which case the weighting may be inaccurate.

Since the 4-volume TMN report was released in early 1969, over 40 state employment agencies have undertaken projections of manpower requirements; to date 38 of these have been completed and 33 published. Most of the studies are restricted to State-wide estimates, but some utilized the TMN methods to develop manpower requirements for sub-State regions and/or metropolitan areas. Before the TMN report was released, the Bureau tested the recommended procedures in a few large States to measure their success in predicting past changes in employment. The results of one such test in Ohio were included in Volume I of the TMN report.

The BLS bulletin was prepared by Joseph S. Cangialosi under the supervision of Richard E. Dempsey in the Division of Manpower and Occupational Outlook, Russell B. Flanders, Chief. This bulletin presents results of the Bureau's continuing research in developing and testing techniques used to prepare projections of State and area manpower requirements. The preparation of State and local manpower requirements is relatively new and undeveloped; this bulletin attempts to provide some empirical evidence regarding the reliability as well as some of the shortcomings of the techniques presented in *Tomorrow's Manpower Needs*. The Bureau has examined and reported on several important components of these procedures in the following pages.

In "Method B," which indirectly used the National matrices, a State industry-occupational matrix first had to be developed from Census (1960) data. The State matrix then would be projected to the target year (1975) by applying change factors (1975 ratio/1960 ratio) computed from each cell in the National Matrix to the corresponding cell in the State matrix. Once

¹For examples and a more complete discussion of the techniques, see *Tomorrow's Manpower Needs; National Manpower Projections and a Guide to their Use as a Tool in Developing State and Area Manpower Projections*, Bulletin 1606 (Bureau of Labor Statistics, 1969).

projected, individual occupational staffing patterns for each industry in the State matrix could be applied to separately projected State industry employment estimates. Although procedurally superior, "Method B" generally was less desirable since it required the expenditure of considerable resources to develop a base period matrix. Also, much of the advantage gained from local occupational staffing patterns would be offset by the limited amount of industry detail available from the Census for use to develop the State matrix. A Census-based State matrix could include only about 40 industries and 50 occupations, whereas the national matrix includes 116 industries and 160 occupations. Because of resource problems and the technical limitations of "Method B," most State agencies chose to use "Method A."

Before the TMN report was released, a number of tests were conducted to assess the reliability of "Method A". As indicated earlier, one comprehensive test of the method for the State of Ohio was presented in Volume I of the TMN report. However, due to the widespread use of "Method A," especially in small States, in sub-State regions, and SMSA's, more extensive testing seemed warranted. For this purpose, seven States and nine SMSA's representing a wide range of population size, growth rates, industrial development, and geographic areas were selected for testing. The following paragraphs present the results of these tests.

Method Used to Test the Effectiveness of "Method A" in Projecting State Occupational Employment Changes

"Method A" was applied to past situations in predicting past changes in a State's occupational employment and results were measured. How effectively would past changes in national staffing patterns, combined with past changes in a State's (SMSA) industry employment, have measured changes in employment for specific occupations in the State (SMSA)? Or, how much error is introduced by using national occupational patterns instead of State patterns for each industry? This question is important because several years will pass before detailed occupational information for each State can be obtained from the 1970 Census² and from the Federal-State Occupational Employment Statistics program.³ For testing purposes, the 1950-60 period was chosen. National patterns (i.e., the percent distribution of occupational employment in an industry) from the 1950 and 1960 decennial censuses

were developed covering 29 occupations in eight occupational groups for 116 industries. The occupations were selected to represent a cross section of various employment sizes, skill levels, and employment growth rates. Once available, the national patterns then were applied to their corresponding 1950 and 1960 industry employment in each State (SMSA) as reported in the decennial censuses. The results (by industry) for each State were added to all-industry totals in the base (1950) and target (1960) years and were used to compute occupational change factors for the 1950-60 decade. "Method A" projections to 1960 then were computed by applying each occupation's change factor to the actual 1950 occupational employment reported by the Census for the State in 1950. (See tables 2-11.) The resulting projection of employment for 1960 by occupation and the actual data from the 1960 Census were compared.

Results should be interpreted cautiously since in the test procedures actual data from the 1950 and 1960 Censuses were used instead of projections. Thus, the two principal inputs needed to complete "Method A," namely, State (SMSA) projections of industry employment and national projections of occupational patterns by industry, were determined perfectly. The actual use of "Method A" by State agencies would involve error in each. The use of national rather than State occupational composition for each industry is being tested.

When interpreting results, one should consider the degree of accuracy required. However, establishing an objective criteria for a "good" projection is difficult. An acceptable standard in one situation may be completely inappropriate in another. Therefore, when evaluating projections there is no single criteria against which each and every occupation can be judged. In the final analysis, a "good" projection is one that successfully guides those responsible for planning education and training programs to reach correct decisions.

At first, one might say that a projection is accurate if it predicts, within a predetermined range (for example 10 percent), the *level* of employment in a target year. However, since occupational employment projections are often made to establish educational and training needs, the real objective is the measure of employment change. In some occupations, employment projections

²The Bureau of Labor Statistics, in cooperation with the Manpower Administration and the State employment agencies, has undertaken to develop an integrated national/State industry-occupational employment matrix system.

³For a description of this program, see the *Monthly Labor Review*, October 1971, pp. 12-17.

within 5 percent would be sufficient, but in others, especially those having little growth, such projections might be unacceptable. For example, if employment is expected to double over the period, projections to within 10 percent probably would be adequate. However, if employment increases only five percent, then projections accurate to within 10 percent would be misleading. Also, evaluations of projections based on employment levels often can mislead the casual reader. For example, a projection to within 2 or 3 percent may well have erred in forecasting employment change as much as 50 percent. Thus, a better criterion for judging a "good" projection would be if the projection correctly predicts, within an acceptable range, the change in employment by occupation. However, even this criterion cannot be applied to most situations. For example, projecting change within 20 percent may be reasonable for moderate growth but far too rigid for employment which has declined or risen very rapidly. If employment is declining, it may not be necessary to identify the amount of decrease to designate the occupation as one for which training programs should not be offered. Conversely, if an occupation is projected to grow very rapidly, it may not be necessary to predict the change to within 10 percent to mark it as an occupation for which training seems desirable. In such instances, a less accurate projection may adequately guide planners.

Finally, the need to replace workers who leave the labor force due to death, retirement, or other reasons constitutes a large share of total job openings and should be considered in an overall evaluation. Such replacements are more predictable since they depend largely on normal working life patterns and the age distribution of workers in various occupations. The significance of replacement requirements in estimating total openings for an occupation has an inverse relationship to growth requirements, i.e., the slower the growth the larger share of total openings from replacements. Therefore, to measure total openings which is the real goal, the accuracy of the projection depends upon two factors—employment change and death and retirement rates.

The maximum percent error in growth which can be tolerated for any maximum percent error in an estimate of total openings and for any set of growth and separation rates may be predetermined. Table 1 is an example of a maximum 10 percent error in total openings. Tables can be constructed to represent other error margins. Table 1 shows that for occupations having a 25 percent growth and a 2 percent annual separation rate (mostly male workers) the estimated growth could be in error by ± 36 percent without more than a 20 percent error in total openings.

Although this approach appears to give a "hard" numerical measure of whether or not an estimate is good, still a large arbitrary element is involved in setting a criterion for permissible error in the total openings estimate.

No single criterion can be adopted to determine a "good" projection in all circumstances. However, to compare States and areas in this report, an arbitrary evaluation standard of 80-120 percent of the actual employment change was used. Also, the summaries for the tests examine the results to determine the success of predicting employment levels in both the States and SMSA's. As indicated, such results can be misleading and each projection must be judged by the criterion of how well it would have guided educators and planners. Only if it provides proper guidance can a projection be judged "good."

Table 2 shows the overall average percentage (all occupations) deviation from perfect projections in each of the States tested. Although far from conclusive, these results indicate that "Method A" is less reliable than "Method B" for States well below average size and for States expected to undergo significant employment growth.

Even more exacting evaluation criteria were adopted for individual States. Instead of examining how well the procedure predicted the success of 1960 employment levels, evaluations of the following States predicted how accurately the procedure measured *changes* in occupational employment during the 1950-60 decade. Even under the more stringent criteria, "Method A" appears to have made reliable projections in a vast majority of cases. Following is a brief discussion of the results in each State. Complete results are shown in tables 5 through 22.

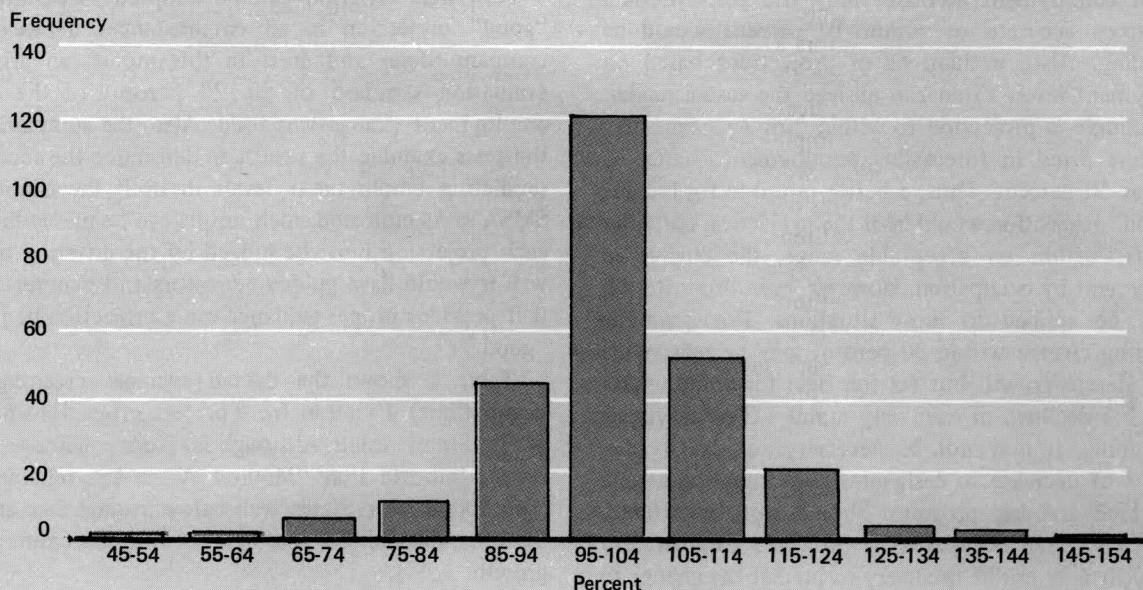
Summary of State Tests of Tomorrow's Manpower Needs Projection "Method A"

A broad overview of the accuracy of "Method A" in projecting occupational employment may be gained from Table 3 and Chart 1. The Table shows the relationship between projected and actual employment levels in the 29 test occupations in each of the States in 1960.

Some of the largest discrepancies, such as electrical engineers, tool and diemakers, and setters in Georgia probably resulted from the lack of industry detail in the national matrix. (See table 8.) For example, a large share of the electrical engineers are concentrated in the

Chart 1.

Distribution of occupational employment projections as percent of actual 1960 employment for seven test states



electrical machinery industry (SIC 36). However, their relative importance differs significantly among the various 3-digit SIC components of SIC 36. For example, in the household appliance sector (SIC 363) they account for less than 5 percent of the total work force, while in the communication equipment sector (SIC 366), especially where military equipment is produced, they often account for 20 percent or more. Therefore, the national matrix would be most effective in projecting electrical engineers in a State when the composition of SIC 36 is similar to that in the Nation.

Another view of Method A's accuracy is shown in table 4, which gives for each State the percent difference between the actual and estimated change in employment in selected test occupations. As can be seen, the percent change was projected within 20 percent of the actual change in well over 80 percent of the cases.

California

Although employment growth in most occupations was significantly greater in California than in the Nation as a whole during the 1950-60 period, the test application of TMN "Method A" resulted in good projections. Actual employment in six of the detailed occupations

more than doubled and "Method A" correctly predicted increases of this magnitude for five. Even the exception, medical and dental technicians, was identified as a growth occupation.

Ten occupations or occupational groups in the test experienced below average growth rates of less than 30 percent, and "Method A" correctly identified all 10.

In 20 of the 29 detailed occupations, estimated growth differed from actual growth by less than 20 percentage points. Five of the nine occupations not meeting this criterion were among those which doubled in employment and all were identified as growth occupations.

