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APPENDIX B

CENSUS DATA ON NUMBER OF ENGINEERS AND CHEMISTS, 1890–1950

WE HERE present the basic data on the number of engineers and chemists and the number of workers in the labor force that we use in Chapters I and III. Census definitions of occupations and industries have changed so greatly even within the last two decades that it proved impossible to utilize census data directly in our analyses. Rather we were forced to develop series with more consistent coverage. The details of our calculations are described in the notes to the following tables.

TABLE B-1

Growth of Labor Force and Engineering and Chemical Professions

	Coverage	Labor Force	*Engineers including Surveyors*	*Chemists including Metallurgists*	*Engineers and Chemists including Surveyors*	*Engineers excluding Surveyors*	*Engineers and Chemists excluding Surveyors*
1. 1890	Gainful workers 10 years and over	23,318,183	28,239	4,503	32,742		
2. 1900	Gainful workers 10 years and over	29,073,233	43,239	8,847	52,086		
3. 1910	Gainful workers 10 years and over	37,370,794	88,755	16,273	105,028		
4. 1920	Gainful workers 10 years and over	42,433,535	136,121	32,941	169,062		
5. 1930	Gainful workers 10 years and over	48,829,920	226,249	47,068	273,317		
6. 1930	Labor force, 14 years and over	47,404,000	228,932	48,009	276,941	217,845	265,494
7. 1940	Labor force, 14 years and over	53,299,000	277,872	60,005	337,877	261,428	321,433
8. 1940	Civilian labor force	53,299,000	302,995	60,005	363,000	286,551	346,556
9. 1950	Civilian labor force	59,071,655	556,176	80,224	636,400	529,947	610,171
10. 1950	Civilian labor force	59,071,655	560,183	75,747	636,400	534,424	610,171
11. 1930	Total employment, gainful workers 10 years and over	45,642,273	218,215	45,703	263,918	208,178	253,881
12. 1940	Total employment, labor force, 14 years and over	45,166,083	258,632	57,025	315,657	245,288	302,313
13. 1940	Civilian employment, labor force, 14 years and over	44,888,083	285,489	57,025	342,514	272,145	329,170
14. 1940	Civilian employment, labor force, 14 years and over	44,888,083	288,669	53,845	342,514	275,325	329,170
15. 1950	Civilian employment, labor force, 14 years and over	56,225,340	546,177	78,833	625,010	520,856	599,689
16. 1950	Civilian employment, labor force, 14 years and over	56,225,340	550,577	74,433	625,010	525,256	599,689

APPENDIX B

NOTES TO TABLE B-1

Labor Force

Line	Source
1–5	Alba M. Edwards, *Comparative Occupation Statistics for the United States, 1870 to 1940*, Bureau of the Census, 1943, p. 104.
6–8	*Ibid.*, p. 12. The figures for 1890–1940 (lines 1–8) include the following numbers in the armed forces in the United States. 1890 27,919 1900 43,195 1910 77,153 1920 225,503 1930 132,830 1940 222,485 1890–1930 from *ibid.*, p. 119; 1940, *ibid.*, p. 56.
9–10	*Census of Population, 1950*, Vol. II, Part 1, Table 124. Since the number of persons in the armed forces in 1950 was very large, but the number of engineers and chemists in the armed forces is not available, we exclude the armed forces from the 1950 figures.
11	*Census of Population, 1930*, Vol. V, *General Report on Occupations*, Chapter 7, Table 1; and *Census of Unemployment, 1930*, Vol. I, Tables 21 and 22, and Vol. II, Table 3.
12	*Census of Population, 1940*, Vol. III, Part 1, Table 58.
13–16	*Census of Population, 1950*, Vol. II, Part 1, Table 125. The figure for employment in 1940 as published in the 1950 census excludes the armed forces and public emergency workers. This estimate of civilian employment in 1940 is slightly smaller than the 1930 figure for total employment. Actually, total employment in 1940 was about 400,000 larger than in 1930 (see *Census of Population, 1940, Population, Estimates of the Labor Force, Employment, and Unemployment in the United States, 1940 and 1930*, prepared by John D. Durand and Edwin D. Goldfield). This discrepancy is due mainly to the fact that the 1930 employment figure is based on the gainful worker concept which includes persons 10–14 years of age. Partly it is due to the exclusion of about 300,000 armed forces from the 1940 census.

