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# *APPENDIX A*

## ENGINEERING EARNINGS

IN THIS appendix we summarize the available data on engineering earnings. The data cover varying periods between 1894 and 1955 and are classified in various ways. We present:

1. Sample studies of engineering income, at different experience levels and for the several major specialties.
2. Income data from the 1940 and 1950 censuses.
3. Annual data on starting salaries for engineers and salaries of research engineers and scientists for recent years.

### SAMPLE STUDIES

Five major sample studies of engineering incomes covering various nonoverlapping periods between 1894 and 1953 are available. The coverage and detail of the data in these sources differ considerably but it is possible to derive from them series describing the income behavior of the engineering profession or significant components thereof for major portions of the last sixty years. Although no single series covers the entire period, the several series are sufficiently comparable to permit broad conclusions about the level and changes in engineering income over the entire period, except for the years between 1924 and 1929.

#### *Data Sources*

The first source is the Report of the *Investigation of Engineering Education,* which presents data on earnings of graduate engineers (i.e., engineers who had received at least a first degree in engineering) at benchmark dates between 1894 and 1924.[1] The data were apparently collected during the academic year 1924/25 and were based on questionnaires distributed to the graduates of a "representative group of engineering colleges in the United States and Canada." Graduates of engineering schools in Canada represent a very small fraction of the combined number in the United States and Canada, as low as 1 or 2 per cent in the thirties. The data can therefore be treated as if they pertained solely to U.S. graduate engineers.

[1] *Report of the Investigation of Engineering Education,* Society for Promotion of Engineering Education, *A Study of Engineering Graduates and Non-Graduate Former Students,* Bull. 3 of the Investigation of Engineering Education, 1930, pp. 226–271.

Questionnaires were distributed to graduates of the classes of 1922 and 1923 and 1924 at 43 institutions and to graduates of the classes of 1884, 1889, 1894, 1899, 1904, 1909, 1914 and 1919 at 34 institutions. The response of the group of recent graduates was about one-half, while the response of the older graduates was about one-third. The report indicates that the returns covered approximately one-sixth of all engineering graduates in the classes 1922–1924, but that the coverage for older graduates was much smaller. Simply on the basis of the number of institutions included in the sample, one might estimate the coverage of the older groups at around 8 or 10 per cent. The committee felt, however, "that the method of sampling by classes of each fifth year and of institutions representing the various types and geographical locations of engineering colleges gives a fair cross-section of the older graduates."

The data are given in terms of annual earnings of engineering graduates of each class at various experience levels. We converted annual to monthly incomes to conform with the data from other sources. About one-fifth of the older graduates (i.e., graduates of classes earlier than 1922) and about one-tenth of the recent graduates were engaged in nonengineering work. For years after 1924 only the incomes of engineers from engineering work are reported.

The second source of data on engineering incomes is BLS Bulletin 682, *Employment and Earnings in the Engineering Profession, 1929 to 1934.*[2] The tabulations in this Bulletin were based on a questionnaire survey in 1935 of all the nation's professional engineers who could be located. The questionnaires were distributed to a total of 173,000 engineers, including all current and former members of engineering societies, all engineers registered with 32 state boards of engineering examiners who are not included in the membership lists, and all engineers who received degrees from engineering schools in 1930–1934 who were not included in either the membership lists or the examining board rosters. The total of 173,000 engineers represent about two-thirds of the estimated total of engineers in the United States in 1935.[3] About one-third of the questionnaires were returned with usable information.

The report suggests that there was a minor bias in the data for older engineers because names were obtained from engineering so-

[2] *Employment and Earnings in the Engineering Profession, 1929 to 1934,* Bureau of Labor Statistics, Bull. 682, 1941.

[3] Estimated by BLS by summing the 1930 census total for technical engineers and the number of first degree engineering graduates between 1930 and 1934, and subtracting estimated deaths of engineers between 1930 and 1934.

ciety rosters; members of such societies are not fully representative of all engineers. A similar minor bias exists for the group of younger (post-1929) engineers since recent entrants into the profession who had not received a first degree from an engineering school were probably underrepresented. However, tests (against 1930 census data) of the distribution of the returns by age, geographical location and professional specialty of the reporting engineers indicated that in these respects the collected data were representative of the entire engineering profession, with the single exception that the younger group (i.e., post-1929 entrants to the profession) was overrepresented in the total returns. Accordingly, in all tabulations which combined data for the two groups, the weight of the younger group was reduced to its proper level.

In addition to other data, the survey collected information on total earned income of respondents "from salaries or personal services in both engineering and nonengineering work" for the calendar years 1929, 1932 and 1934, and on the average monthly rate of income from "engineering work for time actually employed" during the same years. The monthly rates, rather than annual incomes, are used here, for several reasons. First, there was considerable unemployment among engineers during 1932 and 1934.[4] Accordingly, annual incomes of engineers during those years reflected both the salary rates at which they were employed and the proportion of each year in which they were employed. Second, some respondents who entered the profession in 1929, 1932 or 1934 reported their actual income during their first professional year, which may have been for work during only a portion of the year. Third, the monthly rates were restricted to engineering work while the annual incomes covered both engineering and nonengineering work. Although some engineering graduates always leave the field of engineering deliberately and indeed may even contemplate this departure in choosing to study engineering, for many engineers during the thirties the choice was not voluntary.

Thus, we concentrate in the present analysis on monthly salary rates for engineering work in the data for 1929–1934. Equivalent data were available for 1939–1946 and are here used, and only data on income from engineering work are available for 1953. Only in

[4] While unemployment among professional engineers was less than 1 per cent in 1929, 1939, 1943, and 1946, it was as high as 10.1 per cent in 1932 and 8.5 per cent in 1934 (*Employment and Earnings in the Engineering Profession, 1929–1934,* p. 48; and Andrew Fraser, *The Engineering Profession in Transition,* Engineers Joint Council, 1947, p. 54).

the period before 1929 do incomes include earnings in nonengineering work.

The third and fourth sources of data on engineering incomes stem from a survey conducted in 1946 by BLS in cooperation with the Engineers Joint Council and the National Roster of Scientific and Specialized Personnel. The mailing list for this survey was derived from the files of the National Roster which included the names of about 200,000 engineers, originally derived from the membership lists of the professional societies, state boards of engineering examiners, schools of engineering, and the occupational questionnaires filled out in connection with Selective Service registration of all male civilians aged 18 to 64. These persons had been sent National Roster questionnaires and the returns had been screened to eliminate those who were deemed not qualified as engineers. BLS estimated that there were about 300,000 engineers in the United States in 1946; the Engineers Joint Council estimated 317,000.[5]

The Roster registrants were classified by age, educational level, and engineering specialty and a sample of 20 per cent of the engineers in each group were sent questionnaires by BLS. The Engineers Joint Council wished to obtain similar information from the members of its six constituent societies so the same questionnaires were sent to all persons on the membership lists of these societies. All persons who were included in both the sample from the National Roster and the membership lists for the EJC were sent only the EJC questionnaire but their returns were marked and included in the summary data for the Roster sample.

About 42,000 questionnaires were mailed to the Roster sample in September 1946; about 25,000 returns were received—a 59 per cent response. The summaries for the Roster sample excluded those engineers answering the questionnaire who were in the armed forces, outside the United States, or engaged in nonengineering work. The results of the survey were presented in a BLS Bulletin, entitled *Employment Outlook for Engineers.*[6]

The survey obtained information from respondents on annual income in 1939 and 1943 (but not 1946) from "salaries or personal services in both engineering and nonengineering work, including fees and bonuses," and on monthly salary rates (exclusive of fees

[5] See Appendix E for discussion of the varying estimates of the number of engineers in recent years.

[6] *Employment Outlook for Engineers,* Bureau of Labor Statistics, Bull. 968, 1948.

and bonuses) for 1939, 1943 and 1946 "for the time actually employed in engineering work." The monthly rates were obtained inclusive and exclusive of overtime compensation; actually it was found that overtime compensation provided substantial supplements to income in 1943 only and the tabulations for this year alone are presented inclusive and exclusive of overtime.

To test the representativeness of the data, the returns were compared with the full Roster sample and with the 1940 census data with regard to distribution by engineering field, age and educational status. In general, the conformity was found to be good, notwithstanding slight overrepresentation of the younger age groups, minor discrepancies in the distribution by engineering specialty, and some overrepresentation of engineering graduates. It was concluded that "a presentation of earnings disregarding experience and education would not be distorted to any extent, because the high proportion of younger and hence lower-paid engineers would probably be offset by the too high proportion of graduate engineers who earn, on the average, more than those with less education."