Pennsylvania

In contrast to California, employment changes in Pennsylvania reflected slower growth rates than in the Nation as a whole. Table 6 shows that in only two occupations were Pennsylvania test projections more than 20 percentage points different from the actual growth. In one of these, office machine operators, "Method A" predicted correctly that employment would double. Of the dozen occupations that experienced actual growth of at least 30 percent, "Method A"

failed to project such growth in only two instances; secretaries were predicted to increase 23 percent and welders and flame-cutters 26 percent. Both projections, however, are within 20 percentage points of actual increases.

Eleven occupations declined between 1950 and 1960. "Method A" correctly predicted decreases in 10 cases, with the sole exception of compositors and typesetters. Numeric changes in table 6 illustrate that even in this occupation the false requirements indicated by "Method A" would have had little, if any, implications for job training, since far more training would have been required to replace those who left this occupation or the labor force because of deaths, retirements, or other reasons.

The test also showed that "Method A" was quite successful in correctly projecting changes in detailed occupations when these changes ran counter to the change for the broad group of which the occupation is a part. For example, although the professional group increased moderately, "Method A" correctly predicted a small decline in the number of chemists. Similarly, although the number of craftsmen remained almost constant, the projections correctly show moderate growth for linemen, radio and TV repairmen, tool and diemakers, and declines for bakers, brickmasons, carpenters, electricians, machinists, and painters. Comparable patterns also may be seen in the operatives group.

Ohio

Projections results for Ohio appear good. (See table 7.) Only two occupations, electrical engineers and office machine operators, had projected increases which were more than 20 percentage points different from actual increases. Of seven occupations or groups showing declines, "Method A" would have correctly identified six of the seven. The one exception was compositors and typesetters, and as in Pennsylvania, the discrepancy is probably not large enough to have serious training implications, if the magnitude of demand generated by deaths and retirements is considered.

Perhaps most important for training, the test would have correctly identified all nine occupations that increased by more than 30 percent between 1950 and 1960.

In this State also, "Method A" would have done a creditable job in identifying those detailed occupations where employment moved in the opposite direction from their broad group. For example, laundry and dry cleaning operatives were correctly forecast to decrease, even though the operatives group showed a small

increase. Similar patterns are exhibited in several of the crafts.

Georgia

In the decade studied, employment in this medium-size State increased at a rate considerably above the Nation as a whole, as indicated in table 8. In contrast, 10 occupations among those tested grew 30 percent or less. "Method A" correctly predicted that nine of these would grow at this slower rate; automobile mechanics and repairmen was the exception.

Three occupations showed actual decreases in employment. "Method A" forecast two of these and projected little change in the third, painters.

Although 12 occupations grew at a rate which was not within 20 percentage points of the actual increase, six doubled (or nearly did), and "Method A" predicted they would grow above average. Of the remaining six, chemists had a numeric discrepancy which indicates that replacement needs would be more important than the projection error.

Virginia

Only four occupations in Virginia had predicted and actual growth rates which differed more than 20 percentage points. In one of these occupations, bank tellers, "Method A" correctly predicted that employment would more than double during the decade. Another, auto service and parking attendants, would have few vocational training implications.

The projections correctly show declines in employment of carpenters and laundry and dry cleaning operatives, even though the broad occupational groups of which these are a part showed opposite movement. Even if "Method A" failed to predict an actual employment decrease for bakers, the discrepancy amounted to less than 10 jobs a year, a figure which would be far outweighed by needs generated through deaths and retirements. Of the 16 occupations which grew over 30 percent in the decade, "Method A" correctly identified 15.

West Virginia

"Method A" also performed well in this State, where employment actually fell in the decade under study. As table 10 shows, only five occupations had predictions that differed from actual rates of employment change by more than 20 percentage points. In one of these, office

machine operators, a very large increase was correctly predicted.

In spite of generally declining employment, seven occupations showed employment increases of 30 percent or more in the 1950-60 period. "Method A" correctly identified all seven.

The projections also identified occupations having trends which differ from those of their broad occupational groups. For example, craftsmen declined in employment from 1950 to 1960, yet the component occupations compositors, linemen, radio and TV repairmen, millwrights, and tool and diemakers were all correctly predicted to increase. The operatives category showed a substantial employment decline, but the method correctly predicted increases for auto service and parking attendants and welders.

Vermont

Table 11 shows that for the smallest of the test States, only eight occupations had predicted and actual growth changes differing more than 20 percentage points. One of these, office machine operators, was correctly forecast to double, and many of the others had small numeric differences; the discrepancies would have

had little effect on the planning of training programs over the 10-year period.

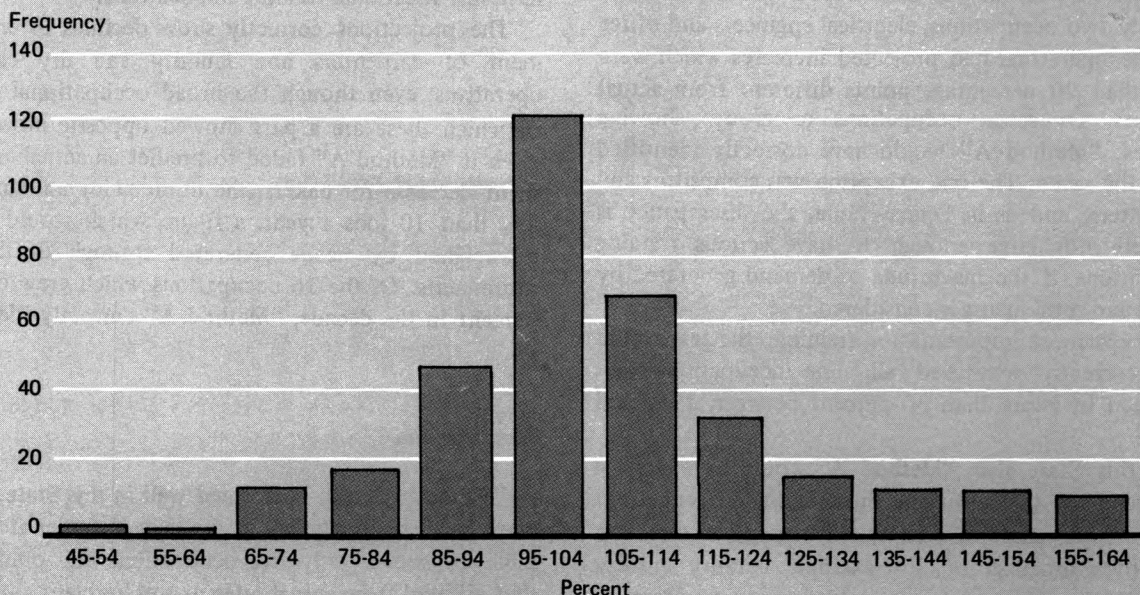
As in most other States, "Method A" identified those occupations having trends counter to the trends of the broad group of which they are a part. For example, although craftsmen were correctly forecast to increase slightly, employment declines were correctly predicted for bakers, carpenters, and painters. Similarly, although the operatives group showed a small decline, auto service and parking attendants and welders and flame-cutters were correctly projected to increase rapidly.

Summary of Metropolitan (SMSA) tests of "Method A"

As indicated earlier, tests of "Method A," also were conducted on a selected group of SMSA's. The frequency distribution of occupational employment estimates for 1960 generated by "Method A" as a percentage of actual 1960 employment in nine SMSA's is depicted on chart 2. As with State results, a strong central tendency is seen; "Method A" predicted over 36 percent of the occupations within 5 percent of their actual 1960 employment level and 86 percent within 25 percent. Table 12 shows the average deviation from 100 percent for each SMSA.

Chart 2.

Distribution of occupational employment projections as percent of actual 1960 employment for nine test metropolitan areas



To what extent does "Method A" become less reliable as the population size of the area decreases? As expected, the test showed that accuracy tends to decline when "Method A" is followed in smaller SMSA's. However, in most of the small SMSA's tested, "Method A" appears to have predicted many of the important employment shifts that occurred during the 1950-60 decade. Size is not the only factor affecting the procedure. For example, the industrial mix and the area's growth rate also may significantly affect its reliability. Baltimore's average deviation was the smallest of the nine areas studied, yet was the third largest in population. The relatively good performance of "Method A" probably was due to diversity of the industrial mix in the Baltimore SMSA and the fact that its rate of growth between 1950 and 1960 was near the national average. The test showed somewhat contradictory results in two rapidly growing

areas—Phoenix and Los Angeles—but the better results in Los Angeles probably stem from its broad industrial base and large size.

Complete numeric and percentage comparisons of the projected and actual employment data for the nine SMSA's are presented in tables 12 through 22. Again, as with the State tests, results should be interpreted cautiously since the test assumes that perfect projections of national occupational patterns and SMSA industrial employment were available. In actual practice, error would be involved in both. Also, the summary tables evaluate the test projections for the predictability of employment levels. As indicated earlier, a more satisfactory criterion of judging the accuracy of projections is the success of the method in predicting employment changes. For such information, the reader should examine the tables of each metropolitan area.

Table 1. Percent permissible error in projected employment growth when 10 percent error in total openings is acceptable for selected growth and separation rates

10-year growth rate (percent)	Selected annual death and retirement rates (percent)											
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
Percent permissible error in employment projection												
1	60	110	160	210	260	310	360	410	460	510	560	610
5	20	30	40	50	60	70	80	90	100	110	120	130
10	15	20	25	30	35	40	45	50	55	60	65	70
15	13	17	20	23	27	30	33	37	40	43	47	50
20	13	15	18	20	23	25	28	30	33	35	38	40
25	12	14	16	18	20	22	24	26	28	30	32	34
30	12	13	15	17	18	20	22	23	25	27	28	30
35	11	13	14	16	17	19	20	21	23	24	26	27
40	11	13	14	15	16	18	19	20	21	23	24	25
45	11	12	13	14	16	17	18	19	20	21	22	23
50	11	12	13	14	15	16	17	18	19	20	21	22
60	11	12	13	13	14	15	16	17	18	18	19	20
70	11	11	12	13	14	14	15	16	16	17	18	19
80	11	11	12	13	13	14	14	15	16	16	17	18
90	11	11	12	12	13	13	14	14	15	16	16	17
100	11	11	12	12	13	13	14	14	15	15	16	16

Table 2. Average deviation of test results from actual employment in seven states¹

State	Percent deviation
California	9.0
Pennsylvania	5.2
Ohio	5.7
Georgia	14.4
Virginia	8.6
West Virginia	8.1
Vermont	11.5

¹ Mean difference from 100.0 percent, ignoring sign.