Engineers and Chemists including Surveyors

Line	Source	
1–5	Edwards, *op. cit.*, p. 111.	
6–7	*Ibid.*, p. 49.	
	Lines 1–7 include engineers and chemists in the armed forces in the United States.	
8	Employed engineers in 1940 from *Census of Population, 1950* (Vol. II, Part 1, Table 124),	275,325
	plus unemployed engineers from 1940 census [a]	16,140
	Total engineers (including metallurgists)	291,465
	Total engineers (excluding metallurgists) [b]	286,551

NOTES TO TABLE B-1 (continued)

Employed chemists in 1940 from *Census of Population, 1950* (excluding metallurgists who are included in employed engineers)		53,845
plus unemployed chemists from 1940 census [a]		1,246
Total chemists		55,091
Total chemists, including metallurgists [b]		60,005
Employed surveyors in 1940 from *Census of Population, 1950*		13,344
plus unemployed surveyors from 1940 census [a]		3,100
Total surveyors		16,444
Total engineers	286,551	
Total surveyors	16,444	302,995
Total chemists		60,005
Total engineers and chemists		363,000

[a] The numbers of unemployed engineers, chemists, and surveyors are the differences between the total number reported in each of these occupations by Edwards (*op. cit.*, p. 49) and the numbers of employed in each of these occupations as given in the 1940 census (see *Census of Population, 1940,* Vol. III, Part 1, Table 58).

[b] The total number of chemists was raised to 60,005 to correspond to the figure given in the 1940 Census, which includes metallurgists. The number of engineers was reduced accordingly to exclude metallurgists.

Line	Source
9–10	*Census of Population, 1950,* Vol. II, Part 1, Table 124. Line 10 represents figures as given in the source. In line 9 the estimated number of metallurgists was shifted from engineers to chemists. Up to and including 1940, the census classified metallurgists as chemists. In the 1950 census metallurgists were shifted to engineers. The 1940 census reports 57,025 employed chemists, the 1950 census lists for 1940 only 53,845 employed chemists, a discrepancy of 5.91 per cent. The 1950 census figures for all and for employed chemists—75,747 and 74,433, respectively—were raised by 5.91 per cent to 80,224 and 78,833 respectively and the 1950 census figures for engineers were reduced accordingly.
11	*Census of Population, 1930,* Vol. V, Chapter 7, Table 1 and *Census of Unemployment, 1930,* Vol. I, Tables 21 and 22, and Vol. II, Table 3.
12	*Census of Population, 1940,* Vol. III, Part 1, Table 58.

Employed engineers	245,288	
Employed surveyors	13,344	258,632
Employed chemists		57,025
Total engineers and chemists (including surveyors)		315,657

13–16	*Census of Population, 1950,* Vol. II, Part 1, Table 125. Lines 14 and 16 are as given in source. In lines 13 and 15 metallurgists were shifted from engineers to chemists.
7, 12, 14	The 1940 census reports 277,872 employed and unemployed engineers including surveyors, and 261,428 engineers excluding surveyors. The 1950 census reports for 1940 some 288,669 employed engineers including, and 275,325 employed engineers excluding, surveyors. The 1940 census reports 16,140 unemployed engineers. If these had

NOTES TO TABLE B-1 (continued)

Line Source

been added to the number of employed engineers in 1940, as shown in the 1950 census, the total for 1940 would be 291,465, instead of 261,428. This discrepancy of some 30,000 appears to be due to changes in classification.

The 1940 data on engineers in lines 13 and 14 are from the 1950 census and are comparable to the 1950 figures in lines 15 and 16. (The 1950 census does not give any data on the total number of engineers in 1940, including unemployed.)