No attempt was made in the tabulations to correct for these minor biases. Rather, data were in general presented separately for each field of engineering and for different experience levels. Although this procedure eliminated biases in the data presented in the Bulletin, it created difficulties for us, since it proved impossible in almost all cases to aggregate the data to provide information on incomes of all engineers or all graduate engineers. In fact, only in 1946 could median and quartile monthly salary rates for all engineers be derived. In no year could median or quartile annual incomes be obtained.

An earlier report summarized the information obtained by the Engineers Joint Council from a circularization of this questionnaire to the 87,000 engineers who were members of their six constituent societies in May 1946.[7] Returns were received from 47,000 engineers or 53 per cent of the total. The basic tabulations in the report were based on returns from those engineers who maintained continuous residence as civilians in the United States over the seven-year period 1939–1946, about 83 per cent of the total returns.[8]

The report compared the 1939 distribution of EJC respondents by age, geographic location, professional specialty and industry with

[7] Fraser, *op. cit.*

[8] Data on incomes were given separately for those engineers who were civilians in 1939 and 1946 but were in the armed forces in 1943.

corresponding distributions of all technical engineers in the 1940 census, and the rate of growth in the number of engineers between 1939 and 1946 (as indicated by the sample returns) with the rate of growth independently estimated from such data as engineering degrees. Although younger engineers were slightly overrepresented in the sample and there was some discrepancy between the two distributions by industry, the report concluded that the composition of the reporting engineers was adequately "representative of all professional engineers who maintained continuous residence as civilians in the United States, over the period 1939 to 1946" and that the returns from this group could be taken as describing the economic changes in "the entire engineering profession, or its several general fields of employment" over the seven-year period.

The EJC report on incomes of society members of 1939–1946 was issued in 1947. The BLS report covering incomes of all engineers in the same period was not published until 1949. It is interesting to note that both reports said that their samples were representative of all engineers, although BLS added a note of caution on the over-all figures, and that both reports included sections on changes in income of engineers between 1929 and 1946 in which each tied its data to the data gathered in the 1935 BLS survey. Actually, a comparison of salaries given in the two reports for 1946 indicates that society members tend to have somewhat higher salaries than all engineers; this is particularly true at the upper end of the respective income distributions, and holds in nearly all comparisons of salaries by professional field and experience level.

The BLS collected the same data as did the EJC (identical questionnaires were used) but published a much larger quantity. Income distributions for all engineers, graduate and nongraduate engineers, engineers classified by years of experience and by public and private employment were available in the BLS report in nearly all cases for the three years 1939, 1943 and 1946, and medians and quartiles are presented later in this appendix. We use only the monthly salary rates for 1939–1946.

The final major study of engineering incomes analyzed here is that of the Engineers Joint Council for 1953.[9] It provides data on incomes of engineers employed in industry, in government and in educational institutions. Companies and government agencies were asked to make reports covering their employees, while for engineers employed in education, the reports were made by each

[9] *Professional Income of Engineers*, Engineers Joint Council, 1954.

individual faculty member. No questionnaires were sent to self-employed engineers. This survey was designed to cover only graduate engineers and the questionnaires specifically requested this limitation. But in our analysis of the actual returns (see Chapter II) we discovered that some companies explicitly included nongraduate engineers; others undoubtedly did the same without so indicating on the report form. Unlike the 1946 EJC study, this report was not restricted to members of engineering societies; the varying coverage at different educational levels is not known.

Returns were received from 295 companies employing 65,000 graduate engineers, estimated by the EJC to represent about 18 per cent of all engineers employed by industry. Twelve government agencies, employing 4,000 graduate engineers or about 4 per cent of publicly employed engineers, submitted reports. Data were received from almost 3,000 college staff members, or about 30 per cent of all engineers employed in engineering education.[10]

For engineers employed by industry and government, data were collected on annual salaries, defined as "base salary including cost of living allowance, if any, and bonus if considered part of salary but not including payments for overtime work." This definition accords with that for monthly salary rates used in the 1935 and 1946 surveys (except for some uncertainty about the treatment of bonuses). For college teachers, both annual salaries and total income from the practice of engineering were obtained. In this appendix all annual salaries are converted to monthly rates. We discuss the reliability of this study below.

A new salary study, conducted for the EJC and covering the year 1956, was reported in the *New York Times* (January 18, 1957) after this book went to press. Some of the results are referred to briefly in footnote 24, below.

### *Classification of the Income Data*

With a single exception, all the income data available are in the form of medians, with most sources also providing quartiles and occasionally upper and lower deciles. For most analytical purposes the arithmetical mean incomes would be preferable to medians but they are not available.

[10] These coverage estimates imply an estimate for total privately employed engineers of 362,000, for publicly employed engineers (exclusive of the armed forces) of 97,000, and for engineering faculties of 10,000, or a grand total of about 469,000 engineers in the United States in 1953.

## APPENDIX A

The several sources present income data in various classifications, e.g. all engineers, graduate or nongraduate engineers, engineers classified by years of experience, publicly or privately-employed engineers, engineers classified by specialty. Incomes for the separate components of the engineering profession are of interest and are presented here. Further, since data for neither the over-all group of engineers nor any of its components are available at all dates, the income behavior of the profession for the entire period can be followed only by shifting attention from one classification to another.

TABLE A-1

Median and Quartile Base Monthly Salary Rates of All Engineers, 1929–1946

| | *First Quartile* | *Median* | *Third Quartile* | *Ratio of Inter Quartile Difference to Median* | *Ratio of Third Quartile to First Quartile* | *Index of Median Salary (1929 = 100)* | *Index of Median Salary (1939 = 100)* |
|---|---|---|---|---|---|---|---|
| 1929 | $215 | $289 | $415 | 0.69 | 1.93 | 100.0 | |
| 1932 | 167 | 235 | 334 | 0.71 | 2.00 | 81.3 | |
| 1934 | 148 | 210 | 304 | 0.74 | 2.05 | 72.7 | |
| 1939 | 196 | 277 | 411 | 0.78 | 2.10 | 95.8 | 100.0 |
| 1943 | 251 | 334 | 469 | 0.65 | 1.87 | 115.6 | 120.7 |
| 1943 [a] | 272 | 354 | 480 | 0.59 | 1.76 | 122.5 | 127.9 |
| 1946 [b] | 319 | 409 | 553 | 0.57 | 1.73 | 141.5 | 147.7 |
| 1946 [c] | 311 | 392 | 506 | 0.50 | 1.63 | 135.6 | 141.5 |

[a] Base salary plus overtime. [b, c] See source note, below.

Source: 1929, 1932, 1934: *Employment and Earnings in the Engineering Profession, 1929 to 1934,* Bureau of Labor Statistics, Bull. 682, 1941, p. 162. 1939, 1943, 1946 [b]: Calculated from frequency distributions in Andrew Fraser, *The Engineering Profession in Transition,* Engineers Joint Council, 1947, pp. 74–75. Restricted to members of the six principal engineering societies. 1946 [c]: *Employment Outlook for Engineers,* Bureau of Labor Statistics, Bull. 968, 1949, p. 49.

### *Salary Rates for All Engineers and for Graduate Engineers, 1929–1953*

Table A-1 presents median and quartile base monthly salary rates for all engineers for benchmark years between 1929 and 1946. Salary rates declined through 1934 and rose steadily thereafter. In 1934 median engineering salaries were slightly more than a quarter below their 1929 level but by 1939 they had almost recovered to the 1929 level. In 1943 salaries were about 16 per cent higher than in 1929 and 21 per cent higher than in 1939 (23 and 28 per cent including overtime); in 1946, between 36 and 42 per cent higher than in 1929

and between 42 and 48 per cent higher than in 1939, depending upon which of two estimates of median salaries in 1946 is used.

One estimate of salaries in 1946 covers solely members of the six principal engineering societies and one covers all engineers without regard to society membership. The median salary for the latter group was about 4 per cent less than the median for the group of society members; the two quartiles were similarly lower for the total group. Comparisons of engineers classified by professional field and experience level corroborate the fact that society members tend to have slightly higher salaries than other engineers, and are particularly numerous at the upper end of the income distribution.