Table 3. Projections as percent of actual employment, selected occupations, by State

Occupation	State						
	California	Pennsylvania	Ohio	Georgia	Virginia	West Virginia	Vermont
Professional, technical, and kindred	98	101	104	98	96	102	100
Chemists	93	103	100	84	102	88	116
Draftsmen	115	114	109	92	112	115	135
Engineers, electrical	75	109	126	32	82	106	137
Nurses, professional	100	99	103	82	90	110	123
Technicians, medical and dental	67	105	100	85	91	85	88
Managers, officials and proprietors, except farm ..	103	104	103	91	99	104	105
Clerical and kindred	98	102	102	101	98	103	103
Bank tellers	124	91	92	93	86	119	107
Cashiers	98	97	105	118	101	110	100
Office machine operators	114	86	115	92	98	85	82
Secretaries, stenographers, and typists	94	95	96	90	138	89	86
Salesworkers	103	98	102	107	102	102	103
Craftsmen, foremen and kindred	104	101	103	101	103	104	100
Bakers	116	111	109	118	107	116	102
Brickmasons, stonemasons and tilers	88	100	93	93	83	107	111
Carpenters	108	92	98	105	105	103	100
Compositors and typesetters	99	105	115	93	110	98	120
Electricians	101	99	101	95	105	102	107
Linemen	107	93	105	95	101	111	92
Machinists	97	112	105	98	100	114	84
Mechanics and repairmen, auto	109	95	103	125	106	100	84
Mechanics and repairmen, radio and TV	116	101	100	85	92	73	60
Millwrights	123	103	112	75	109	92	99
Painters, construction and maintenance	99	96	106	101	95	95	125
Plumbers and pipefitters	101	98	101	106	103	101	116
Tool and die makers and setters	107	96	91	45	100	93	74
Operatives and kindred	103	101	103	99	102	99	109
Attendants, auto service, and parking	96	102	107	91	86	99	109
Bus, truck and tractor drivers	106	104	110	103	114	113	104
Laundry and dry cleaning operatives	97	97	97	98	98	90	91
Meatcutters	104	95	96	95	91	95	75
Welders and flamecutters	124	94	111	85	110	104	103
Service workers, except private household	105	97	102	95	98	98	94
Practical nurses	134	74	97	79	114	83	98
Waiters and waitresses	104	103	101	99	110	106	97
Laborers, except farm and mine	99	104	91	105	147	92	102

Table 4. Percent difference between actual and estimated change in selected occupations, 1950-60, seven States

Percent differences	7 States	California	Pennsylvania	Ohio	Georgia	Virginia	Vermont	West Virginia
Total test occupations	259	37	37	37	37	37	37	37
0-10	165	23	32	27	19	21	19	24
11-20	50	5	3	7	6	11	10	8
21-30	16	1	0	2	7	3	1	2
31-40	16	4	1	1	3	2	3	2
41-50	5	2	0	0	0	0	3	0
51-60	2	0	1	0	0	0	0	1
61 and over	5	2	0	0	2	0	1	0

Table 5. Projections and actual employment changes in California, by selected occupation, 1950-60

Occupation	Employment				
	1950	1960		Percent change 1950-60	
		Actual	Projected	Actual	Projected
Professional, technical, and kindred	430,382	357,526	343,195	83	80
Chemists	5,410	2,102	1,555	39	29
Draftsmen	11,370	12,653	16,232	111	143
Engineers, electrical	9,357	20,999	13,369	224	143
Nurses, professional	38,214	21,762	21,548	57	56
Technicians, medical and dental	7,905	13,300	6,301	168	80
Managers, officials and proprietors, except farm	441,843	108,980	124,096	25	28
Clerical and kindred	552,932	384,345	361,718	70	65
Bank tellers	7,919	8,726	12,706	110	160
Cashiers	20,019	22,604	21,758	113	109
Office machine operators	14,975	20,755	25,672	139	171
Secretaries, stenographers, and typists	134,580	99,795	85,429	74	63
Saleworkers	331,291	117,562	130,011	35	39
Craftsmen, foremen, and kindred	594,935	208,635	238,927	35	40
Bakers	8,712	723	2,269	8	26
Brickmasons, stonemasons and tilers	6,692	2,755	1,588	41	24
Carpenters	78,609	-4,593	1,478	-6	2
Compositors and typesetters	11,729	3,140	2,957	27	25
Electricians	26,338	8,468	8,718	32	33
Linemen	20,423	8,152	10,248	40	50
Machinists	38,604	19,526	18,041	51	47
Mechanics and repairmen, automobile	49,028	8,532	13,812	17	28
Mechanics and repairmen, radio and TV	7,931	3,510	5,358	44	68
Millwrights	1,969	710	1,338	36	68
Painters, construction and maintenance	36,544	2,682	2,181	7	6
Plumbers and pipefitters	20,780	5,552	5,691	27	27
Tool and diemakers and setters	7,853	6,241	7,231	79	92
Operatives and kindred	599,706	256,147	284,340	43	47
Attendants, auto service and parking	21,714	13,353	11,933	61	55
Bus, truck and tractor drivers	106,794	32,069	40,031	30	37
Laundry and drycleaning operatives	32,278	1,075	80	3	0
Meatcutters	15,083	2,028	2,672	13	18
Welders and flame-cutters	18,058	12,296	19,497	68	108
Service workers, except private household	344,426	132,898	158,778	39	46
Practical nurses	12,708	5,911	12,254	47	96
Waiters and waitresses	59,957	20,550	23,613	34	39
Laborers, except farm and mine	219,721	26,805	24,438	12	11

Table 6. Projections and actual employment changes in Pennsylvania by selected occupation, 1950-60

Occupation	Employment				
	1950	1960		Percent change 1950-60	
		Actual	Projected	Actual	Projected
Professional, technical, and kindred	328,905	112,244	116,610	34	35
Chemists	6,907	-277	-68	-4	-1
Draftsmen	13,900	4,507	7,076	32	51
Engineers, electrical	8,491	2,525	3,517	30	41
Nurses, professional	29,944	10,667	10,416	36	35
Technicians, medical and dental	4,983	2,689	3,093	54	62
Managers, officials and proprietors, except farm	303,731	-13,346	-2,492	-4	-1
Clerical and kindred	491,289	99,883	110,509	20	22
Bank tellers	4,254	4,123	3,374	97	79
Cashiers	13,379	13,285	12,438	99	93
Office machine operators	8,085	10,761	8,084	133	100
Secretaries, stenographers, and typists	108,870	32,652	25,109	30	23
Salesworkers	271,238	35,602	28,982	13	11
Craftsmen, foremen, and kindred	624,199	-5,911	3,279	-1	1
Bakers	10,932	-1,626	-587	-15	-5
Brickmasons, stonemasons and tilersettters	14,651	-372	-333	-3	-2
Carpenters	46,673	-7,031	-10,059	-15	-22
Compositors and typesetters	13,686	-372	334	-3	2
Electricians	25,141	-1,783	-2,078	-7	-8
Linemen	13,142	3,249	2,171	25	17
Machinists	51,880	-10,023	-5,183	-19	-10
Mechanics and repairmen, automobile	41,363	2,075	-282	5	-1
Mechanics and repairmen, radio and TV	5,371	454	484	8	9
Millwrights	5,849	225	392	4	7
Painters, construction and maintenance	23,028	-3,620	-4,387	-16	-19
Plumbers and pipefitters	22,926	-39	-430	0	-2
Tool and diemakers and setters	9,508	1,516	1,020	16	11
Operatives and kindred	1,047,050	-111,722	-102,099	-11	-10
Attendants, auto service and parking	13,616	4,552	4,973	33	37
Bus, truck and tractor drivers	107,946	3,427	8,118	3	8
Laundry and drycleaning operatives	23,821	-3,089	-3,645	-13	-15
Meatcutters	12,097	-409	-977	-3	-8
Welders and flame-cutters	25,804	8,957	6,781	35	26
Service workers, except private household	283,151	55,801	44,838	20	16
Practical nurses	6,187	6,938	3,554	112	57
Waiters and waitresses	43,860	6,868	8,617	16	20
Laborers, except farm and mine	304,302	-64,328	-54,699	-21	-18

Table 7. Projections and actual employment changes in Ohio, by selected occupation, 1950-60

Occupation	Employment				
	1950	1960		Percent change 1950-60	
		Actual	Projected	Actual	Projected
Professional, technical, and kindred	263,202	118,300	131,738	45	50
Chemists	5,020	334	351	7	7
Draftsmen	9,870	4,887	6,211	50	63
Engineers, electrical	6,288	2,328	4,588	37	73
Nurses, professional	20,244	9,480	10,263	47	51
Technicians, medical and dental	3,543	2,800	2,794	79	79
Managers, officials and proprietors, except farm	25,317	8,735	16,129	35	64
Clerical and kindred	396,064	105,589	113,689	27	29
Bank tellers	3,485	3,902	3,312	112	95
Cashiers	13,394	12,832	14,030	96	105
Office machine operators	9,589	7,506	10,066	78	105
Secretaries, stenographers, and typists	88,470	30,724	26,284	35	30
Salesworkers	221,682	34,883	40,801	16	18
Craftsmen, foremen, and kindred	506,537	31,758	48,039	6	9
Bakers	6,933	-968	-423	-14	-6
Brickmasons, stonemasons and tilesetters	9,824	1,929	1,161	20	12
Carpenters	38,043	-3,324	-3,960	-9	-10
Compositors and typesetters	11,080	-915	634	-8	6
Electricians	19,081	1,224	1,493	6	8
Linemen	10,760	2,327	2,975	22	28
Machinists	47,731	-6,545	-4,585	-14	-10
Mechanics and repairmen, automobile	33,700	1,271	2,248	4	7
Mechanics and repairmen, radio and TV	4,073	723	707	18	17
Millwrights	7,432	94	1,020	1	14
Painters, construction and maintenance	19,394	-2,756	-1,737	-14	-9
Plumbers and pipefitters	15,268	1,342	1,565	9	10
Tool and diemakers and setters	18,011	3,657	1,621	20	9
Operatives and kindred	705,773	25,601	48,026	4	7
Attendants, auto service and parking	13,151	3,815	5,037	29	38
Bus, truck and tractor drivers	84,626	6,291	14,962	7	18
Laundry and dry cleaning operatives	20,426	-2,228	-2,808	-11	-14
Meatcutters	9,389	559	181	6	2
Welders and flame-cutters	25,416	4,221	7,379	17	29
Service workers, except private household	230,381	54,160	60,901	24	26
Practical nurses	6,380	5,235	4,905	82	77
Waiters and waitresses	38,273	9,039	9,479	24	25
Laborers, except farm and mine	182,614	-5,387	-20,585	-3	-11

Table 8. Projections and actual employment changes in Georgia, by selected occupation, 1950-60

Occupation	Employment				
	1950	1960		Percent change 1950-60	
		Actual	Projected	Actual	Projected
Professional, technical, and kindred	78,035	39,592	37,493	51	48
Chemists	526	200	84	38	16
Draftsmen	956	983	836	103	87
Engineers, electrical	359	1,509	237	420	66
Nurses, professional	5,333	3,641	2,036	68	38
Technicians, medical and dental	1,326	1,213	822	91	62
Managers, officials and proprietors, except farm	89,497	25,738	15,782	29	18
Clerical and kindred	107,718	54,557	55,460	51	51
Bank tellers	886	1,295	1,149	146	130
Cashiers	4,486	4,076	5,657	91	126
Office machine operators	1,620	2,847	2,492	176	154
Secretaries, stenographers, and typists	23,419	15,114	11,233	65	48
Salesworkers	74,807	17,084	23,265	23	31
Craftsmen, foremen, and kindred	128,438	32,900	35,081	26	27
Bakers	1,458	17	286	1	20
Brickmasons, stonemasons and tilesetters	4,160	1,323	918	32	22
Carpenters	22,444	-1,945	-859	-9	-4
Compositors and typesetters	1,966	588	420	30	21
Electricians	4,494	1,593	1,279	35	28
Linemen	3,619	1,559	1,324	43	37
Machinists	5,493	998	871	18	16
Mechanics and repairmen, automobile	14,865	1,495	5,549	10	37
Mechanics and repairmen, radio and TV	1,182	931	623	79	53
Millwrights	397	197	50	50	13
Painters, construction and maintenance	7,766	-46	30	-1	0
Plumbers and pipefitters	4,050	602	897	13	22
Tool and diemakers and setters	193	644	184	334	95
Operatives and kindred	248,211	46,848	44,573	19	18
Attendants, auto service and parking	5,024	4,041	3,259	80	65
Bus, truck and tractor drivers	35,058	10,793	12,235	31	35
Laundry and dry cleaning operatives	11,988	-1,452	-1,629	-12	-14
Meatcutters	2,549	330	200	13	8
Welders and flame-cutters	2,513	2,578	1,817	103	72
Service workers, except private household	79,282	27,605	22,187	35	28
Practical nurses	3,249	1,364	410	42	13
Waiters and waitresses	9,926	3,446	3,254	35	33
Laborers, except farm and mine	93,919	-8,069	-4,139	-9	-4

Table 9. Projections and actual employment changes in Virginia, by selected occupation, 1950-60