Excluding Surveyors

Line Source

6–16 For 1940 and 1950 the total numbers of surveyors and of employed surveyors are given in *Census of Population, 1950* (Vol. II, Part 1, Table 124), and in *Census of Population, 1940* (Vol. III, Part 1, Table 58). For 1930 the number of surveyors was estimated by reference to the ratio of surveyors to engineers in 1940 and 1950. The actual figures are:

	All Surveyors	*Employed Surveyors*
1950	26,229	25,321
1940	16,444	13,344
1930	11,447	10,037

TABLE B-2

Engineers and Chemists as a Percentage of the Labor Force

	Engineers including Surveyors	*Chemists including Metallurgists*	*Engineers and Chemists including Surveyors*	*Engineers excluding Surveyors*	*Engineers and Chemists excluding Surveyors*
1. 1890	0.121	0.019	0.140		
2. 1900	0.149	0.030	0.179		
3. 1910	0.237	0.044	0.281		
4. 1920	0.321	0.078	0.398		
5. 1930	0.463	0.096	0.560		
6. 1930	0.483	0.101	0.584	0.459	0.560
7. 1940	0.521	0.113	0.634	0.490	0.603
8. 1940	0.568	0.113	0.681	0.538	0.650
9. 1950	0.942	0.136	1.077	0.897	1.033
10. 1950	0.949	0.128	1.077	0.905	1.033
11. 1930	0.478	0.100	0.578	0.456	0.556
12. 1940	0.573	0.126	0.699	0.543	0.669
13. 1940	0.636	0.127	0.763	0.606	0.733
14. 1940	0.643	0.120	0.763	0.613	0.733
15. 1950	0.971	0.140	1.112	0.926	1.067
16. 1950	0.979	0.132	1.112	0.934	1.067

Source: Table B-1.

TABLE B-3

Total Employment and Employment of Chemists and Technical Engineers in Selected Industries, 1930, 1940, and 1950
(number of persons)

INDUSTRY	TOTAL EMPLOYMENT: *All Gainful Workers 1930*	*Estimated Total Employment 1930*	*Total Employment 1940 (comparable to 1930)*	*Total Employment 1940 (comparable to 1950)*	*Total Employment 1950*	EMPLOYMENT OF CHEMISTS AND TECHNICAL ENGINEERS — *Including Surveyors*: *Gainful Workers 1930*	*Estimated Employed 1930*	*Excluding Surveyors*: *Employed 1940 (comparable to 1930)*	*Employed 1940 (comparable to 1950)*	*Employed 1950*
I. Mining, total	1,156,377	966,885	907,520	907,520	928,260	9,137	8,391	10,940	10,080	13,860
1) Coal mining	691,288		523,680	523,680	510,180	2,485		2,020	1,700	2,610
2) Petroleum and natural gas	198,446		181,860	181,860	233,160	2,047		4,100	3,660	7,290
3) Metal mining	114,235		116,340	116,340	92,970	2,062		3,560	3,480	2,730
4) Other, including quarries	152,408		85,640	85,640	91,950	2,543		1,260	1,240	1,230
II. Construction	3,029,791	2,489,700	2,094,220	2,094,220	3,398,040	31,712	28,892	45,360	41,040	77,130
III. Manufacturing [a]	5,472,037	4,972,946	5,626,440	5,626,440	8,182,290	73,543	70,496	114,700	114,560	253,580
(Durable goods [a])	3,741,824	3,364,202	3,617,300	3,617,300	5,534,970	44,611	42,366	73,540	73,400	173,060
1. Iron and steel industries	1,931,857	n.a.	1,876,380	1,267,280	1,660,560	21,423	n.a.	34,200	18,940	33,840
a) Blast furnaces, steel works	620,894		545,300	545,300	661,380	7,126		9,500	9,500	13,860
b) Other primary iron and steel	1,310,963		1,331,080	721,980	285,180	14,297		24,700	9,440	4,050
c) Miscellaneous iron and steel products					714,000					15,930