The data for 1929–1934 are derived from a study which leaned heavily on society memberships for its mailing list. The EJC report for 1939–1946 was restricted solely to society members. The BLS survey for 1946 was based on the National Roster list of engineers in which society members were augmented by engineers located through Selective Service registration. The 1946 BLS study, therefore, probably had the widest coverage of the three. It is reasonable to assume that the movement of engineering salaries in 1929–1934 as reported by BLS and the movement of salaries in 1939–1946, as reported by the EJC, are approximately accurate. It should be recognized, however, that salaries of experienced engineers do not always move in strict proportion to those of inexperienced engineers, and, thus, movements of salaries of society members (who have greater experience—including in this term educational experience) are not strictly accurate for all engineers. We notice differential movements among the various experience classes below (see Tables A-3 and A-6–8). The chief effect is probably that the 1939–1946 rise is underestimated moderately. In addition, it is likely that the level of salaries in 1939–1946, as reported by the EJC is slightly higher than would have been indicated by a sample comparable to that for 1929–1934. Similarly, the level of salaries in 1946, as reported by BLS, is probably slightly lower than one derived from a sample comparable to that for 1929–1934. Thus, the actual increase in salary rates from 1929 to 1946 lies between 36 per cent and 42 per cent and the increase from 1939 to 1946, between 42 and 48 per cent.

Two measures of relative variability of incomes are available: the ratio of the interquartile difference to the median and the ratio of the upper quartile to the lower quartile. Both measures show a rise in relative variability of engineering salaries between 1929 and 1934 and a probable further rise to 1939. Variability dropped sharply

during the war (the drop would be even greater if overtime were included) and dropped further by 1946. In that year, the relative variability of engineering salaries was substantially below that in any year since 1929. The rise in variability between 1929 and 1939 appears to be largely a function of the differential movement of engineering salaries at various experience levels. The decline since 1939 is due to the narrowing of the salary differential for experience and the decline in salary variability within each experience level.

TABLE A-2

Median and Quartile Base Monthly Salary Rates of Graduate Engineers, 1946 and 1953

| | *First Quartile* | *Median* | *Third Quartile* | *Ratio of Inter Quartile Difference to Median* | *Ratio of Third Quartile to First Quartile* | *Index of Median Salary (1946 = 100)* |
|---|---|---|---|---|---|---|
| 1946 | $319 | $405 | $527 | 0.52 | 1.66 | 100.0 |
| 1953 [a] | 418 | 518 | 682 | 0.51 | 1.63 | 127.9 |

[a] Excludes engineers on college faculties, estimated in the source to comprise about two per cent of all engineers, and all self-employed engineers.

Source: 1946: Calculated from frequency distribution in Andrew Fraser, *The Engineering Profession in Transition,* Engineers Joint Council, 1947, pp. 82, 83. Restricted to members of the six principal engineering societies. 1953: Monthly equivalents of annual rates given in *Professional Income of Engineers,* Engineers Joint Council, 1954, p. 12.

Table A-2 compares salary rates in 1946 and in 1953 for graduate engineers. The data show a 28 per cent increase in median salaries between these two years, so engineering salaries were about 75 or 80 per cent higher in 1953 than in 1929 and about 80 to 90 per cent higher than in 1939. This may be some slight understatement of the increase between 1946 and 1953, in view of the restriction of the 1946 data to members of professional societies, but society members are much more representative of graduate engineers than they are of all engineers.

A slight decline in relative variability of engineering salary rates is indicated between 1946 and 1953, but the drop is so small as to be untrustworthy in view of the differences in coverage of the data. Indeed, if one adjusted the 1946 measures of variability by the ratio of income variability for all engineers to that for all society members (from Table A-1), the uncorrected data would show a slight rise in variability between 1946 and 1953.

*Salary Rates Classified by Years of Experience, 1929–1946*

All studies of engineering salaries, and indeed most studies of professional incomes, stress the important effect of years of experience on individual earnings. In all professions, a substantial and

increasing premium is paid for experience until one reaches an age ranging from 45 to 60 when a peak is reached. There is usually some reduction of incomes after this peak. The importance of income differentials resulting from varying years of experience in the engineering profession is illustrated in Table A-3. In 1946, engineers with less than one year of experience had a median monthly salary rate of $231; engineers with 9–11 years' experience, $395; engineers with 30–34 years' experience, $550.

TABLE A-3

Median and Quartile Base Monthly Salary Rates, by Years of Experience, for All Engineers, 1929–1946

| | *First Quartile* | *Median* | *Third Quartile* | *Ratio of Inter Quartile Difference to Median* | *Ratio of Third Quartile to First Quartile* | *Index of Median Salary (1929 = 100)* | *Index of Median Salary (1939 = 100)* |
|---|---|---|---|---|---|---|---|
| | | | | *Under 1 Year* | | | |
| 1929 | $130 | $149 | $174 | 0.30 | 1.34 | 100.0 | |
| 1932 | 89 | 111 | 137 | 0.43 | 1.54 | 74.5 | |
| 1934 | 91 | 110 | 129 | 0.35 | 1.42 | 73.8 | |
| 1939 | 110 | 128 | 156 | 0.36 | 1.42 | 85.9 | 100.0 |
| 1943 | 164 | 183 | 216 | 0.28 | 1.32 | 122.8 | 143.0 |
| 1943 [a] | 195 | 218 | 251 | 0.26 | 1.29 | 146.3 | 170.3 |
| 1946 | 206 | 231 | 259 | 0.23 | 1.26 | 155.0 | 180.4 |
| | | | | *9–11 Years* | | | |
| 1929 | 245 | 304 | 396 | 0.50 | 1.62 | 100.0 | |
| 1932 | 192 | 239 | 300 | 0.45 | 1.56 | 78.6 | |
| 1934 | 169 | 212 | 262 | 0.44 | 1.55 | 69.7 | |
| 1939 | 206 | 250 | 314 | 0.43 | 1.52 | 82.2 | 100.0 |
| 1943 | 269 | 325 | 413 | 0.44 | 1.54 | 106.9 | 130.0 |
| 1943 [a] | 290 | 351 | 428 | 0.39 | 1.48 | 115.4 | 138.7 |
| 1946 | 333 | 395 | 470 | 0.35 | 1.41 | 129.9 | 157.7 |
| | | | | *30–34 Years* | | | |
| 1929 | 297 | 419 | 608 | 0.74 | 2.05 | 100.0 | |
| 1932 | 241 | 341 | 488 | 0.72 | 2.02 | 81.4 | |
| 1934 | 212 | 307 | 441 | 0.75 | 2.08 | 73.3 | |
| 1939 | 311 | 434 | 669 | 0.82 | 2.15 | 103.6 | 100.0 |
| 1943 | 359 | 485 | 720 | 0.74 | 2.01 | 115.7 | 111.7 |
| 1943 [a] | 370 | 492 | 727 | 0.73 | 1.96 | 117.4 | 113.3 |
| 1946 | 414 | 550 | 813 | 0.73 | 1.96 | 131.2 | 126.6 |

[a] Based on salary plus overtime.

Source: 1929, 1932, 1934: *Employment and Earnings in the Engineering Profession, 1929 to 1934*, Bureau of Labor Statistics, Bull. 682, 1941, p. 167. Estimates for 9–11 years' experience and 30–34 years' experience interpolated. 1939, 1943, 1946: Andrew Fraser, *The Engineering Profession in Transition*, Engineers Joint Council, 1947, p. 41. Restricted to members of the six principal engineering societies.

The magnitude of these experience differentials suggests two ways in which a series on engineering incomes, drawn from data not classified by years of experience, might yield a distorted or incomplete picture of the movement of incomes in this profession. First, a change in the experience composition of the profession will result in a change in reported median salaries of the entire profession, although there may have been no actual change in salary rates for engineers at given experience levels. Second, there may be disparate movements in salary rates for different experience levels. As a result of these two possible complications, it is general practice to present income series for engineers with specified years of experience.

Three such series are presented in Table A-3 (and Chart A-1) and following tables. One series is for inexperienced engineers, viz. those with less than one year's experience. A second series covers engineers with substantial experience, viz. 9–11 years' experience. The third series covers engineers with 30–34 years' experience, i.e. engineers at about their peak of earning capacity.