Occupation	Employment				
	1950	1960		Percent change 1950-60	
		Actual	Projected	Actual	Projected
Professional, technical, and kindred	94,723	59,006	53,257	62	56
Chemists	1,219	152	176	12	14
Draftsmen	2,443	1,182	1,614	48	66
Engineers, electrical	2,321	2,173	1,343	94	58
Nurses, professional	7,082	4,795	3,593	68	51
Technicians, medical and dental	1,216	1,183	964	97	79
Managers, officials and proprietors, except farm	89,308	16,989	15,568	19	17
Clerical and kindred	129,057	59,177	54,855	46	43
Bank tellers	1,073	1,644	1,266	153	118
Cashiers	4,228	5,120	5,239	121	124
Office machine operators	1,767	2,289	2,215	130	125
Secretaries, stenographers, and typists	33,926	20,422	13,754	60	41
Salesworkers	72,000	21,967	23,750	31	33
Craftsmen, foremen, and kindred	152,022	25,527	31,308	17	21
Bakers	1,400	-71	27	-5	2
Brickmasons, stonemasons and tilesetters	4,007	1,401	495	35	12
Carpenters	23,696	-2,736	-1,589	-12	-7
Compositors and typesetters	2,395	388	689	16	29
Electricians	7,402	1,048	1,467	14	20
Linemen	4,259	1,699	1,764	40	41
Machinists	7,837	223	258	3	3
Mechanics and repairmen, automobile	13,964	1,038	1,931	7	14
Mechanics and repairmen, radio and TV	1,346	884	699	66	52
Millwrights	774	94	174	12	22
Painters, construction and maintenance	9,472	225	-265	2	-3
Plumbers and pipefitters	6,686	1,095	1,365	16	20
Tool and diemakers and setters	259	142	143	55	55
Operatives and kindred	223,314	17,585	23,072	8	10
Attendants, auto service and parking	4,912	3,807	2,556	78	52
Bus, truck and tractor drivers	37,529	4,587	10,603	12	28
Laundry and drycleaning operatives	10,114	-1,014	-1,185	-10	-12
Meatcutters	2,191	456	222	21	10
Welders and flame-cutters	3,339	2,032	2,561	61	77
Service workers, except private household	75,259	26,267	24,441	35	32
Practical nurses	3,220	740	1,286	23	40
Waiters and waitresses	12,296	2,937	4,433	24	36
Laborers, except farm and mine	87,917	-32,669	-6,924	-37	-8

Table 10. Projections and actual employment changes in West Virginia by selected occupation, 1950-60

Occupation	Employment				
	1950	1960		Percent change 1950-60	
		Actual	Projected	Actual	Projected
Professional, technical, and kindred	45,813	9,777	10,629	21	23
Chemists	927	179	44	19	5
Draftsmen	699	127	249	18	36
Engineers, electrical	673	49	93	7	14
Nurses, professional	3,614	910	1,342	25	37
Technicians, medical and dental	610	553	375	91	61
Managers, officials and proprietors, except farm	46,427	-5,241	-3,766	-11	-8
Clerical and kindred	53,104	5,885	7,822	11	15
Bank tellers	467	208	338	45	72
Cashiers	2,204	1,577	1,940	72	88
Office machine operators	565	669	479	118	85
Secretaries, stenographers, and typists	10,354	2,599	1,222	25	12
Saleworkers	38,715	1,302	2,090	3	5
Craftsmen, foremen, and kindred	90,537	-9,661	-6,641	-11	-7
Bakers	802	-241	-150	-30	-19
Brickmasons, stonemasons and tilers	1,808	-268	-165	-15	-9
Carpenters	9,130	-2,795	-2,622	-31	-29
Compositors and typesetters	934	49	28	5	3
Electricians	6,480	-1,231	-1,146	-19	-18
Linemen	1,937	167	402	9	21
Machinists	4,584	-1,388	-933	-30	-20
Mechanics and repairmen, automobile	6,556	-557	-571	-9	-9
Mechanics and repairmen, radio and TV	436	450	211	103	48
Millwrights	980	193	105	20	11
Painters, construction and maintenance	3,109	-637	-760	-20	-24
Plumbers and pipefitters	3,466	-179	-137	-5	-4
Tool and diemakers and setters	330	54	29	16	9
Operatives and kindred	195,118	-66,320	-67,642	-34	-35
Attendants, auto service and parking	2,642	1,146	1,118	43	42
Bus, truck and tractor drivers	21,332	-2,376	109	-11	1
Laundry and dry cleaning operatives	3,817	-803	-1,092	-21	-29
Meatcutters	1,275	-81	-143	-6	-11
Welders and flame-cutters	2,816	426	544	15	19
Service workers, except private household	36,590	5,303	4,300	14	12
Practical nurses	1,059	833	509	79	48
Waiters and waitresses	7,164	124	543	2	8
Laborers, except farm and mine	39,744	-6,507	-9,225	-16	-23

Table 11. Projections and actual employment changes in Vermont, by selected occupation, 1950-60

Occupation	Employment				
	1950	1960		Percent change 1950-60	
		Actual	Projected	Actual	Projected
Professional, technical, and kindred	11,745	3,944	3,957	34	34
Chemists	53	-11	-4	-21	-8
Draftsmen	334	67	208	20	62
Engineers, electrical	136	11	65	8	48
Nurses, professional	1,470	190	567	13	39
Technicians, medical and dental	155	161	97	104	63
Managers, officials and proprietors, except farm	11,786	-72	523	-1	4
Clerical and kindred	13,967	3,046	3,505	22	25
Bank tellers	210	150	174	71	83
Cashiers	405	423	424	104	105
Office machine operators	86	125	90	145	105
Secretaries, stenographers, and typists	2,834	1,154	604	41	21
Salesworkers	8,077	1,071	1,307	13	16
Craftsmen, foremen, and kindred	17,571	979	915	6	5
Bakers	199	-21	-18	-11	-9
Brickmasons, stonemasons and tilers	186	9	30	5	16
Carpenters	2,314	-155	-161	-7	-7
Compositors and typesetters	406	-13	66	-3	16
Electricians	556	-7	30	-1	5
Linemen	528	118	68	22	13
Machinists	1,145	240	16	21	1
Mechanics and repairmen, automobile	2,085	7	-338	0	-16
Mechanics and repairmen, radio and TV	107	119	29	111	27
Millwrights	116	3	2	3	2
Painters, construction and maintenance	1,006	-245	-54	-24	-5
Plumbers and pipefitters	728	-28	85	-4	12
Tool and diemakers and setters	163	114	42	70	26
Operatives and kindred	25,985	-676	-649	-3	-3
Attendants, auto service and parking	493	190	254	39	52
Bus, truck and tractor drivers	3,772	280	441	7	12
Laundry and dry cleaning operatives	595	4	-52	1	-9
Meatcutters	274	93	1	34	0
Welders and flame-cutters	194	89	97	46	50
Service workers, except private household	9,331	2,887	2,165	31	23
Practical nurses	452	227	211	50	47
Waiters and waitresses	1,574	641	583	41	37
Laborers, except farm and mine	8,174	-1,550	-1,443	-19	-18

Table 12. Average deviation of test results from actual employment in 9 metropolitan areas¹

SMSA	1950 population	Average percent deviation
Los Angeles-Long Beach ..	4,367,911	10.5
Washington, D.C.	1,464,089	11.2
Baltimore	1,405,399	9.7
Miami	495,084	11.1
Omaha	366,395	11.2
Phoenix	331,770	16.6
Trenton	229,561	13.2
Spokane	221,561	12.7
Baton Rouge	158,236	13.0

¹ Mean difference from 100.0 percent, ignoring sign.

Table 13. Percent difference between actual and estimated change in employment in selected occupations, 1950-60, nine metropolitan areas

Percent Differences	Los Angeles-Long Beach	D.C.-Md. Va.	Balti-more	Mi-ami	Oma-ha	Tren-ton	Spo-kane	Baton Rouge	Phoe-nix
0-10	23	16	24	16	21	19	20	18	3
11-20	5	11	9	7	11	7	9	7	3
21-30	0	3	1	3	1	6	2	1	3
31-40	4	5	1	3	1	3	1	5	2
41-50	1	0	1	3	0	0	3	1	2
51-60	3	0	1	1	1	0	1	3	3
61 and over	1	2	0	4	2	2	1	2	21

Table 14. Projections and actual employment changes in Long Beach-Los Angeles, Calif. by selected occupation, 1950-60

Occupation	Employment				
	1950	1960		Percent change 1950-60	
		Actual	Projected	Actual	Projected
Professional, technical, and kindred	207,196	162,386	173,101	78	84
Chemists	2,266	700	815	31	36
Draftsmen	5,515	7,295	9,013	132	163
Engineers, electrical	4,974	12,330	9,142	248	184
Nurses, professional	16,999	9,978	9,647	59	57
Technicians, medical and dental	3,814	3,706	2,956	97	78
Managers, officials and proprietors, except farm	203,406	47,097	59,484	23	29
Clerical and kindred	253,673	194,590	183,455	77	72
Bank tellers	3,173	3,621	5,457	114	172
Cashiers	10,266	9,780	10,210	95	99
Office machine operators	7,328	11,176	14,004	153	191
Secretaries, stenographers, and typists	53,443	49,407	45,213	78	71
Salesworkers	157,476	54,193	63,513	34	40
Craftsmen, foremen, and kindred	265,659	100,628	114,039	38	43
Bakers	3,907	529	952	14	24
Brickmasons, stonemasons and tilersettters	3,236	1,116	507	34	16
Carpenters	30,604	-4,630	-891	-15	-3
Compositors and typesetters	5,617	1,635	1,381	29	25
Electricians	11,546	3,786	4,124	33	36
Linemen	9,057	3,939	5,011	43	55
Machinists	19,269	14,061	11,268	73	58
Mechanics and repairmen, automobile	19,816	5,008	6,690	25	34
Mechanics and repairmen, radio and TV	3,795	997	2,630	26	69
Millwrights	731	102	521	14	71
Painters, construction and maintenance	16,869	1,347	211	8	1
Plumbers and pipefitters	8,762	2,698	2,119	31	24
Tool and diemakers and setters	6,083	3,040	5,159	50	85
Operatives and kindred	293,627	150,130	158,883	51	54
Attendants, auto service and parking	9,890	5,806	5,015	59	51
Bus, truck and tractor drivers	42,507	14,784	16,265	35	38
Laundry and dry cleaning operatives	13,668	666	291	5	2
Meatcutters	6,206	859	909	14	15
Welders and flame-cutters	8,614	6,555	9,735	76	113
Service workers, except private household	145,119	58,249	58,423	40	40
Practical nurses	6,129	1,678	5,114	27	83
Waiters and waitresses	25,805	8,821	11,286	34	44
Laborers, except farm and mine	78,507	15,918	10,729	20	14

Table 15. Projections and actual employment changes in Washington, D.C., by selected occupation, 1950-60

Occupation	Employment				
	1950	1960		Percent change 1950-60	
		Actual	Projected	Actual	Projected
Professional, technical, and kindred	98,519	52,820	49,991	54	51
Chemists	1,344	531	26	40	2
Draftsmen	3,093	807	1,370	26	44
Engineers, electrical	3,224	2,260	1,224	70	38
Nurses, professional	5,415	2,304	1,882	43	35
Technicians, medical and dental	1,367	1,031	769	75	56
Managers, officials and proprietors, except farm	50,960	19,152	7,411	38	15
Clerical and kindred	170,756	23,754	41,820	14	24
Bank tellers	737	640	588	87	80
Cashiers	3,198	2,451	3,514	77	110
Office machine operators	4,075	1,059	3,609	26	89
Secretaries, stenographers, and typists	54,304	12,713	13,323	23	25
Saleworkers	39,253	10,345	12,598	26	32
Craftsmen, foremen, and kindred	73,107	7,809	9,413	11	13
Bakers	1,085	-172	92	-16	8
Brickmasons, stonemasons and tilers	3,392	-314	242	-9	7
Carpenters	8,081	-1,236	-1,095	-15	-14
Compositors and typesetters	3,228	24	-307	1	-10
Electricians	3,360	125	518	4	15
Linemen	2,984	996	813	33	27
Machinists	4,052	-1,299	-526	-32	-13
Mechanics and repairmen, automobile	5,484	401	19	7	0
Mechanics and repairmen, radio and TV	1,303	-111	364	-9	28
Millwrights	25	12	7	48	28
Painters, construction and maintenance	4,918	353	-201	7	-4
Plumbers and pipefitters	3,732	-48	421	-1	11
Tool and diemakers and setters	285	-49	28	-17	10
Operatives and kindred	54,309	3,621	5,905	7	11
Attendants, auto service and parking	2,517	556	1,040	22	41
Bus, truck and tractor drivers	12,157	1,711	1,937	14	16
Laundry and dry cleaning operatives	5,752	3,138	-719	55	-13
Meatcutters	1,653	32	557	2	34
Welders and flame-cutters	720	268	256	37	36
Service workers, except private household	62,940	9,043	12,349	14	20
Practical nurses	1,844	686	888	37	48
Waiters and waitresses	8,491	401	331	5	4
Laborers, except farm and mine	29,346	-2,340	-262	-8	-1

Table 16. Projections and actual employment changes in Baltimore, Md., by selected occupation, 1950-60