2. Non-ferrous metal industries	151,681	n.a.	202,880	202,880	320,040	2,176	n.a.	3,300	3,280	7,920
a) Primary nonferrous products	69,964		89,520	89,520	216,120	2,176		1,960	1,940	6,450
b) Miscellaneous nonferrous products	81,717		113,360	113,360	103,920			1,340	1,340	1,470
3. Not specified metal industries	168,899	n.a.	121,460	38,260	13,410	1,220	n.a.	3,120	500	300
4. Machinery	436,814	n.a.	464,080	1,073,180	2,054,610	13,639	n.a.	18,320	33,580	80,870
a) Electric machinery and equipment	383,570	n.a.	372,940	372,940	770,970	13,311		16,980	16,980	38,070
b) Agricultural machinery	53,244		91,140	91,140	178,770	328		1,340	1,340	3,900
c) Office and store machinery	included in 5c		included in 5c	61,560	105,570	included in 5c		included in 5c	740	2,730
d) Miscellaneous machinery				547,540	999,300				14,520	36,170
5. Transportation equipment	968,693	n.a.	879,840	879,840	1,336,230	5,917		14,140	14,020	42,240
a) Aircraft and parts	in 9d		in 9d	107,680	257,220	in 9d	n.a.	in 9d	4,900	23,820
b) Motor vehicles and equipment	640,474		575,480	575,480	863,400	5,132		6,760	6,720	13,710
c) Ships and boats	93,437		151,420	151,420	153,780	444		1,820	1,740	3,030
d) Railroad and misc. transportation equipment	234,782		152,940	45,260	61,830	341		5,560	660	1,680
6. Professional equip. and instruments	83,880	n.a.	72,660	155,860	196,740	236	n.a.	460	3,080	7,890
a) Professional equipment	included in 7		included in 7		115,200	included in 7		included in 7	2,620	4,740
b) Photographic equipment				83,200	46,620					2,730
c) Watches, clocks, timepieces	83,880		72,660		34,920	236		460	460	420
(Nondurable goods [a])	1,730,259	1,608,744	2,009,140	2,009,140	2,647,320	28,932	28,130	41,320	41,320	80,520

TABLE B-3 (continued)

INDUSTRY	TOTAL EMPLOYMENT					EMPLOYMENT OF CHEMISTS AND TECHNICAL ENGINEERS				
						Including Surveyors		*Excluding Surveyors*		
	All Gainful Workers 1930	*Estimated Total Employment 1930*	*Total Employment 1940 (comparable to 1930)*	*Total Employment 1940 (comparable to 1950)*	*Total Employment 1950*	*Gainful Workers 1930*	*Estimated Employed 1930*	*Employed 1940 (comparable to 1930)*	*Employed 1940 (comparable to 1950)*	*Employed 1950*
7. Food, drink, tobacco	1,056,816	974,725	1,207,940	1,207,940	1,472,550	4,233	4,069	6,400	6,400	13,020
8. Chemicals and allied products	321,492	305,851	440,820	440,820	654,480	16,810	16,403	21,200	21,180	43,860
a) Synthetic fibres	33,982		52,480	52,480	53,370	723		1,160	1,160	2,220
b) Paints, varnishes, etc.	37,074		43,280	43,280	57,090	1,427		2,640	2,640	3,450
c) Drugs and medicines	250,436		345,060	345,060	57,030	14,660		17,400	17,380	3,570
d) Misc. chemicals					486,990					34,620
9. Petroleum and coal products	185,564	176,537	202,180	202,180	284,280	5,924	5,780	10,700	10,560	18,690
a) Petroleum refining	173,798		178,980	178,980	257,190	5,628		9,960	9,820	17,790
b) Misc. petroleum and coal products	11,766		23,200	23,200	27,090	296		740	740	900
10. Rubber products	166,391	151,631	158,200	158,200	236,010	1,965	1,878	3,020	3,020	4,950
Transportation, communications, and other public utilities	4,013,684	3,788,587	3,295,920	3,414,540	4,869,460	42,548	41,447	41,500	43,820	68,520
IV. Transportation	2,737,997	2,553,118	2,176,460	2,176,460	2,927,010	14,858	14,358	8,600	8,380	11,910
1) Air transportation	18,189		22,320	22,320	94,500	467		480	440	1,260
2) Railroads and express service	1,645,306		1,137,000	1,137,000	1,381,740	10,706		5,820	5,680	6,180