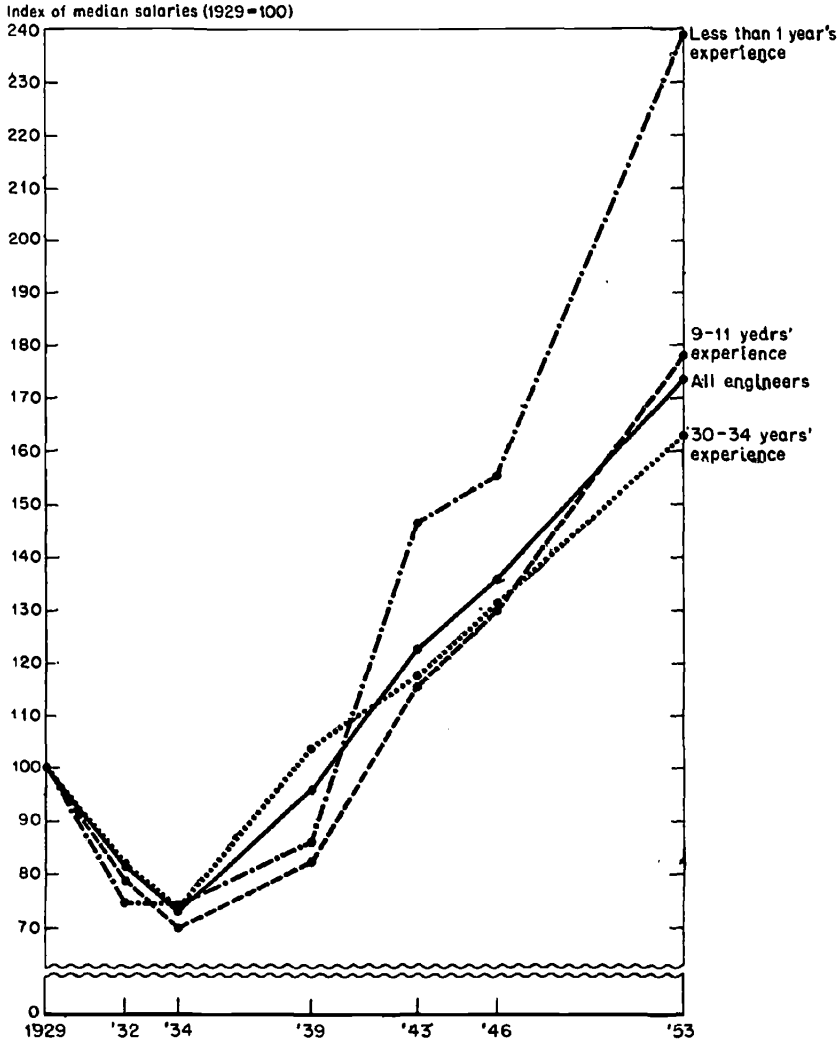
Two notes of caution must be given in the interpretation of these data. First, years of experience are measured by the time elapsed since an engineer started his first professional job (in the 1939–1946 data) or by the difference between the age of an engineer and the median age at which graduate engineers receive a first professional degree (in the 1929–1934 data). Thus, periods of unemployment or work in another occupation are implicitly counted here as engineering experience. Second, the experience level data for 1929–1934 are, as just noted, based in part on the median age at which graduate engineers receive a first engineering degree. Nongraduates may, on the average, enter the profession at a somewhat later age than graduate engineers.

All three series show a decline in salary rates to 1934 and a steady rise thereafter. The three classes of engineers had a decline in salaries of about the same proportion between 1929 and 1934, but the older engineers had a more substantial recovery in salary rates by 1939 than either of the two younger groups.[11] Thus, salary rates

[11] Unemployment among engineers was extremely low in 1929 and 1939 and of course negligible thereafter. During 1932 and 1934, when engineering unemployment was substantial, unemployment rates were highest both among the very young and the very experienced engineers. Thus, engineers under the age of 25 in 1932 reported a 17 per cent unemployment rate and engineers over 50, a rate of 11 per cent. Less than 9 per cent of engineers between 31 and 50 years of age were unemployed. Similarly, in 1934, engineers under 25 had a 14 per cent unemployment rate; engineers over 52, a 12 per cent rate; and engineers between 25 and 52 a rate between 7 and 8 per cent.

## Chart A-1

### Indexes of Median Salaries for All Engineers and for Engineers at Stated Experience Levels, Selected Years, 1929–1953




Source: Table A-8.

for engineers with 30–34 years' experience were slightly higher in 1939 than in 1929, while engineers with less than one and with 9–11 years' experience were still earning substantially lower salaries in 1939 than in 1929. Between 1939 and 1946 percentage increases in salaries were inversely related to experience level, so that salary levels for engineers with both 9–11 years' and 30–34 years' experience were about 30 per cent above 1929 levels while inexperienced engineers were receiving salaries about 55 per cent above the comparable 1929 level.[12]

The substantial narrowing of the experience differential between 1939 and 1946 can be seen more clearly when salaries are related to a 1939 base (Table A-3). By 1943 younger engineers' salaries increased 43 per cent, intermediate engineers, 30 per cent, and older engineers, only 12 per cent. When overtime in 1943 is included in the calculations, the comparable percentage increases are 70, 39, and 13. By 1946, younger engineers' salaries were 80 per cent higher than in 1939, intermediate engineers' salaries, 58 per cent higher, and older engineers', 27 per cent higher. It will be noted that the narrowing of the differential took place early during the war (particularly when overtime is included) and that the early postwar salary structure largely maintained the war-created differentials. Thus, the ratio of intermediate engineers' median salary rates to rates for younger engineers was 2.0 in 1939, 1.8 in 1943 (1.6 including overtime), and 1.7 in 1946. Median rates for older engineers were 3.4 times the salaries for younger engineers in 1939, 2.7 times in 1943 (2.3 including overtime), and 2.4 times in 1946.

Overtime in 1943 was more important for the younger and less well paid engineers than for the older and better-paid engineers. Engineers with less than one year of experience had median salaries including overtime in 1943 which were 19 per cent higher than median base salaries for the same group in that year. For engineers with 9–11 years' experience the increase in median salary due to the inclusion of overtime was only 8 per cent; for engineers with 30–34 years' experience, the increase was only 1 per cent. Similarly, the ratio of the upper quartile salary to the lower quartile salary for each of the three groups in 1934 was lower for base salaries including overtime than it was for base salaries alone.

Relative income variability changed erratically for the three

[12] The data for 1939–1946 are restricted to society members while those for 1929–1934 have wider coverage. The actual increases between 1929 and 1946, thus, are probably somewhat greater than those indicated in the text and table.

groups of engineers between 1929 and 1939, but declined consistently between 1939 and 1946. For both the younger and the older engineers, the two measures of variability were higher in 1939 than in 1929. Younger engineers' incomes rose in variability between 1929 and 1932, declined by 1934 and remained at about the same level through 1939. Variability of older engineers' salaries declined between 1929 and 1932 and rose steadily through 1939. Intermediate engineers, however, experienced a decline in variability of salary rate throughout the 1929–1939 period. For all three groups variability in incomes was substantially lower in 1946 than in 1939.

In every year, relative (as well as absolute) income variability increased with years of experience. Thus, in 1929 the ratio of the interquartile difference to the median for younger engineers was 0.30; for intermediate engineers, 0.50; for older engineers, 0.74. In 1946, the comparable ratios were 0.23, 0.35, and 0.73. This is in accord with a priori expectation, since the longer an engineer works, the more opportunity is afforded for individual ability (as well as random factors) to affect earnings.

### *Engineering Earnings, Classified by Years of Experience, 1894–1924*

When attention is restricted to graduate engineers, it is possible to extend the analysis of incomes, classified by years of experience, back of 1929 (in at least one case to 1894) and forward to 1953. Tables A-4 to A-6 perform the first function; Table A-7, the second.[13]

There is some question as to the reliability of the pre-1929 data and serious question as to their comparability with data for following years. Although the estimate of median starting earnings for graduate engineers with less than one year's experience was lower in 1924 than in 1929, reported median earnings in the earlier years were 6 per cent higher for graduate engineers with 9–11 years' experience and 48 per cent higher for graduate engineers with

[13] Indexes of monthly earnings of graduate engineers show almost the same movements between each benchmark year from 1929 to 1946 as were shown in Table A-3 for all engineers. This conformity suggests that the movements (if not the levels) of incomes for graduate engineers can be taken to represent adequately the movements of income for all engineers in at least the later years of the pre-1929 period and in the post-1946 period, when data for all engineers are not available. The conformity is extremely close for the younger and intermediate engineers and only slightly less so for the older engineers. However, while salary rates for nongraduate engineers approximate those for graduates at younger experience levels, they tend to fall below rates for graduates at the older levels.

30–34 years' experience. A decrease in salaries of engineers at specified experience levels is totally unreasonable for these years.[14] In fact one would have expected some increase in view of the high levels of prosperity and investment during the late twenties.

There are three possible reasons for this apparent movement. First, with the exception of the younger engineers (for whom starting salaries are apparently reported), all of the pre-1929 data relate to total earnings, while the data for later periods are based on salary rates for engineering work. Thus, the earlier data include bonuses and, particularly, fees for outside engineering work, as well as outside earnings in nonengineering work. But in 1929 and 1939, annual earnings of engineers did not exceed 12 times base monthly salary rates by more than 5 per cent, except possibly at the highest experience levels.[15] This difference in coverage, then, accounts for only a portion of the apparent decline in engineering incomes between 1924 and 1929.