Occupation	Employment				
	1950	1960		Percent change 1950-60	
		Actual	Projected	Actual	Projected
Professional, technical, and kindred	48,258	25,817	24,881	53	52
Chemists	993	-116	23	-12	2
Draftsmen	1,825	1,002	1,133	55	62
Engineers, electrical	1,430	1,927	1,158	135	81
Nurses, professional	4,073	1,924	1,637	47	40
Technicians, medical and dental	843	692	658	82	78
Managers, officials and proprietors, except farm	47,873	381	2,186	1	5
Clerical and kindred	79,297	28,437	27,445	36	35
Bank tellers	603	688	586	114	97
Cashiers	2,389	2,622	2,260	110	95
Office machine operators	2,109	2,058	2,400	98	114
Secretaries, stenographers, and typists	18,642	6,767	6,132	36	33
Saleworkers	39,577	8,042	5,557	20	14
Craftsmen, foremen, and kindred	87,587	7,036	11,038	8	13
Bakers	1,496	-256	-32	-17	-2
Brickmasons, stonemasons and tilesetters	2,427	-113	234	-5	10
Carpenters	7,754	-335	-1,165	-4	-15
Compositors and typesetters	2,358	-145	0	-6	0
Electricians	3,891	359	395	9	10
Linemen	1,980	706	553	36	28
Machinists	6,495	-1,062	-39	-16	-1
Mechanics and repairmen, automobile	5,134	659	773	13	15
Mechanics and repairmen, radio and TV	1,120	-133	267	-12	24
Millwrights	524	-90	156	-17	30
Painters, construction and maintenance	4,174	-127	-538	-3	-13
Plumbers and pipefitters	4,095	-267	316	-7	8
Tool and diemakers and setters	1,205	178	216	15	18
Operatives and kindred	104,542	9,965	11,986	10	11
Attendants, auto service and parking	1,747	1,038	1,135	59	65
Bus, truck and tractor drivers	12,242	2,343	1,320	19	11
Laundry and dry cleaning operatives	4,917	-765	-726	-16	-15
Meatcutters	1,670	-305	-186	-18	-11
Welders and flame-cutters	3,484	779	1,027	22	29
Service workers, except private household	46,569	9,064	7,137	19	15
Practical nurses	1,421	231	521	16	37
Waiters and waitresses	6,821	648	1,286	10	19
Laborers, except farm and mine	40,263	-5,552	-3,470	-14	-9

Table 17. Projections and actual employment changes in Miami, Fla, by selected occupation, 1950-60

Occupation	Employment				
	1950	1960		Percent change 1950-60	
		Actual	Projected	Actual	Projected
Professional, technical, and kindred	19,501	19,724	19,542	101	100
Chemists	63	71	44	113	70
Draftsmen	262	497	397	190	152
Engineers, electrical	293	162	298	55	102
Nurses, professional	1,939	1,765	2,149	91	111
Technicians, medical and dental	525	538	721	102	137
Managers, officials and proprietors, except farm	28,213	12,198	13,102	43	46
Clerical and kindred	25,904	28,019	29,199	108	113
Bank tellers	251	550	686	219	273
Cashiers	1,933	1,996	3,296	103	171
Office machine operators	274	897	687	327	251
Secretaries, stenographers, and typists	6,315	6,883	6,656	109	105
Saleworkers	19,369	13,660	14,137	71	73
Craftsmen, foremen, and kindred	30,038	16,939	16,799	56	56
Bakers	539	283	277	53	51
Brickmasons, stonemasons and tilers	996	-29	176	-3	18
Carpenters	4,763	-551	-31	-12	-1
Compositors and typesetters	577	101	198	18	34
Electricians	1,378	360	572	26	42
Linemen	1,127	703	1,225	62	109
Machinists	522	510	393	98	75
Mechanics and repairmen, automobile	2,409	1,470	1,614	61	67
Mechanics and repairmen, radio and TV	468	536	545	115	116
Millwrights	8	8	8	100	100
Painters, construction and maintenance	2,110	806	95	38	5
Plumbers and pipefitters	891	87	202	10	23
Tool and diemakers and setters	65	232	135	357	208
Operatives and kindred	21,713	18,734	17,702	86	82
Attendants, auto service and parking	1,146	735	1,050	64	92
Bus, truck and tractor drivers	4,903	3,173	2,927	65	60
Laundry and dry cleaning operatives	2,551	310	489	12	19
Meatcutters	751	249	336	33	45
Welders and flame-cutters	281	577	393	205	140
Service workers, except private household	27,368	15,005	15,019	55	55
Practical nurses	591	429	501	73	85
Waiters and waitresses	5,805	2,069	2,131	36	37
Laborers, except farm and mine	11,331	3,483	3,777	31	33

Table 18. Projections and actual employment changes in Omaha, Nebraska, by selected occupation, 1950-60

Occupation	Employment				
	1950	1960		Percent change 1950-60	
		Actual	Projected	Actual	Projected
Professional, technical, and kindred	13,679	5,572	6,656	41	49
Chemists	121	28	4	23	3
Draftsmen	322	137	351	43	109
Engineers, Electrical	274	118	261	43	95
Nurses, professional	1,384	673	853	49	62
Technicians, medical and dental	272	232	245	85	90
Managers, officials and proprietors, except farm	14,236	1,145	631	8	4
Clerical and kindred	27,131	6,449	7,736	24	29
Bank tellers	145	146	127	101	88
Cashiers	749	848	632	113	84
Office machine operators	900	691	872	77	97
Secretaries, stenographers, and typists	6,044	1,780	1,766	29	29
Salesworkers	12,571	1,030	1,962	8	16
Craftsmen, foremen, and kindred	20,192	2,862	3,307	14	16
Bakers	420	-60	-52	-14	-12
Brickmasons, stonemasons and tilersettters	453	121	105	27	23
Carpenters	1,980	32	-47	2	-2
Compositors and typesetters	527	-21	47	-4	9
Electricians	792	213	144	27	18
Linemen	612	339	320	55	52
Machinists	1,032	66	15	6	1
Mechanics and repairmen, automobile	1,925	211	185	11	10
Mechanics and repairmen, radio and TV	158	99	100	63	63
Millwrights	98	5	6	5	6
Painters, construction and maintenance	1,194	-208	-14	-17	-1
Plumbers and pipefitters	667	208	108	31	16
Tool and diemakers and setters	32	167	22	522	69
Operatives and kindred	21,823	5,500	3,425	25	16
Attendants, auto service and parking	557	361	301	65	54
Bus, truck and tractor drivers	4,754	184	279	4	6
Laundry and dry cleaning operatives	1,188	-143	-209	-12	-18
Meatcutters	492	-78	-4	-16	-1
Welders and flame-cutters	708	249	375	35	53
Service workers, except private household	13,396	3,154	3,338	24	25
Practical nurses	314	228	341	73	109
Waiters and waitresses	2,300	316	364	14	16
Laborers, except farm and mine	11,845	-3,252	-1,744	-27	-15

Table 19. Projections and actual employment changes in Trenton, New Jersey, by selected occupation, 1950-60

Occupation	Employment				
	1950	1960		Percent change 1950-60	
		Actual	Projected	Actual	Projected
Professional, technical, and kindred	10,052	5,115	4,539	51	45
Chemists	181	78	15	43	8
Draftsmen	302	201	161	67	53
Engineers, electrical	210	160	132	76	63
Nurses, professional	810	366	411	45	51
Technicians, medical and dental	188	52	169	28	90
Managers, officials and proprietors, except farm	8,816	-512	299	-6	3
Clerical and kindred	14,515	3,566	3,967	25	27
Bank tellers	108	47	74	44	69
Cashiers	337	201	286	60	85
Office machine operators	429	282	380	66	89
Secretaries, stenographers, and typists	4,072	1,365	1,031	34	25
Salesworkers	5,856	685	659	12	11
Craftsmen, foremen, and kindred	13,482	1,119	768	8	6
Bakers	250	-18	-7	-7	-3
Brickmasons, stonemasons and tilers	415	-10	83	-2	20
Carpenters	1,113	18	-102	2	-9
Compositors and typesetters	299	39	40	13	13
Electricians	505	53	38	11	8
Linemen	304	186	195	61	64
Machinists	1,141	-298	-215	-26	-19
Mechanics and repairmen, automobile	909	22	-58	2	-6
Mechanics and repairmen, radio and TV	173	-47	18	-27	10
Millwrights	92	-10	9	-11	10
Painters, construction and maintenance	579	54	-13	9	-2
Plumbers and pipefitters	519	139	67	27	13
Tool and diemakers and setters	428	69	-88	16	-21
Operatives and kindred	25,612	-3,159	-3,411	-12	-13
Attendants, auto service and parking	284	47	83	17	29
Bus, truck and tractor drivers	2,269	132	68	6	3
Laundry and dry cleaning operatives	833	-113	-99	-14	-12
Meatcutters	324	-52	-53	-16	-16
Welders and flame-cutters	312	114	30	37	10
Service workers, except private household	8,005	2,090	1,855	26	23
Practical nurses	187	-7	142	-4	76
Waiters and waitresses	964	365	236	38	24
Laborers, except farm and mine	5,927	-910	-859	-15	-14

Table 20. Projections and actual employment changes in Spokane, Washington, by selected occupation, 1950-60

Occupation	Employment				
	1950	1960		Percent change 1950-60	
		Actual	Projected	Actual	Projected
Professional, technical, and kindred	7,909	3,351	3,788	42	48
Chemists	62	2	4	3	6
Draftsmen	104	64	66	62	63
Engineers, electrical	167	39	62	23	37
Nurses, professional	873	425	315	49	36
Technicians, medical and dental	200	92	133	46	67
Managers, officials and proprietors, except farm	9,280	1,664	433	18	5
Clerical and kindred	11,492	3,709	3,795	32	33
Bank tellers	131	142	113	108	86
Cashiers	492	423	486	86	99
Office machine operators	238	238	278	100	117
Secretaries, stenographers and typists	2,808	710	891	25	32
Salesworkers	7,808	893	1,451	11	19
Craftsmen, foremen, and kindred	12,245	511	1,113	4	9
Bakers	227	-49	-48	-22	-21
Brickmasons, stonemasons and tilersettters	161	20	15	12	9
Carpenters	1,744	-436	-203	-25	-12
Compositors and typesetters	202	79	-15	39	-7
Electricians	523	-6	45	-1	9
Linemen	471	84	73	18	16
Machinists	434	-68	-23	-16	-5
Mechanics and repairmen, automobile	1,182	-83	52	-7	16
Mechanics and repairmen, radio and TV	78	100	44	128	56
Millwrights	104	-22	23	-21	22
Painters, construction and maintenance	669	-166	-63	-25	-9
Plumbers and pipefitters	353	28	23	8	7
Tool and diemakers and setters	21	-1	7	-5	33
Operatives and kindred	11,598	295	1,133	3	10
Attendants, auto service and parking	425	164	181	39	43
Bus, truck and tractor drivers	2,610	-25	222	-1	9
Laundry and dry cleaning operatives	691	-133	-147	-19	-21
Meatcutters	293	-105	29	-36	10
Welders and flame-cutters	263	115	130	44	49
Service workers, except private household	7,990	1,907	2,545	24	32
Practical nurses	329	229	403	70	122
Waiters and waitresses	1,464	118	79	8	5
Laborers, except farm and mine	4,626	-416	-518	-9	-11

Table 21. Projections and actual employment changes in Baton Rouge, Louisiana, by selected occupation, 1950-60