3) Streetcars and buses	195,408		202,320	202,320	325,200	1,549		900	900	1,320
4) Trucking and taxicabs	483,148		511,520	511,520	765,260	40		100	100	540
5) Warehousing and storage	59,394		62,060	62,060	97,350	429		240	240	840
6) Water transportation	299,804		180,240	180,240	203,250	1,325		400	320	480
7) Pipelines	25,001		17,420	17,420	20,220	217		460	440	990
8) Incidental transportation services	11,747		43,580	43,580	41,490	125		260	260	300
V. Communications	871,502	851,284	703,140	703,140	1,163,950	13,303	13,149	12,180	12,160	25,020
1) Postal service	283,936		309,240	309,240	460,510	0		80	80	150
2) Telephone	578,602		370,300	370,300	594,750	12,760		9,820	9,800	15,600
3) Telegraph					46,260					510
4) Radio and television	8,964		23,600	23,600	62,430	543		2,280	2,280	8,760
VI. Utilities and sanitary services	404,185	384,185	416,320	534,940	778,500	14,297	13,940	20,660	23,280	31,590
1) Electric light and power	289,255		329,880	329,880	448,890	12,633		18,640	18,280	22,860
2) Gas supply	114,930		86,440	86,440	114,720	1,664		2,020	1,980	2,760
3) Water supply	n.a.		excl.		73,700	n.a.		excl.		3,420
4) Sanitary services	n.a.		excl.	118,620	105,820	n.a.		excl.	3,020	1,170
5) Not specified utilities	n.a.		excl.		35,370	n.a.		excl.		1,380
VII. Professional and related services										
Including education	2,965,742	2,908,072	3,320,000			57,934	57,373	25,860		
Excluding education				1,749,880	2,572,020				21,240	38,190
VIII. Education				1,570,120	2,076,630				2,180	7,740
1) Government	included in 16	included in 16	included in 16	n.a.	1,547,000	included in 16	included in 16	included in 16	n.a.	4,980
2) Private				n.a.	529,620				n.a.	2,760
IX. Public administration										
Including armed forces	1,049,576	1,019,903	1,448,680			26,935	26,555	35,280		

TABLE B-3 (continued)

INDUSTRY	TOTAL EMPLOYMENT					EMPLOYMENT OF CHEMISTS AND TECHNICAL ENGINEERS				
						Including Surveyors		*Excluding Surveyors*		
	All Gainful Workers 1930	*Estimated Total Employment 1930*	*Total Employment 1940 (comparable to 1930)*	*Total Employment 1940 (comparable to 1950)*	*Total Employment 1950*	*Gainful Workers 1930*	*Estimated Employed 1930*	*Employed 1940 (comparable to 1930)*	*Employed 1940 (comparable to 1950)*	*Employed 1950*
Excluding armed forces				1,147,180	2,030,160				28,100	54,480
1) Federal government	n.a.		excl.	299,280	1,006,260	n.a.		excl.	11,380	36,660
2) State government	n.a.		excl.	847,900	266,760	n.a.		excl.	16,720	5,400
3) Local government	n.a.		excl.		757,140	n.a.		excl.		12,420
Subtotal, above industries	17,687,257	16,146,093	16,692,780	16,509,900	24,103,480	241,719	233,154	273,800	261,020	513,500
All other industries [b]	31,142,663	29,496,180	28,688,580	28,569,960	31,700,040	31,598	30,764	39,000	34,980	79,000
Total, all industries										
Including armed forces	48,829,920	45,642,273	45,381,360			273,317	263,918	312,800		
Excluding armed forces				45,079,860	55,803,520				296,000	592,500

n.a. = not available.

[a] Includes industries listed under this heading; excludes manufacturing industries included in "All other industries," enumerated in footnote *b*.