Second, the pre-1929 data relate to all engineering graduates, regardless of whether or not they were engaged in engineering work. About one-fifth of the reporting engineers who graduated before 1922 and about one-tenth of the reporting graduates of the class of 1922, 1923 and 1924 were employed in work of a nonengineering nature in 1924. However, at most experience levels graduate engineers employed in engineering work in 1929 earned *more* than graduates engaged in nonengineering work.[16] In isolation, this difference in coverage, then, should have yielded a rise in income between 1924 and 1929.

We are left, then, with the presumption that there was, in addition, some selective bias in the sample for the pre-1929 data which precludes a comparison of the levels of income reported before 1929

[14] The decline between 1924 and 1929 was found at each experience level (for which data were available) between 5 years and 30 years, and increased with increasing experience. At the 1 to 2-year level, earnings in 1924 were 10 per cent lower than in 1929. At the 5-year level, earnings in 1924 were 1 per cent higher than salaries in 1929; at the 10-year level, 6 per cent higher; at the 15-year level, 16 per cent higher; at the 20-year level, 13 per cent higher; and at the 30-year level, 42 per cent higher.

[15] *Employment and Earnings in the Engineering Profession, 1929–1934,* pp. 140, 170; Fraser, *op. cit.,* pp. 41, 43.

[16] Of the seven experience levels between 1–2 years and 25–32 years in 1929, graduates engaged in engineering had higher median earnings than graduates in nonengineering work at six levels. The excess declined from 15 per cent at 1–2 years' experience to zero at 13–16 years, amounted to minus 10 per cent at 17–24 years, and was three per cent at 25–32 years. *Employment and Earnings in the Engineering Profession, 1929–1934,* p. 151.

with those reported for 1929 and following years. It also appears that we cannot compare the experience differentials of the two periods, since the bias seems greatest at the upper levels of experience.[17]

However, there is no evidence of strong bias in the *movement* over time of the reported incomes of engineering graduates with specified years of experience. This is particularly true at the younger experience levels where there is always considerably less salary variability and where outside earnings play a smaller role.

In Table A-4 are shown annual earnings of engineering graduates at various specified experience levels for the period 1894–1924, derived from data in the *Report of the Investigation of Engineering Education.* When graphed, earnings at the several experience levels show quite similar movements, particularly so at the lower levels. The internal consistency of the data supports the view that they can be accepted as depicting at least the broad movements of engineering incomes over the three decades in question.

When the earnings data are converted to indexes with a 1924 base (Table A-5), the major movements can be more readily traced.[18] Earnings of engineering graduates (at least at the younger experience levels) increased between 100 and 150 per cent between the end of the nineteenth century and 1924, with the bulk of this increase occurring during World War I and the immediate postwar years. The median percentage increase between 1894–1896 and 1904–1906 (for those experience levels reporting) was about 20 per cent. This rise is equivalent to about a 1½ to 2 per cent compound annual rate. The median increase for the decade 1904–1906 to 1914–1916 was 11 per cent, or about 1 per cent compounded annually, with nearly all of this increase coming in the second half of the period. For the half-decade 1914–1916 to 1919–1921, covering the first World War, the median rise was 33 per cent, or about 6 per cent compounded annually. For the somewhat shorter period 1919–1921 to 1924, the increase was 14 per cent or between a 3 and 4 per cent compound rate per year.

There was perceptible narrowing of the experience differentials over the two or three decades prior to 1924. Starting salaries in

[17] Thus, while relative income variability at less than one year's experience was about the same in the 1924 and 1929 data, at 9–11 years' experience it was slightly higher in 1924 than in 1929, and at 30–34 years it was substantially higher in the 1924 income data than in the 1929 data.

[18] The 3-year experience class is omitted since no earnings data for the base year, 1924, were available for this group.

1899 were 41 per cent of their 1924 level while earnings of engineering graduates with five years' experience in 1899 were 52 per cent of comparable earnings in 1924. Similarly the ratios of earnings in 1909 to earnings in 1924 were 0.49 for starting engineers, 0.53 for

TABLE A-4

Annual Earnings of Engineering Graduates, Classified by Years since Graduation, 1894–1924

| | STARTING SALARY | YEARS SINCE GRADUATION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | *1* | *2* | *3* | *5* | *10* | *15* | *20* | *30* |
| 1894 | $ 600 | | | | | | | | |
| 1895 | | $ 900 | | | | | | | |
| 1896 | | | $1,000 | | | | | | |
| 1897 | | | | $1,200 | | | | | |
| 1899 | 600 | | | | $1,500 | | | | |
| 1900 | | 800 | | | | | | | |
| 1901 | | | 1,075 | | | | | | |
| 1902 | | | | 1,380 | | | | | |
| 1904 | 720 | | | | 1,600 | $2,400 | | | |
| 1905 | | 900 | | | | | | | |
| 1906 | | | 1,200 | | | | | | |
| 1907 | | | | 1,300 | | | | | |
| 1909 | 720 | | | | 1,530 | 2,700 | $3,600 | | |
| 1910 | | 900 | | | | | | | |
| 1911 | | | 1,200 | | | | | | |
| 1912 | | | | 1,366 | | | | | |
| 1914 | 800 | | | | 1,800 | 2,500 | 4,000 | $5,000 | |
| 1915 | | 1,000 | | | | | | | |
| 1916 | | | 1,200 | | | | | | |
| 1917 | | | | 1,600 | | | | | |
| 1919 | 1,300 | | | | 2,400 | 3,000 | 4,000 | 6,000 | |
| 1920 | | 1,800 | | | | | | | |
| 1921 | | | 2,000 | | | | | | |
| 1922 | 1,320 | | | 2,200 | | | | | |
| 1923 | 1,440 | 1,800 | | | | | | | |
| 1924 | 1,476 | 1,800 | 2,100 | | 2,860 | 4,000 | 5,000 | 5,500 | $7,500 |

Source: *Report of the Investigation of Engineering Education, 1923–1929,* Society for the Promotion of Engineering Education, 1930, Vol. I, p. 261.

engineers with five years' experience, 0.68 at the ten year level, and 0.72 for the fifteen year level.

The bulk of this narrowing occurred during the first World War; there was some reversal of the movement during the immediate postwar years. Thus, the increase in earnings at the starting level

and at one and two years' experience ranged between 61 and 80 per cent between 1914–1916 and 1919–1921, while the increase for engineering graduates with 10, 15, and 20 years' experience ranged between zero and 20 per cent. During the following period (1919–1921 to 1924), the comparable ranges were zero to 14 per cent for the younger engineers and 25 to 33 per cent for the intermediate engineers (excluding those with 30 years' experience, who showed a slight decline).

TABLE A-5

Indexes of Annual Earnings of Engineering Graduates, Classified by Years since Graduation, 1894–1924 (1924 = 100)

| | | YEARS SINCE GRADUATION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | STARTING SALARY | *1* | *2* | *5* | *10* | *15* | *20* | *30* |
| 1894 | 40.7 | | | | | | | |
| 1895 | | 50.0 | | | | | | |
| 1896 | | | 47.6 | | | | | |
| 1899 | 40.7 | | | 52.4 | | | | |
| 1900 | | 44.4 | | | | | | |
| 1901 | | | 51.2 | | | | | |
| 1904 | 48.8 | | | 55.9 | 60.0 | | | |
| 1905 | | 50.0 | | | | | | |
| 1906 | | | 57.1 | | | | | |
| 1909 | 48.8 | | | 53.4 | 67.5 | 72.0 | | |
| 1910 | | 50.0 | | | | | | |
| 1911 | | | 57.1 | | | | | |
| 1914 | 54.5 | | | 62.9 | 62.5 | 80.0 | 90.9 | |
| 1915 | | 55.6 | | | | | | |
| 1916 | | | 57.1 | | | | | |
| 1919 | 87.8 | | | 83.9 | 75.0 | 80.0 | 109.1 | |
| 1920 | | 100.0 | | | | | | |
| 1921 | | | 95.2 | | | | | |
| 1922 | 89.5 | | | | | | | |
| 1923 | 97.6 | 100.0 | | | | | | |
| 1924 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Source: Table A-4.