Occupation	Employment				
	1950	1960		Percent change 1950-60	
		Actual	Projected	Actual	Projected
Professional, technical, and kindred	6,886	4,952	4,512	72	66
Chemists	262	94	1	36	0
Draftsmen	114	187	109	164	96
Engineers, electrical	104	38	44	37	42
Nurses, professional	384	193	209	50	54
Technicians, medical and dental	80	99	69	124	86
Managers, officials and proprietors, except farm	4,857	3,007	1,464	62	30
Clerical and kindred	7,412	4,367	4,247	59	57
Bank tellers	53	58	75	109	142
Cashiers	371	323	528	87	142
Office machine operators	149	196	205	132	138
Secretaries, stenographers, and typists	2,156	1,267	1,015	59	47
Saleworkers	3,777	1,444	1,721	38	46
Craftsmen, foremen, and kindred	8,779	1,934	2,424	22	28
Bakers	129	-4	8	-3	6
Brickmasons, stonemasons and tilers	254	105	67	41	26
Carpenters	1,198	-120	18	-10	2
Compositors and typesetters	137	26	46	19	34
Electricians	519	114	135	22	26
Linemen	271	134	139	49	51
Machinists	444	-22	-14	-5	-3
Mechanics and repairmen, automobile	585	40	253	7	43
Mechanics and repairmen, radio and TV	57	87	54	153	95
Millwrights	40	6	17	15	43
Painters, construction and maintenance	501	50	16	10	3
Plumbers and pipefitters	872	36	113	4	13
Tool and diemakers and setters	1	-1	0	-100	0
Operatives and kindred	8,894	925	2,043	10	23
Attendants, auto service and parking	336	188	198	56	59
Bus, truck and tractor drivers	1,493	588	542	39	36
Laundry and drycleaning operatives	772	-135	-34	-17	-4
Meatcutters	116	82	19	71	16
Welders and flame-cutters	360	261	99	73	28
Service workers, except private household	5,278	2,651	2,651	50	50
Practical nurses	190	45	59	24	31
Waiters and waitresses	737	185	314	25	43
Laborers, except farm and mine	4,532	45	320	1	7

Table 22. Projections and actual employment changes in Phoenix, Arizona, by selected occupation, 1950-60

Occupation	Employment				
	1950	1960		Percent change 1950-60	
		Actual	Projected	Actual	Projected
Professional, technical, and kindred	5,259	22,701	25,115	432	478
Chemists	16	97	58	606	363
Draftsmen	70	842	637	1,203	910
Engineers, electrical	102	1,001	849	981	832
Nurses, professional	536	1,838	1,634	343	305
Technicians, medical and dental	95	356	355	375	374
Managers, officials and proprietors, except farm	5,653	17,705	20,293	313	359
Clerical and kindred	6,834	26,791	32,251	392	472
Bank tellers	82	459	548	560	668
Cashiers	388	1,982	2,895	511	746
Office machine operators	142	755	1,235	532	870
Secretaries, stenographers, and typists	1,841	6,933	8,090	377	439
Salesworkers	4,209	15,994	15,449	380	367
Craftsmen, foremen, and kindred	4,764	27,335	24,675	574	518
Bakers	100	328	307	328	307
Brickmasons, stonemasons and tilers	131	957	782	731	597
Carpenters	488	3,068	2,218	629	455
Compositors and typesetters	145	430	446	297	308
Electricians	208	1,047	1,088	503	523
Linemen	203	1,080	969	532	477
Machinists	120	1,152	778	960	648
Mechanics and repairmen, automobile	491	2,241	2,136	456	435
Mechanics and repairmen, radio and TV	39	377	208	967	533
Millwrights	6	54	38	900	633
Painters, construction and maintenance	332	1,533	1,440	462	434
Plumbers and pipefitters	158	1,029	869	651	550
Tool and diemakers and setters	43	296	484	688	1,126
Operatives and kindred	4,260	24,783	22,468	582	527
Attendants, auto service and parking	253	1,364	1,541	539	609
Bus, truck and tractor drivers	1,001	5,000	4,224	500	422
Laundry and dry cleaning operatives	386	1,128	987	292	256
Meatcutters	160	453	619	283	387
Welders and flame-cutters	109	963	853	883	783
Service workers, except private household	4,163	14,787	14,838	355	356
Practical nurses	145	443	632	306	436
Waiters and waitresses	763	2,664	2,641	349	346
Laborers, except farm and mine	1,739	9,356	6,982	538	402

Chapter II. Variances in Occupational Death and Retirement Rates⁴ by State

Introduction

For the Nation as a whole, over one-half of all new entrants into the labor force are needed to replace workers who die, retire, or leave the labor force for other reasons. In Volume I, appendix A of TMN, the Bureau presented national annual death and retirement rates, by occupation and by sex, that State agencies could use to compute the overall occupational demand. These rates were calculated by applying age-specific death and retirement rates by sex for the United States to the number of workers in each occupation in the United States in 1960. Thus, the number of losses in each occupation, as a percent of employment in that occupation, provided a national average rate. In addition, Volume I also described and presented examples of how the standard working life table, together with State occupational age distribution information from the decennial census, might be used to develop occupational death and retirement rates for the State.

During the past 3 years since the release of TMN, many States preparing estimates of job openings from death and retirements have used the national rates. This procedure merely assumes that the State age distribution generally followed the national age distribution for the same occupation. Because of the importance of estimating job openings from this source, especially in States expecting below-average growth, the Bureau examined the accuracy of the attrition estimates based on national age composition of each occupation by comparing them to attrition estimates computed from the actual age composition in each State. An effort also was made to determine whether these differences could be identified easily by examining factors such as the State's median or average age of the working population or the State's median age of a specific occupation, and comparing them to national averages. If consistencies in such relationships could be determined, then national rates could be adjusted to fit the State's particular age differences and thereby localize the death and retirement rates without developing death and retirement

rates by occupation for the State through the regular procedures.

Test Results

As indicated earlier, Volume I of *Tommorrow's Manpower Needs* presented a table of "Estimated Death and Retirement Rates for Selected Occupations, by Sex, for Employed Workers in the United States." (See appendix A.) These rates were based on 1960 labor force participation rates and age distributions. Many States have used these national rates even though general age and occupational age distributions vary from State to State, as does the participation of women. To test the effect of these differences on death and retirement rates, occupational rates were computed for a selected group of States and compared with national average rates. Table 23 presents statistics for each of the States and for the Nation as a whole to provide insight into the possibility of adjusting the national rates to take into account the overall age distribution of States. These data were computed by age distribution for men and women employed in each State as reported in the 1960 Census to which were applied the age-specific separation rates for men and women shown in Volume I, tables 14 and 16.

Although patterns are by no means consistent, data do show that, as expected, death and retirement rates *tend* to diverge from the U.S. rates in the same direction as does the median age. However, the exact shape of the age distribution also plays a part in determining death and retirement rates. For example, Missouri has a higher median age for both men and women than does Nebraska, yet it has *lower* estimated death and retirement rates in both cases. The contradiction results because higher proportion of Nebraska's

⁴ Although the term "death and retirement rates" is used, the data presented here include withdrawals from the labor force for all reasons (e.g., marriage, childbearing, etc.).

employed population is concentrated in the younger and older age groups where withdrawals are higher.

Another factor affecting the combined men and women death and retirement rates is the proportion of employed women. Because of marriage and childbearing, death and retirement rates for women are higher than for men; the higher the percentage of women employed, the higher will be the overall death and retirement rate, excluding other factors. For example, in the District of Columbia where median ages are not far different from the national average, the death and retirement rate is exceeded only by the State of Nebraska. The unusually high rate for the District occurs principally because women account for over 45 percent of the persons employed in D.C. compared to less than 33 percent in the United States as a whole.

Tables 24 and 25 present death and retirement rates for men and women for selected States by occupation, based on the 1960 Census and the age-specific separation rates in Volume I. These data indicate that the use of the U.S. average rate introduces a substantial error in estimating some occupations in some States. For example, the U.S. average for electrical engineers is one-third less than the average in Georgia. Also, not all State death and retirement rates diverge from the national rate in the same direction as do the rates for total employment. For example, although the death and retirement rate for males in West Virginia, based on total employment, exceeds that for the Nation, in only 14 cases have rates for the State been less than for the Nation for the same occupation, and in an additional eight occupations they are equal. Therefore, a procedure that adjusts the annual death and retirement rates for an occupation in the Nation as a whole, either by comparing the median age of all workers in the State with those in the United States, or by computing death and retirement rates in the State for all workers and adjusting occupations, will not produce accurate estimates for every occupation in the State.

The potential implications of using national rather than State death and retirement rates are shown for Pennsylvania in table 28. Based on total employment, the rates for both men and women are equal to the rates

for the Nation as a whole. The first column of table 28 shows estimated deaths and retirements for the 1950-60 decade if national rates had been applied. The second column shows the estimated deaths and retirements when rates were calculated specifically for the State. Columns 3 and 4 show the numeric and percentage differences between the two estimates. Discrepancies range up to 27 percent; differences of 10 percent or more are not uncommon. However, these results are for a State which has death and retirement rates equal to those for the Nation.

Tables 26 and 27 present estimated annual death and retirement rates for men and women by selected occupations for eight SMSA's. Differences in the dispersion of the SMSA rates from the national averages were similar to dispersions shown by State rates. Although SMSA's in some instances have a smaller population than States, the range of dispersion does not appear significantly different.

Test conclusions

In general, the test results appeared to indicate that for some States the use of national occupational rates generally will result in acceptable estimates of attrition. However, in others, especially those having below-average growth rates or above-average median age, the development of specific rates appears warranted and may significantly improve estimates of replacements. Although there generally appears to be a relationship between individual States and the Nation in median age and in death and retirement rates, this relationship is by no means highly predictable because of other factors, such as the age distribution and the participation of women in the labor force. No simple procedure exists for adjusting national rates to account for differences among States. Since more accurate estimates can be made easily by repetitive calculations and applying age-specific death and retirement rates to the actual age composition of the members of each occupation in the State, by sex, this procedure is recommended. It must be recognized that this procedure has limitations as described.

Table 23. Comparison of estimated annual death and retirement rates by State, 1960

State	Employed males		Employed females		Females as a percent of employed population	Combined annual death and retirement rate
	Median age	Annual death and retirement rate	Median age	Annual death and retirement rate		
United States	40.6	.0196	40.4	.0479	32.75	.0289
Alabama	39.7	.0178	39.1	.0452	32.85	.0268
Alaska	38.5	.0135	36.1	.0417	36.56	.0238
Arizona	38.6	.0154	39.4	.0451	30.88	.0246
Arkansas	41.7	.0216	41.0	.0472	30.18	.0293
California	40.1	.0178	40.4	.0459	33.02	.0271
Colorado	39.6	.0187	39.6	.0478	32.46	.0281
Connecticut	41.2	.0197	41.6	.0477	34.17	.0293
Delaware	40.0	.0181	39.9	.0464	33.24	.0275
District of Columbia	40.4	.0199	41.1	.0475	45.67	.0325
Florida	39.9	.0182	39.9	.0447	34.94	.0275
Georgia	38.9	.0168	38.7	.0450	35.79	.0269
Hawaii	40.5	.0157	36.9	.0407	34.65	.0244
Idaho	40.4	.0202	40.4	.0478	28.69	.0281
Illinois	41.1	.0207	41.1	.0491	32.88	.0301
Indiana	40.1	.0196	40.4	.0488	31.13	.0287
Iowa	41.1	.0227	41.6	.0534	30.26	.0320
Kansas	41.2	.0228	41.5	.0511	31.18	.0316
Kentucky	40.6	.0202	40.2	.0484	29.41	.0285
Louisiana	39.4	.0165	39.1	.0451	31.44	.0255
Maine	41.1	.0213	42.2	.0505	33.42	.0310
Maryland	40.0	.0176	39.8	.0452	33.28	.0268
Massachusetts	41.3	.0214	42.0	.0509	36.14	.0312
Michigan	40.2	.0183	39.4	.0475	30.39	.0272
Minnesota	40.8	.0215	40.5	.0536	31.88	.0317
Mississippi	40.7	.0207	39.5	.0464	33.61	.0293
Missouri	41.8	.0224	41.7	.0500	32.97	.0315
Montana	40.9	.0213	40.8	.0498	29.43	.0296
Nebraska	41.6	.0244	41.6	.0538	30.92	.0335
Nevada	41.0	.0191	39.5	.0427	33.06	.0269
New Hampshire	41.4	.0212	42.0	.0495	36.26	.0315
New Jersey	41.5	.0198	41.1	.0468	32.52	.0286
New Mexico	38.1	.0155	37.7	.0463	29.87	.0247
New York	42.0	.0217	41.7	.0493	34.39	.0312
North Carolina	38.8	.0167	38.1	.0444	35.07	.0264
North Dakota	41.0	.0214	39.5	.0525	28.15	.0302
Ohio	40.3	.0194	40.3	.0487	31.07	.0285
Oklahoma	41.2	.0211	41.6	.0484	31.29	.0296
Oregon	41.7	.0171	42.0	.0489	31.83	.0299
Pennsylvania	41.4	.0200	40.6	.0483	32.52	.0292
Rhode Island	41.6	.0205	41.6	.0476	35.88	.0302
South Carolina	38.3	.0157	38.1	.0442	36.65	.0261
South Dakota	41.3	.0234	40.8	.0530	29.08	.0320
Tennessee	40.1	.0189	39.2	.0463	32.99	.0279
Texas	39.8	.0188	39.7	.0465	31.68	.0276
Utah	38.3	.0175	38.0	.0509	29.69	.0274
Vermont	41.1	.0216	42.7	.0514	32.75	.0314
Virginia	39.8	.0179	39.1	.0460	33.66	.0273
Washington	40.9	.0196	41.2	.0481	31.80	.0287
West Virginia	41.2	.0205	40.7	.0478	28.44	.0275
Wisconsin	40.9	.0209	40.8	.0506	31.14	.0295
Wyoming	39.8	.0193	40.1	.0474	29.01	.0274

SOURCE: 1960 Census of Population.