[b] Includes agriculture, forestry, fisheries; the following manufacturing industries: lumber and wood products, glass products, stone and clay products, textiles and clothing, paper and printing, leather and leather products. Includes further: wholesale and retail trade, finance, insurance and real estate, business and repair service, entertainment and recreation, and personal services.

NOTES TO TABLE B-3 (continued)

Source: *Census of Population, 1930,* Vol. V, *General Report on Occupations,* Chap. 7, Table 2 (based on full count); *Census of Population, 1940, The Labor Force, Occupational Characteristics,* Table 19 (based on a 5 per cent sample); *Census of Population, 1950,* Special Report P. E., 1 C, *Occupation by Industry* (based on a 3⅓ per cent sample); *Census of Unemployment, 1930,* Vol. I, Tables 21 and 22; Vol. II, Table 3; Alba M. Edwards, *Comparative Occupation Statistics for the United States, 1870 to 1940,* Bureau of the Census, 1943.

Comparability and Adjustment of Data

a) *Gainful Workers and Employed Persons*

The 1930 census refers to "gainful workers, 10 years old and over"; the relevant tables of the 1940 and 1950 censuses to "employed persons (except on public emergency work), 14 years old and over." Partly because of these different concepts the total number of persons included in the occupation-by-industry cross-classification was 48.8 million in 1930 as compared to 45.4 million in 1940.

In the second column for 1930 the unemployed gainful workers have been excluded using the data given in the Census of Unemployment. Since this adjustment does not take account of the differences between the "labor force" and "gainful worker" concept, the resulting total for employed persons in 1930 (45.6 million) is still some 260,000 larger than the total employment figure for 1940. On a basis comparable to that of the 1940 census, total employment in 1930 would have been 45.0 million, that is, about 400,000 less than in 1940 (see *Census of Population, 1940, Population, Estimates of the Labor Force, Employment, and Unemployment in the United States, 1940 and 1930,* prepared by John D. Durand and Edwin D. Goldfield). These adjusted data, however, are available only for total labor force and employment, not for industries or occupations.

The 1930 Census of Unemployment gives data for broad industry groups, a few industrial subgroups, and for occupations. Unemployment data for occupation by industry and for most industrial subgroups are not available. For some other industry groups unemployment had to be estimated. The broad group "Chemicals and allied products" of the Unemployment Census was broken down into "Chemicals," "Petroleum and coal products," and "Gas works." Unemployment in these subgroups was assumed to be at the same rate as for the group as a whole. "Gas works" were shifted to "Utilities" and unemployment in "Electric light and power" (a group which is missing in the Unemployment Census) was estimated at the same rate as in "Gas works." For the remaining industry groups the Unemployment Census data were used.

The estimated numbers of unemployed chemists and engineers in the various industry groups were derived as follows: The rate of unemployment was calculated for each industry. These rates (which varied from 1.9 to 16.4 per cent) were applied to the total number of chemists and engineers attached to each industry group. Since unemployment in these professions was far below the average rate, the resulting figures added up to a total almost twice as large as the number of unemployed chemists and engineers given in the Unemployment Census. These figures for the various industry groups were then reduced using the ratio of the given total to the above-mentioned calculated total.

b) *Occupational Classification*

In 1930, "Surveyors" are included in "Civil Engineers" and could not be separated. In the attached tables they are included in the 1940 column comparable to 1930; excluded from the 1940 figures comparable to 1950.

In 1930 and 1940 "Chemists" include also "Assayers and Metallurgists" and

possibly also some metallurgical engineers. In 1950, metallurgists are allocated to "Technical Engineers." This shift in classification is largely responsible for the apparent decline in the employment of chemists in the metal industries, and especially in "Primary metals" between 1940 and 1950.

At the 1940 census persons under 35 years were not classified as technical engineers unless they had had at least four years of college education. In 1930 this rule did not apply (see Edwards, *op. cit.*, p. 24), nor did it in 1950.