In Table A-6, the pre-1929 earnings data for engineering graduates (converted to monthly equivalents) are presented for the three experience groups with which we have been concerned in this appendix. The earnings experience of younger engineers has already

been outlined. To summarize the data briefly, starting salaries of graduate engineers increased 146 per cent between 1894 and 1924. The largest increases were during the first World War and in the immediately following years; the smallest increases were in the decade prior to 1914. Thus, the increase in starting

TABLE A-6

Median and Quartile Base Monthly Salary Rates of Graduate Engineers, by Years of Experience, 1894–1924

| | *First Quartile* | *Median* | *Third Quartile* | *Ratio of Inter Quartile Difference to Median* | *Ratio of Third Quartile to First Quartile* | *Index of Median Salary (1924 = 100)* |
|---|---|---|---|---|---|---|
| | | | *Under 1 Year* [a] | | | |
| 1894 | | $ 50 | | | | 40.7 |
| 1899 | | 50 | | | | 40.7 |
| 1904 | | 60 | | | | 48.8 |
| 1909 | | 60 | | | | 48.8 |
| 1914 | | 67 | | | | 54.5 |
| 1919 | | 108 | | | | 87.8 |
| 1922 | | 110 | | | | 89.5 |
| 1923 | | 120 | | | | 97.6 |
| 1924 | $100 | 123 | $130 | 0.24 | 1.30 | 100.0 |
| | | | *9–11 Years* | | | |
| 1904 | | 200 | | | | 60.1 |
| 1909 | | 225 | | | | 67.6 |
| 1914 | | 208 | | | | 62.5 |
| 1919 | | 250 | | | | 75.1 |
| 1924 | 259 | 333 | 425 | 0.50 | 1.68 | 100.0 |
| | | | *30–34 Years* | | | |
| 1924 | 385 | 667 | 1,354 | 1.45 | 3.52 | 100.0 |

[a] Starting salaries.

Source: Monthly equivalents of annual earnings given in *Report of the Investigation of Engineering Education, 1923–1929,* Society for the Promotion of Engineering Education, 1930, Vol. I, pp. 261–262. Data for 9–11 years interpolated and for 30–34 years extrapolated.

salaries in the decade 1894–1904 was 20 per cent; in the decade 1904–1914, 12 per cent; in the half-decade 1914–1919, 61 per cent; and in the half-decade 1919–1924, 14 per cent. Earnings for graduate engineers with 9–11 years' experience increased 66 per cent between 1904 and 1924, with the largest increases again coming after 1914. Between 1904 and 1914, the reported increase in earnings was 4 per cent; between 1904 and 1919, 20 per cent; and between 1919 and 1924, 33 per cent. For graduate engineers with 30–34

years' experience, an estimate of earnings for the pre-1929 period is available only for 1924.

*Salary Rates, Classified by Years of Experience, 1946–1953*

In the most recent period, comprehensive data are available only for privately employed graduate engineers, classified by years of experience (Table A-7). Much less information is available on

TABLE A-7

Base Monthly Salary Rates of Privately Employed Graduate Engineers, by Years of Experience, 1946–1953

| | *First Quartile* | *Median* | *Third Quartile* | *Ratio of Inter Quartile Difference to Median* | *Ratio of Third Quartile to First Quartile* | *Index of Median Salary (1946 = 100)* |
|---|---|---|---|---|---|---|
| | | | | *Under 1 Year* [a] | | |
| 1946 | $209 | $232 | $262 | 0.23 | 1.25 | 100.0 |
| 1953 | 334 | 357 | 387 | 0.15 | 1.16 | 153.9 |
| | | | | *9–11 Years* [b] | | |
| 1946 | 340 | 401 | 472 | 0.33 | 1.39 | 100.0 |
| 1953 | 481 | 549 | 630 | 0.27 | 1.31 | 136.9 |
| | | | | *30–34 Years* | | |
| 1946 | 463 | 622 | 925 | 0.74 | 2.00 | 100.0 |
| 1953 | 630 | 771 | 1,008 | 0.49 | 1.60 | 124.0 |

[a] Data collected by a large private agency indicate that average starting salaries of research engineers and scientists with B.S. degrees were $281 per month in 1948; for those with one year's experience, average monthly salaries were $302.

[b] The agency referred to in the note above reported that average monthly salaries for research engineers and scientists with B.S. degrees and with nine years' experience were $434 in 1948; for those with ten years' experience, monthly salaries were $452; for those with eleven years' experience, $468.

Source: 1939–1946: Andrew Fraser, *The Engineering Profession in Transition*, Engineers Joint Council, 1947, pp. 46, 48. Restricted to members of the six principal engineering societies. 1953: *Professional Income of Engineers*, Engineers Joint Council, 1954, p. 14. Monthly equivalents of annual salaries. Excludes engineers on college faculties, estimated in the source to comprise about two per cent of all engineers, and all self-employed engineers. On p. 13, the average starting salary for privately-employed engineers is given as $341. Salaries for engineers with 9–11 years' and 30–34 years' experience interpolated.

publicly employed graduates but private employment heavily outweighs public employment.

For the younger and intermediate engineers, the movement of salary rates for privately employed graduates between 1939 and 1946 (for which period we do have data on both privately employed

engineers and all engineers) conforms almost precisely to the movement for all engineers. For older engineers, somewhat smaller increases are recorded for the graduate group than for others.

All three groups of privately employed graduates show substantial increases in salary rates between 1946 and 1953. The increases (in relative terms) were larger, the lower the experience level, so that experience differentials were narrowed again during this seven-year period. Younger engineers' salaries increased 54 per cent between 1946 and 1953; intermediate engineers' salaries, 37 per cent; and older engineers' salaries, 24 per cent. The ratio of median salary rates for engineers with 9–11 years' experience to salary rates for engineers with less than one year's experience declined from 1.7 in 1946 to 1.5 in 1953; the corresponding ratio for older engineers declined from 2.4 to 2.2. A major decline in relative income variability also occurred within each of the three groups between 1946 and 1953.

Since the salary data for 1946 were based on reports from society members only, while the 1953 data include both society and non-society members, the actual increases in salary were probably slightly greater than those indicated in the table.

The validity of these estimates of salary rate increases depends on the accuracy of the 1953 survey. This survey was probably the least scientific of the four studies conducted since 1934. The sample appears to be mainly restricted to employees of larger companies, since the 295 companies which provided data had an average total employment of almost 10,000, and this limitation may impart some bias to the results. Similarly, no tests were made to check the age, industrial or geographical distribution of the reporting engineers against data from the 1950 census. Since the bulk of the data in the report relates to engineering salaries, classified by experience level, for individual industries, possible biases in industrial and age distributions were not too important for the EJC. But for the present analysis such biases may be serious. Accordingly, we have compared the salary data in the 1953 survey against other available data to see if at least the rough orders of magnitude seem reasonable.

The 1953 survey reported an average starting monthly salary for private employment of $341 and a median salary rate for engineers with less than a year's experience of $357. Surveys conducted by Frank S. Endicott, Director of Placement, Northwestern University, based on reports from business and industrial companies, show an

average starting salary for graduate engineers of $305 in 1952 and $325 in 1953.[19] The National Industrial Conference Board reported average starting salaries for engineering graduates in private manufacturing employment as $309 in 1952 and $334 in 1953; for nonmanufacturing private employment in 1953, average salaries were $321.[20] A survey of starting salaries in 1953 by the Family Economics Bureau of the Northwestern National Life Insurance Company, based on data from universities, colleges and technical schools, indicated that the prevailing starting salary rate for graduate engineers was between $325 and $375 per month in 1953.[21]

All of these studies yield results quite close to the figures in the 1953 EJC survey. The Endicott and NICB estimates are between 2 and 6 per cent lower than those in the EJC report, while the latter are close to middle of the range indicated in the insurance company data. The difference could easily be accounted for by differences in timing, sampling variability and sample design.

Another study of engineering earnings was made by the National Society of Professional Engineers in 1952.[22] The members of this society are all registered under state registration laws and probably have somewhat higher salaries, at comparable experience levels, than all engineers or even all graduate engineers. Further, the data apparently refer to incomes, which of course are higher than base salaries. On both counts, then, one would expect the earnings of members of this society to exceed salary rates for graduate engineers. The data conform to this expectation.[23]

[19] *Journal of College Placement,* March 1953, p. 53.

[20] *Management Record,* January 1953, p. 2, as cited in "Shortage and Salaries of Scientists and Engineers," processed, Civil Service Commission, November 1953, pp. 7, 8.

[21] "Shortage and Salaries of Scientists and Engineers," p. 14.

[22] *Ibid.,* p. 23.

[23] In 1952 the median income of members of this society who had less than one year's experience and who were employed in private industry (excluding public utilities) was $375 per month. This is about one-fifth higher than starting salaries for privately employed graduates with less than a year's experience in 1953 (Table A-7). However, the Endicott and NICB studies suggest that salaries for privately employed younger engineers increased from five to seven per cent between 1952 and 1953, so that median incomes for privately employed younger members of this society probably exceeded the 1953 estimate for all privately employed younger graduates by about 10 per cent.