Table 24. Annual death and retirement rates for men, United States and selected States, by occupation, 1950-60

Occupation	United States	California	Ohio	Pennsylvania	Georgia	Virginia	West Virginia	Vermont
Total	2.0	1.8	1.9	2.0	1.7	1.8	2.1	2.2
Professional, technical and kindred	1.6	1.4	1.7	1.7	1.6	1.5	1.9	1.8
Chemists	1.1	1.0	1.2	1.2	0.8	0.9	0.8	0.3
Draftsmen	0.8	0.9	1.0	1.1	0.7	0.9	1.0	1.3
Engineers, electrical	1.0	0.8	1.1	1.2	1.5	1.1	1.5	1.7
Technicians, medical and dental	1.1	1.4	1.1	1.1	1.0	0.9	1.4	1.9
Managers, officials and proprietors, except farm	2.5	2.2	2.5	2.6	2.2	2.3	2.9	2.8
Clerical and kindred	1.8	1.6	1.8	1.9	1.5	1.6	1.8	2.2
Salesworkers	2.0	2.0	1.9	2.0	1.7	1.7	1.9	1.9
Craftsmen, foremen, and kindred	1.9	1.8	1.9	2.0	1.5	1.6	1.9	2.1
Bakers	2.1	1.9	1.9	1.9	2.3	1.1	1.3	1.8
Brickmasons, stonemasons and tilesetters	1.5	1.4	1.4	1.6	1.2	1.2	1.3	2.0
Carpenters	2.3	2.0	2.1	2.2	2.1	2.2	2.6	2.8
Compositors and typesetters	1.9	2.1	2.0	2.0	1.5	1.4	1.9	1.7
Electricians	1.6	1.8	1.7	1.9	1.0	1.4	1.5	1.7
Linemen	0.9	0.7	0.9	1.1	0.6	0.7	0.8	0.9
Machinists	2.0	1.8	1.9	2.1	1.5	1.9	2.2	1.9
Mechanics and repairmen, automobile	1.3	1.3	1.3	1.4	1.0	1.1	1.2	1.4
Mechanics and repairmen, radio and TV	0.9	1.0	1.0	1.0	1.7	0.7	0.9	1.3
Millwrights	1.9	1.8	1.9	1.9	1.1	1.7	1.7	2.9
Painters, construction and maintenance	2.5	2.4	2.5	2.6	2.2	2.2	2.6	3.0
Plumbers and pipefitters	1.8	1.8	1.9	2.0	1.3	1.4	1.8	2.3
Tool and diemakers and setters	1.8	1.7	1.7	1.9	1.3	1.5	1.6	1.1
Operatives and kindred	1.5	1.3	1.5	1.6	1.1	1.2	1.4	1.6
Attendants, auto service and parking	1.0	0.9	1.0	1.0	0.9	0.8	1.0	1.3
Bus, truck and tractor drivers	1.2	1.1	1.3	1.3	1.0	1.0	1.0	1.1
Laundry and dry cleaning operatives	2.1	2.1	2.2	2.4	1.3	1.5	1.7	1.8
Meatcutters	2.0	1.7	2.1	2.1	1.3	1.3	1.7	2.2
Welders and flame-cutters	1.2	1.3	1.2	1.3	0.9	1.1	1.2	1.7
Service workers, except private household	2.7	2.4	3.0	3.1	2.2	2.2	2.9	3.0
Waiters and waitresses	1.9	2.0	2.2	2.2	0.9	1.4	1.9	0.9
Laborers, except farm and mine	1.7	1.7	1.7	1.9	1.5	1.6	1.6	2.0

Table 25. Annual death and retirement rates for women, United States and selected States, by occupation, 1950-60

Occupation	United States	California	Ohio	Pennsylvania	Georgia	Virginia	West Virginia	Vermont
Total	4.8	4.6	4.9	4.8	4.5	4.6	4.8	5.1
Professional, technical, and kindred	4.9	4.5	5.1	5.1	4.5	4.7	4.7	5.0
Draftsmen	—	4.0	4.8	4.7	3.8	4.3	4.2	5.1
Nurses, professional	4.6	4.4	4.7	4.8	4.3	4.6	4.4	4.4
Technicians, medical and dental	5.2	4.4	5.7	5.9	5.2	5.3	5.5	6.1
Managers, officials and proprietors, except farm	4.7	4.6	4.7	4.8	4.3	4.4	4.8	5.2
Clerical and kindred	4.9	4.6	5.0	5.1	4.8	4.7	4.9	5.0
Cashiers	4.5	4.2	4.6	4.4	4.6	4.3	4.6	4.5
Office machine operators	5.1	4.8	5.0	5.2	4.9	5.4	4.9	4.8
Secretaries, stenographers and typists	5.1	4.7	5.1	5.4	5.1	5.1	5.3	5.2
Salesworkers	4.8	4.5	4.7	4.7	4.6	4.6	4.6	5.1
Craftsmen, foremen, and kindred	4.3	4.1	4.3	4.3	3.8	4.0	4.5	4.1
Operatives and kindred	4.1	4.0	4.0	4.0	3.9	4.0	4.1	4.3
Laundry and dry cleaning operatives	4.4	4.2	4.3	4.4	4.0	4.2	4.1	5.1
Service workers, except private household	4.7	4.4	4.7	4.7	4.4	4.4	4.6	5.4
Practical nurses	5.6	5.9	5.4	5.2	5.3	5.9	5.4	5.5
Waiters and waitresses	4.3	3.9	4.4	4.2	4.8	4.3	4.6	5.3
Laborers, except farm and mine	4.7	4.7	4.6	4.5	4.6	4.3	4.7	5.1

Table 26. Annual death and retirement rates for men, selected metropolitan areas, by occupation, 1950-60

Occupation	Los Angeles-Long Beach	Wash., D.C.	Baltimore	Miami	Omaha	Trenton	Spokane	Phoenix
Professional, technical, and kindred	1.4	1.6	1.5	1.7	1.7	1.5	1.6	1.2
Chemists	1.0	1.5	1.3	1.5	0.9	0.9	0.8	1.7
Draftsmen	0.9	1.0	1.0	1.2	0.7	0.9	1.2	0.6
Engineers, electrical	0.8	1.1	0.8	0.8	1.0	1.3	1.6	0.8
Technicians, medical and dental	1.3	1.0	1.1	1.3	1.5	1.9	1.5	1.1
Managers, officials and proprietors, except farm	2.2	2.0	2.6	2.4	2.6	2.6	2.4	2.0
Clerical and kindred	1.6	1.4	1.7	1.8	1.9	1.6	1.8	1.4
Salesworkers	2.1	1.7	2.1	2.3	2.0	1.8	1.7	1.7
Craftsmen, foremen, and kindred	1.7	1.7	1.8	1.6	1.9	2.0	2.1	1.4
Bakers	1.9	1.9	2.6	1.9	1.8	1.4	2.0	1.5
Brickmasons, stonemasons and tilers	1.4	1.4	1.3	2.0	1.2	1.8	1.3	1.1
Carpenters	2.0	2.1	2.1	1.8	2.3	1.9	2.2	1.6
Compositors and typesetters	2.0	2.0	1.8	1.8	2.1	2.0	1.7	1.3
Electricians	1.8	1.6	1.4	1.3	1.2	2.1	1.5	1.3
Linemen	0.7	0.8	0.7	0.5	1.1	0.6	0.8	0.6
Machinists	1.6	2.1	1.8	2.0	1.8	2.1	2.7	1.4
Mechanics and repairmen, automobile	1.3	1.0	1.3	1.4	1.4	1.4	1.6	1.2
Mechanics and repairmen, radio and TV	1.0	0.8	1.1	0.8	1.1	0.6	1.1	0.9
Millwrights	1.7	0.7	2.1	2.1	3.3	2.4	2.4	0.6
Painters, construction and maintenance	2.5	2.1	2.5	2.7	2.6	2.5	2.6	1.9
Plumbers and pipefitters	1.7	1.4	1.6	1.7	1.7	2.0	2.7	1.8
Tool and diemakers and setters	1.8	2.1	1.8	2.0	1.0	1.7	2.9	1.2
Operatives and kindred	1.3	1.3	1.4	1.3	1.5	1.6	1.6	1.0
Attendants, auto service and parking	0.9	0.6	1.1	1.3	1.2	1.0	0.8	0.7
Bus, truck and tractor drivers	1.1	1.0	1.1	1.1	1.3	1.5	1.2	0.9
Laundry and dry cleaning operatives	2.2	1.6	1.9	1.8	2.9	1.3	2.7	2.1
Meatcutters	1.9	1.8	2.2	2.2	2.4	1.8	1.7	1.5
Welders and flame-cutters	1.2	1.1	1.2	1.2	1.4	1.2	1.3	1.0
Service workers, except private household	2.4	2.0	2.3	2.0	3.2	2.8	2.9	2.0
Waiters and waitresses	1.8	1.9	2.3	2.1	2.0	1.4	2.7	1.2
Laborers, except farm and mine	1.6	1.5	1.6	1.4	1.7	1.8	1.9	1.4

Table 27. Annual death and retirement rates for women, selected metropolitan areas, by occupation 1950-60

Occupation	Los Angeles-Long Beach	Wash., D.C.	Baltimore	Miami	Omaha	Trenton	Spokane	Phoenix
Professional, technical, and kindred	4.5	4.4	4.8	4.3	5.6	5.1	4.9	4.4
Draftsmen	4.1	4.1	5.1	4.0	4.9	4.8	6.2	3.7
Nurses, professional	4.5	4.6	4.6	4.2	5.2	4.3	4.9	4.1
Technicians, medical and dental	4.3	4.2	5.8	4.7	6.6	5.4	5.3	4.4
Managers, officials and proprietors, except farm	4.6	4.2	4.6	4.7	4.8	4.5	4.6	4.2
Clerical and kindred	4.6	4.6	4.7	4.3	5.2	4.8	4.6	4.3
Cashiers	4.3	4.2	4.4	4.2	4.3	3.9	3.6	4.0
Office machine operators	4.6	4.3	4.8	5.0	6.1	4.0	5.2	5.0
Secretaries, stenographers, and typists	4.7	4.8	5.0	4.4	5.3	5.1	4.6	4.4
Salesworkers	4.8	4.6	4.6	4.4	5.2	4.8	4.5	4.1
Operatives and kindred	4.0	4.0	4.0	4.0	4.5	3.7	4.6	4.1
Laundry and drycleaning operatives	4.2	3.5	3.9	4.4	4.5	4.1	4.5	4.8
Service workers, except private household	4.5	4.3	4.3	4.2	5.2	4.8	4.9	4.3
Practical nurses	6.4	5.0	4.8	5.7	6.6	6.0	5.6	5.2
Waiters and waitresses	3.9	4.0	4.0	3.3	4.5	4.4	4.5	4.0
Laborers, except farm and mine	4.8	4.5	4.7	4.6	4.0	3.8	4.4	4.6

Table 28. Comparison of estimated separations due to death and retirement, using national and State rates for Pennsylvania, by occupation, 1950-60