The 1930 and 1950 data for chemists and engineers attached to the various industries refer to males and females, the 1940 data to males only. But in this year the number of employed females in these professions was negligible. The final census count (not the sample statistics used for the attached tables) reports 2,384 employed female chemists and engineers, that is, 0.78 per cent of the total employment in these professions.

c) *Industrial Classification*

The 1930 data and the data for 1940 comparable to 1930 refer to all industries, including the armed forces, but excluding public emergency work. The 1950 data and the 1940 totals comparable to 1950 exclude the armed forces.

The 1940 and 1950 censuses use basically the same industrial classification. The 1950 Census lists a number of additional subgroups which for comparison with earlier years had to be combined into larger units, e.g. "Professional equipment" and "Photographic equipment" are one subgroup in 1940. A few subgroups had to be shifted, as for instance, "Broadcasting and television" from "Entertainment and recreation" to "Communications." The 1940 subgroup "National defense" was removed from "Public administration" which in 1950 is limited to civilians. For a few subgroups comparability could not be established: in 1950 there is a separate category "Watches, clocks, and timepieces," while "Jewelry and silverware" are included in "Miscellaneous manufacturing industries." In 1940, watches and clocks are combined with jewelry and silverware and could not be separated. In the nonferrous industries, the subgroups "primary products" and "miscellaneous products" are not identical in 1940 and 1950, but the group as a whole appears to be comparable for these years.

Generally, large relative changes in small subgroups should be interpreted with caution. Thus the large increase in professional employment in "Warehousing" or "Trucking" appears to be due partly to changes in classification or errors resulting from the small size of the sample. (Since in the 1950 occupation-by-industry-tables the number of persons in the sample was multiplied by 30, these tables include small industrial subgroups which show 30 females, but no males as employed chemists.)

The industrial classification system used in the 1930 census was markedly different from the later systems. First of all, the group "Professional service, including education, excluding amusement and recreation" includes a considerable number of engineers and chemists who were not allocated to specific industries although most likely they were not working as independent professionals but were employed by different industries. The 1930 census reports 57,934 chemists and engineers in "Professional service" as compared to 25,860 in 1940. That is, comparability with later years is impaired by the fact that some 30,000 to 35,000 were not distributed among the various industries. It appears that the construction industry is especially affected and that a much larger number of engineers was attached to this group in 1930 than shown by the census data.

For two of the most important industry groups—chemicals and iron and steel industries—the 1930 classification is so different from the later systems that Edwards and also Daniel Carson in his "Changes in the Industrial Composi-

tion of Manpower since the Civil War" (in *Studies in Income and Wealth, Volume Eleven,* National Bureau of Economic Research, 1949) declare these 1930 and 1940 industries are not comparable. In the attached tables the attempt has been made to establish more or less comparable groups, mainly by shifting and combining of subgroups. Thus the 1940 category "Miscellaneous machinery" was combined with "Miscellaneous iron and steel products" for comparison with 1930. But certain inconsistencies could not be eliminated. The subgroup "Agricultural machinery" includes tractors in 1940 but not in 1930; the 1930 group "Blast furnaces and steel rolling mills" includes some workers in manufacturing establishments, etc.

The 1930 group "Utilities" consists of "Gas works" (shifted from Chemicals and allied products) and "Electric light and power" from the census group "Miscellaneous manufacturing industries." Other utilities, for which 1930 data are not available, were excluded from the 1940 column comparable to 1930 and shifted to "All other industries."

Except for the different treatment of "Other utilities" and "Jewelry and silverware" (see above—1950), the broad group "All other industries" includes in 1930 the same categories as in 1940 and 1950. It combines all those industries in which employment of engineers was negligible and has not been computed for this survey. The groups included are: agriculture, forestry and fishing; textiles and clothing; leather and leather products; lumber and wooden goods; paper and printing; stone, clay and glass products; wholesale and retail trade; finance, insurance and real estate; business and repair services; personal services; amusement and recreation; and industry not specified.

In conclusion it should be pointed out that the comparability of the 1930 figures with later data is affected more strongly by the difference between the "gainful worker" and "employed persons" concept and the incomplete industrial distribution of professional personnel than by inconsistencies in the composition of specific industries or subgroups.