For engineers with 9–11 years' experience, the median income of society members in 1952 was $610 for employees of industry and $517 for employees of public utilities. These figures bear a reasonable relationship to the EJC salary estimate of $549 in 1953 for all privately employed graduates at the same experience level. At the 30–34 years' experience level, the median income of the

The scattered data gathered to test the reasonableness of the EJC 1953 salary estimates all appear to confirm the general levels of those estimates, particularly at the lower experience levels. There is thus considerable basis for accepting them as approximate measures of engineering earnings in that year.

TABLE A-8

Indexes of Median Salary for All Engineers and for Engineers at Stated Experience Levels, Selected Years, 1929–1953 (1929 = 100)

| | *All Engineers* (1) | *Engineers with Less than 1 Year's Experience* (2) | *Engineers with 9–11 Years' Experience* (3) | *Engineers with 30–34 Years' Experience* (4) |
|---|---|---|---|---|
| 1929 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1932 | 81.3 | 74.5 | 78.6 | 81.4 |
| 1934 | 72.7 | 73.8 | 69.7 | 73.3 |
| 1939 | 95.8 | 85.9 | 82.2 | 103.6 |
| 1943 [a] | 122.5 | 146.3 | 115.4 | 117.4 |
| 1946 | 135.6 [b] | 155.0 | 129.9 | 131.2 |
| 1953 | 173.4 [b] | 238.5 | 177.8 | 162.7 |

[a] Including overtime.

[b] Other data for 1946, restricted to members of professional engineering societies (as in cols. 2 through 4), would yield an index of 141.5 for 1946 and an extrapolated value for 1953 of 181.0

Column — Source

1 *1929–1946:* Table A-1. *1939–1943:* Data restricted to members of professional engineering society. *1953:* 1946 value extrapolated by movement of median salary of graduate engineers, Table A-2.

2–4 *1929–1946:* Table A-3. *1939–1946:* Data restricted to members of professional engineering societies. *1953:* 1946 values extrapolated by movement of median salary of privately-employed graduate engineers, Table A-7.

### *Summary of Engineering Earnings, 1929–1953*

Like the working population as a whole, the engineering profession has experienced a large increase in money income over the last decade and a half (Table A-8). The median salary of engineers declined about one-quarter between 1929 and 1934 but rose steadily thereafter until by 1953 it had reached a level three-quarters above that in 1929.

This movement of the median salary for all engineers is affected

society members who were employed by industry in 1952 was $846 and by public utilities, $763. These again are in reasonable agreement, in terms of expected differences, with the 1953 EJC salary estimate of $771 for all privately employed graduates at the comparable experience level.

by the changes in the relative salaries and the distribution of engineers in various experience levels. We can measure only the former influence, and the data show substantial divergences of movement of salary differentials over the period since 1929. Thus, although all three experience levels described in Table A-8 experienced the same decline in salaries between 1929 and 1934, salaries of older engineers (those with 30–34 years' experience) recovered more sharply by 1939 than did those of intermediate engineers (9–11 years' experience) and those of starting engineers.

Since 1939, however, the percentage increases in salary rates have been inversely related to years of experience. By 1953, starting engineers' salaries were 139 per cent above their 1929 level; intermediate engineers were earning 78 per cent more than their counterparts in 1929; and older engineers' earnings were only 63 per cent above their level in 1929.[24]

This has meant, of course, that the salary differential for experience has decreased appreciably. The ratio of intermediate engineers' salaries to those of starting engineers, which was 2.0 in 1929 and 1939, fell to 1.7 in 1946 and to 1.5 in 1953. The ratio of older engineers' salaries to those of new entrants into the profession rose from 2.8 in 1929 to 3.4 in 1939, but fell sharply to 2.4 in 1946 and to 2.2 in 1953. The decline in these differentials has important consequences for the engineering profession, including particularly the fact that expected life earnings of engineers have risen substantially less than is suggested by starting salaries alone.

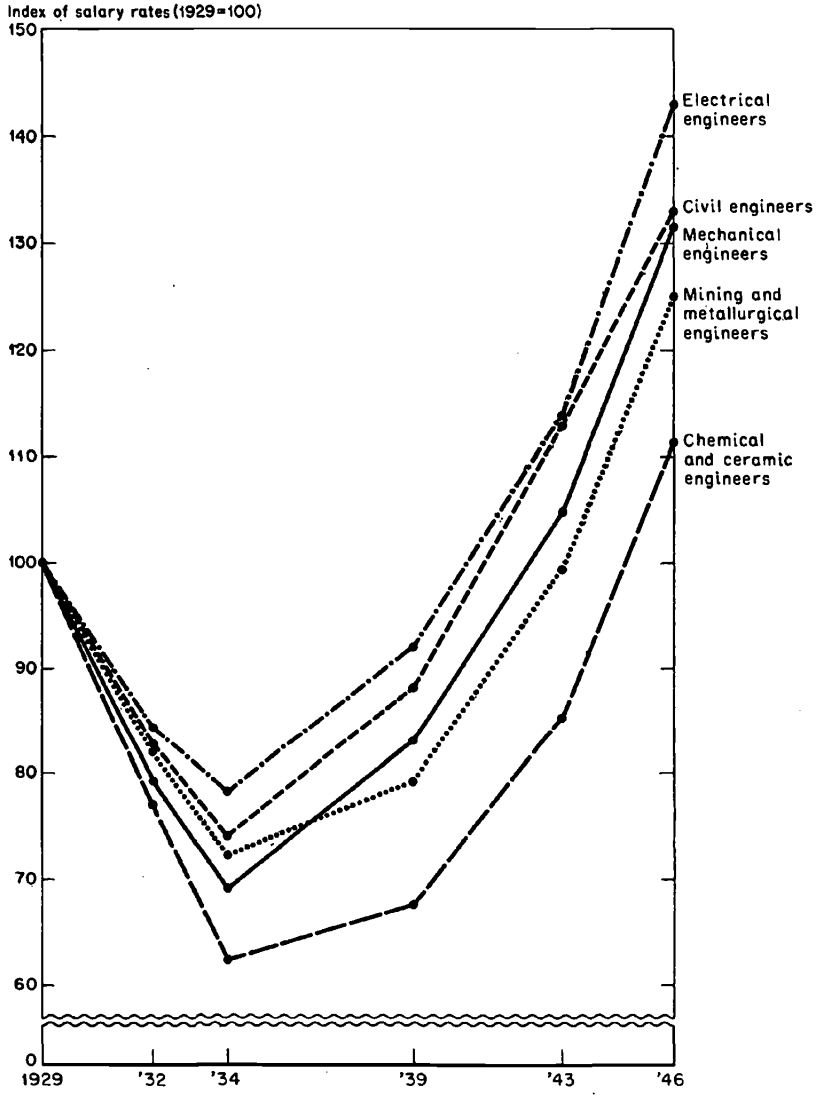
*Salary Rates, Classified by Major Field, 1929–1946*

Earnings data for the five major engineering fields are available only for the period 1929–1946 (Table A-9 and Chart A-2). Median salaries in each field declined between 1929 and 1934 and rose continuously thereafter. Chemical engineers suffered the greatest relative loss in salaries during the thirties (falling more than one-third between 129 and 1934) and received the largest relative increase during 1939–1946. For the seventeen-year period as a whole, median salaries in electrical engineering rose about 43 per cent; median salaries in civil, mechanical and mining engineering, about 25 to 33 per cent; and salaries in chemical engineering, only 11 per cent.

[24] The EJC study of salaries in 1956, as reported in the *New York Times* (January 18, 1957), indicates that median monthly salaries in that year for engineers with 9–11 years' experience were about $688, and for engineers with 30–34 years' experience, about $883, or about 125 per cent and 115 per cent, respectively, of their 1953 level.

## Chart A-2

### Indexes of Base Monthly Salary Rates of All Engineers by Specialization, 1929–1946




Source: Table A-9

Mining engineering commanded the highest base salary rates throughout the period.[25] Chemical engineers, whose median salary was second highest in 1929, fell to last place in 1946. In general, the salary differences among the several fields narrowed perceptibly between 1929 and 1946; the ratio of the highest to the lowest median salary falling from 1.21 to 1.15 (or from 1.19 to 1.13, if we exclude the relatively small field of mining engineering).