Occupation	Estimated death and retirement		Error using national rates	
	National rates	State rates	Numeric	Percent
Professional, technical, and kindred	109,949	115,263	-5314	-5
Chemists	745	812	-67	-8
Draftsmen	1,292	1,777	-485	-27
Engineers, electrical	975	1,170	-195	-17
Nurses, professional	15,768	20,814	-5046	-24
Technicians, medical and dental	2,342	2,623	-281	-11
Managers, officials and proprietors, except farm	82,188	85,159	-2971	-3
Clerical and kindred	199,953	208,672	-8719	-4
Cashiers	9,010	8,809	201	2
Office machine operators	6,867	7,002	-135	-2
Secretaries, stenographers, and typists	63,850	67,006	-3156	-5
Salesworkers	87,697	86,630	1067	1
Craftsmen, foremen, and kindred	122,434	128,463	-6029	-5
Bakers	2,125	2,327	-202	-9
Brickmasons, stonemasons and tilers	2,170	2,314	-144	-6
Carpenters	9,926	9,495	431	5
Compositors and typesetters	2,565	2,700	-135	-5
Electricians	3,880	4,607	-727	-16
Linemen	1,329	1,624	-295	-18
Machinists	9,374	9,842	-468	-5
Mechanics and repairmen, automobile	5,512	5,936	-424	-7
Mechanics and repairmen, radio and TV	504	560	-56	-10
Millwrights	1,133	1,133	---	---
Painters, construction and maintenance	5,305	5,517	-212	-4
Plumbers and pipefitters	4,123	4,581	-458	-10
Tool and diemakers and setters	1,848	1,951	-103	-5
Operatives and kindred	225,917	229,888	-3971	-2
Attendants, auto service and parking	1,589	1,589	---	---
Bus, truck and tractor drivers	13,159	14,056	-897	-6
Laundry and dry cleaning operatives	8,091	8,314	-223	-3
Meatcutters	2,379	2,497	-118	-5
Welders and flame-cutters	3,634	3,937	-303	-8
Services workers, except private household	113,522	120,056	-6534	-5
Practical nurses	5,407	5,021	386	8
Waiters and waitresses	19,063	18,533	530	3
Laborers, except farm and mine	49,345	54,377	-5032	-9

Chapter III. Measuring the Relationship Between Changes in Industrial Employment and Changes in Occupational Employment

Many methods may be used to project employment levels for specific occupations. One technique used by the BLS to prepare long-range projections follows a two-step procedure requiring two interrelated determinants of occupational employment change. First, estimates of total manpower requirements for a target year are prepared for a large number of industry sectors covering the entire economy. Second, occupational staffing patterns (i.e., the percent distribution of total employment in an industry by occupation) for each industry are projected to the target year. The occupational staffing patterns then are applied to their corresponding industry projections in each industry among the various occupations. Total projections then are obtained by adding the individual occupational estimates in each industry to an all-industry total.

In this process, both changes in industry employment and occupational structure play an important role in determining the direction and amount of changes in employment levels. However, until this time little empirical evidence has been available regarding the relative effect of the two factors. Generally, manpower analysts felt that over periods as short as a decade, the occupational structure of most industries remained relatively stable, and consequently, changes in industrial employment are the principal determinants of occupational shifts.

The following section examines changes in occupational employment between 1950 and 1960 and attempts to distinguish between the effect of the two factors by holding occupational structures constant. The test procedure applies a set of occupational patterns developed for 1950 and previously used in testing "Method A" to employment levels for their corresponding industries in the 1960 census and sums the resulting occupational employment data to all-industry totals. These estimated changes then were compared to the actual changes for each occupation. The differences represent that share of the total change caused by shifts in the occupational structure of industries between 1950 and 1960.

Total test results are shown in table 29. The first and third columns show occupational employment as reported in the Censuses for 1950 and 1960. Column 2 shows the test employment for each occupation resulting from the application of 1950 occupational structures to the 1960 industry employment estimates. Column 4 shows the estimated percent change in employment from industry growth and column 5 shows the actual change reported by the Census.

If examined separately, the broad occupational groups indicate that industry employment changes were the principal cause of occupational employment shifts during the 1950-60 decade. For example, industry shifts alone seemed to account for 95 percent of employment change in the professional group, 96 percent in the sales group, and most of the change in the craftsmen (105 percent), and operative (117 percent) categories. However, the detailed occupations in each group indicate that the broad group averages are merely masking large offsetting discrepancies among the individual occupations.

Table 30 shows the actual change from the decennial census (column 1) compared to the change from the test i.e., the change in employment due solely to industry growth (column 2). The proportion of total change in each occupation caused by industry employment change is shown in column 3. For example, between 1950 and 1960 only 23 percent of the change in office machine operators (or 38,000 out of 166,000) was explained by changes in industrial employment. Conversely, 77 percent or 128,000 resulted from increases in the relative use of workers within industries.

The effect of industry employment changes on occupational employment varied significantly. Of the 29 specific occupations covered, one-half or 14 were more strongly affected by industry employment shifts, while shifts in occupational structure were dominant in the remaining 15. Furthermore, if industry shifts alone had been used as a predictor, estimates of employment changes for five occupations (bakers, carpenters, machinists, automobile mechanics, and painters) would have

been used as a predictor, estimates of employment stenographers, etc.; brickmasons, stonemasons, etc., and millwrights) did industry shifts alone account for three fourths or more of 1950-60 employment changes.

Although tests were limited, results appear to indicate that for 10 years or longer, shifts in industry employment and changes in occupational structure within

industries were about equal in determining employment changes. Though far from conclusive, the results do raise serious question about developing occupational employment projections by applying current staffing patterns to projections of industry employment. Such a procedure may be adequate for short periods of 1 to 3 years, but may result in significant error over longer periods.

Table 29. Effect of industry growth on employment change, by occupation, 1950-60

Occupation	1950 Employment, census ¹	1960 Employment, estimated from industry growth	1960 Employment, census ¹	Increase from industry growth	Increase reported by census
	(In thousands)			(Percent)	
Professional, technical, and kindred	4,921	7,125	7,232	45	47
Chemists	75	98	83	31	11
Draftsmen	133	175	213	32	60
Engineers, electrical	106	151	184	42	74
Nurses, professional	400	633	582	58	46
Technicians, medical and dental	77	122	138	58	79
Managers, officials and proprietors, except farm	5,036	5,714	5,410	13	7
Clerical and kindred	6,954	8,610	9,307	24	34
Bank tellers	64	104	129	63	102
Cashiers	231	260	469	13	103
Office machine operators	142	180	308	27	117
Secretaries, stenographers, and typists	1,596	2,090	2,256	31	41
Salesworkers	3,907	4,609	4,639	18	19
Craftsmen, foremen, and kindred	7,821	8,785	8,741	12	12
Bakers	120	129	108	8	-10
Brickmasons, stonemasons and tilersettors	166	184	186	11	12
Carpenters	919	1,012	819	10	-11
Compositors and typesetters	176	225	180	28	2
Electricians	311	354	337	14	8
Linemen	214	239	275	12	29
Machinists	515	626	499	22	-3
Mechanics and repairmen, automobile	654	617	682	-6	4
Mechanics and repairmen, radio and TV	75	94	103	25	37
Millwrights	58	63	64	9	10
Painters, construction and maintenance	392	480	371	22	-5
Plumbers and pipefitters	279	312	304	12	9
Tool and diemakers and setters	153	205	182	34	19
Operatives and kindred	11,180	12,018	11,898	7	6
Attendants, auto service and parking	237	318	352	34	49
Bus, truck and tractor drivers	1,484	1,632	1,739	10	17
Laundry and dry cleaning operatives	430	414	387	-4	-10
Meatcutters	171	178	181	4	6
Welders and flame-cutters	261	310	361	19	38
Service workers, except private household	4,297	5,241	5,445	22	27
Practical nurses	137	177	206	29	50
Waiters and waitresses	668	733	826	10	24
Laborers, except farm and mine	3,436	3,554	3,108	3	-10

¹ SOURCE: 1960 Census of Population, Volume PC(1)-1D, U.S. Table 202.

Table 30. Employment changes, in industry by occupation, 1950-60

[In thousands]

Occupation	Actual change 1950-60 ¹	Estimated change from industry employment	Industry generated change as percent of actual change
Professional, technical, and kindred	2,311	2,204	95
Chemists	8	23	288
Draftsmen	80	42	53
Engineers, electrical	78	45	58
Nurses, professional	182	233	128
Technicians, medical and dental	61	45	136
Managers, officials and proprietors, except farm	374	678	181
Clerical and kindred	2,353	1,656	70
Bank tellers	65	40	62
Cashiers	238	29	12
Office machine operators	166	38	23
Secretaries, stenographers, and typists	660	494	75
Salesworkers	732	702	96
Craftsmen, foremen, and kindred	920	964	105
Bakers	-12	9	(²)
Brickmasons, stonemasons and tilers	20	18	90
Carpenters	-100	93	(²)
Compositors and typesetters	4	49	1,225
Electricians	26	43	165
Linemen	61	25	41
Machinists	-16	111	(²)
Mechanics and repairmen, automobile	28	-37	(²)
Mechanics and repairmen, radio and TV	28	19	68
Millwrights	6	5	83
Painters, construction and maintenance	-21	88	(²)
Plumbers and pipefitters	25	33	132
Tool and diemakers and setters	29	52	179
Operatives and kindred	718	838	117
Attendants, auto service and parking	115	81	70
Bus, truck and tractor drivers	255	148	58
Laundry and drycleaning operatives	-43	-16	37
Meatcutters	10	7	70
Welders and flame-cutters	100	49	49
Service workers, except private household	1,148	944	82
Practical nurses	69	40	58
Waiters and waitresses	158	65	41
Laborers, except farm and mine	-328	118	(²)

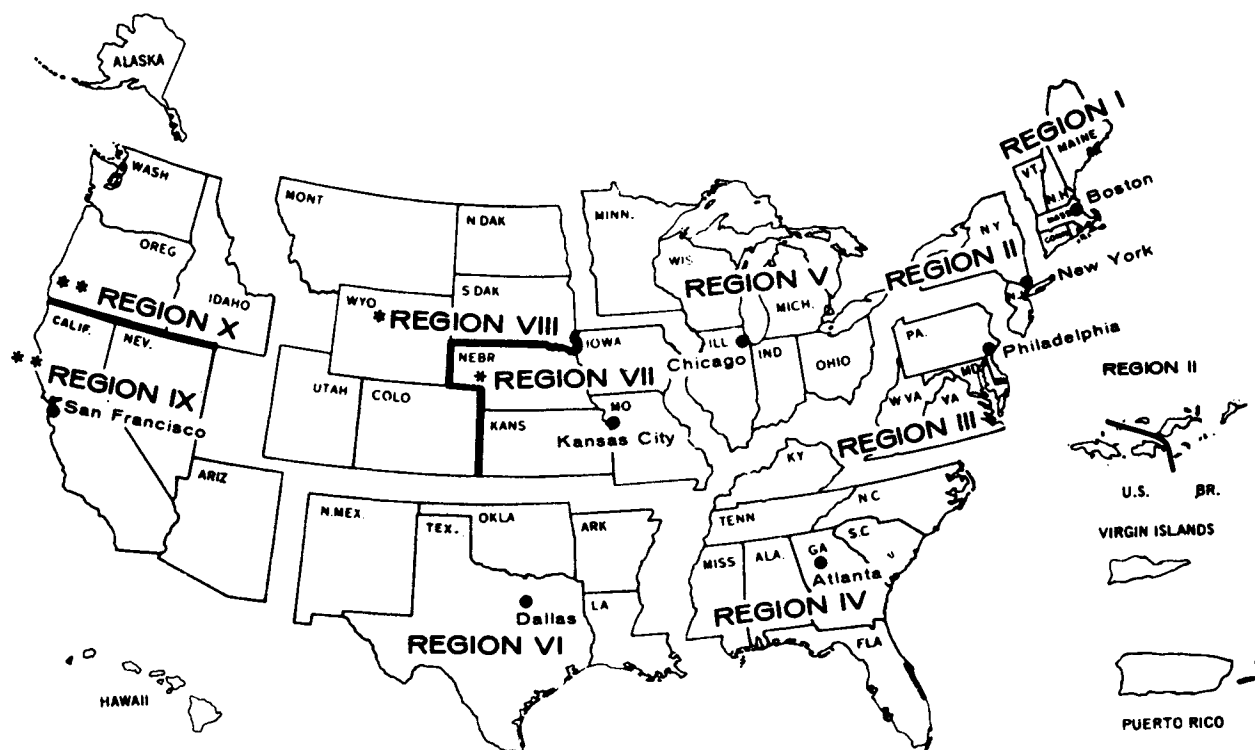
¹ 1960 Census of Population, Volume (PC(1)-1D, U.S. Table 202.

² Estimated employment change in wrong direction.

☆ U.S. GOVERNMENT PRINTING OFFICE : 1973 O - 512-381 (79)

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- * Regions VII and VIII are serviced by Kansas City.
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