In every case, the variability of earnings increased between 1929 and 1934 and declined sharply to 1946. In 1929–1934, chemical engineering had the most variable earnings and civil engineering,

[25] This may be partly due to differences in age structure. Mining engineering grew less rapidly than other fields and its practitioners presumably had a higher average age.

TABLE A-9

Base Monthly Salary Rates of All Engineers by Specialization, 1929–1946

| | *First Quartile* | *Median* | *Third Quartile* | *Ratio of Inter Quartile Difference to Median* | *Ratio of Third Quartile to First Quartile* | *Index of Median Salary (1929 = 100)* | *Index of Median Salary (1939 = 100)* |
|---|---|---|---|---|---|---|---|
| | | | | *Chemical and Ceramic* | | | |
| 1929 | $221 | $326 | $490 | 0.83 | 2.22 | 100.0 | |
| 1932 | 157 | 251 | 400 | 0.91 | 2.55 | 77.0 | |
| 1934 | 131 | 203 | 339 | 1.02 | 2.59 | 62.3 | |
| 1939 | | 220 | | | | 67.5 | 100.0 |
| 1943 | | 278 | | | | 85.3 | 126.4 |
| 1943 [a] | | 303 | | | | 92.9 | 137.7 |
| 1946 | 294 | 363 | 471 | 0.49 | 1.60 | 111.3 | 165.0 |
| | | | | *Civil* | | | |
| 1929 | 213 | 277 | 372 | 0.57 | 1.75 | 100.0 | |
| 1932 | 169 | 229 | 311 | 0.62 | 1.84 | 82.7 | |
| 1934 | 150 | 205 | 279 | 0.62 | 1.86 | 74.0 | |
| 1939 | | 244 | | | | 88.1 | 100.0 |
| 1943 | | 313 | | | | 113.0 | 128.3 |
| 1943 [a] | | 328 | | | | 118.4 | 134.4 |
| 1946 | 304 | 368 | 468 | 0.45 | 1.54 | 132.9 | 150.8 |
| | | | | *Electrical* | | | |
| 1929 | 201 | 275 | 405 | 0.74 | 2.01 | 100.0 | |
| 1932 | 163 | 232 | 336 | 0.75 | 2.06 | 84.4 | |
| 1934 | 148 | 215 | 315 | 0.78 | 2.13 | 78.2 | |
| 1939 | | 253 | | | | 92.0 | 100.0 |
| 1943 | | 313 | | | | 113.8 | 123.7 |
| 1943 [a] | | 355 | | | | 121.8 | 132.4 |
| 1946 | 311 | 393 | 503 | 0.49 | 1.61 | 142.9 | 155.3 |

TABLE A-9 (continued)

| | First Quartile | Median | Third Quartile | Ratio of Inter Quartile Difference to Median | Ratio of Third Quartile to First Quartile | Index of Median Salary (1929 = 100) | Index of Median Salary (1939 = 100) |
|---|---|---|---|---|---|---|---|
| | | | | *Mechanical* | | | |
| 1929 | 225 | 311 | 455 | 0.74 | 2.02 | 100.0 | |
| 1932 | 155 | 246 | 356 | 0.77 | 2.14 | 79.1 | |
| 1934 | 145 | 215 | 313 | 0.78 | 2.16 | 69.1 | |
| 1939 | | 258 | | | | 83.0 | 100.0 |
| 1943 | | 326 | | | | 104.8 | 126.4 |
| 1943 [a] | | 356 | | | | 114.5 | 138.0 |
| 1946 | 322 | 409 | 527 | 0.50 | 1.64 | 131.5 | 158.5 |
| | | | | *Mining and Metallurgical* | | | |
| 1929 | $241 | $334 | $503 | 0.79 | 2.09 | 100.0 | |
| 1932 | 183 | 274 | 409 | 0.82 | 2.23 | 82.0 | |
| 1934 | 154 | 241 | 371 | 0.90 | 2.41 | 72.2 | |
| 1939 | | 267 | | | | 79.1 | 100.0 |
| 1943 | | 332 | | | | 99.4 | 124.3 |
| 1943 [a] | | 348 | | | | 104.2 | 130.3 |
| 1946 | 313 | 417 | 560 | 0.59 | 1.79 | 124.9 | 156.2 |

[a] Base salary plus overtime.

Source: *1929–1934: Employment and Earnings in the Engineering Profession, 1929 to 1934,* Bureau of Labor Statistics, Bull. 682, 1941, p. 165. *1939, 1943: Employment Outlook for Engineers,* Bureau of Labor Statistics, Bull. 968, 1949, p. 63. *1943* [a]*: Ibid.,* p. 61. *1946:* Calculated from frequency distributions in *ibid.,* p. 107.

the least. By 1946, the range of income variability among the separate fields had narrowed considerably, with mining engineering having slightly higher and civil engineering slightly lower variability than the other fields.

*Salary Rates in the Five Engineering Fields, Classified by Years of Experience, 1929–1946*

The differences in salary increases for younger engineers in the five engineering fields in both 1929–1946 and 1939–1946 were quite small (Tables A-10 and A-11). For intermediate engineers, the differences among the engineering specialties were substantially larger in both the longer and shorter periods. For older engineers, the differences in salary increases among the several fields were substantial for 1929–1946 but quite small for 1939–1946 (almost as small, in fact, as among younger engineers).

There is almost no consistent order of engineering fields by de-

gree of salary increase, either among the three age groups or between the 1929–1946 and 1939–1946 periods. The ranking of the five fields by percentage increase in salaries is shown in Table A-12 for all engineers and for each experience level in both periods.

TABLE A-10

Median Base Monthly Salary Rates and Indexes of Salary Rates of Graduate Engineers with Bachelor's Degree, by Professional Field and Years of Experience, 1929–1946

| | *Years of Experience* | *Chemical* | *Civil* | *Electrical* | *Mechanical* | *Mining and Metallurgical* |
|---|---|---|---|---|---|---|
| | | | | *Salary Rates* | | |
| 1929 | Less than 1 | $150 | $155 | $137 | $141 | $156 |
| | 9–11 | 383 | 299 | 329 | 331 | 359 |
| | 30–34 | 500 | 414 | 458 | 493 | 462 |
| 1932 | Less than 1 | 116 | 103 | 106 | 97 | 143 |
| | 9–11 | 279 | 236 | 251 | 256 | 247 |
| | 30–34 | n.a. | 336 | 420 | 392 | 360 |
| 1934 | Less than 1 | 107 | 116 | 106 | 106 | 113 |
| | 9–11 | 258 | 208 | 223 | 223 | 222 |
| | 30–34 | 426 | 294 | 373 | 342 | 341 |
| 1946 | Less than 1 | 242 | 246 | 229 | 226 | 244 |
| | 9–11 | 393 | 348 | 365 | 403 | 385 |
| | 30–34 | 640 | 453 | 520 | 543 | 608 |
| | | | | *Indexes of Salary Rates (1929 = 100)* | | |
| 1929 | Less than 1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| | 9–11 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| | 30–34 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1932 | Less than 1 | 77.3 | 66.5 | 77.4 | 68.8 | 91.7 |
| | 9–11 | 72.8 | 78.9 | 76.3 | 77.3 | 68.8 |
| | 30–34 | n.a. | 81.2 | 91.7 | 79.5 | 77.9 |
| 1934 | Less than 1 | 71.3 | 74.8 | 77.4 | 75.2 | 72.4 |
| | 9–11 | 67.4 | 69.6 | 67.8 | 67.4 | 61.8 |
| | 30–34 | 85.2 | 71.0 | 81.4 | 69.4 | 73.8 |
| 1946 | Less than 1 | 161.3 | 158.7 | 167.2 | 160.3 | 156.4 |
| | 9–11 | 102.6 | 116.4 | 110.9 | 121.8 | 107.2 |
| | 30–34 | 128.0 | 109.4 | 113.5 | 110.1 | 131.6 |

n.a. = not available.

Source: *Employment Outlook for Engineers,* Bureau of Labor Statistics, Bull. 968, 1949, p. 109. Data for 9–11 years and 30–34 years interpolated for 1929, 1932 and 1934.

It can be seen there that electrical engineers, who ranked first in salary increases (without regard to experience levels) between 1929 and 1946, ranked first again among younger engineers, but third among intermediate and older engineers. Chemical engineers ranked first for the same period when no account is taken of ex-

perience levels, but ranked second among younger and older engineers and last among intermediate engineers. The same inconsistency holds for the 1939–1946 period, and holds also for both periods when attention is restricted to the three major engineering fields.

TABLE A-11

Median Base Monthly Salary Rates and Indexes of Salary Rates of All Engineers, by Professional Field and Years of Experience, 1939–1946

| | *Years of Experience* | *Chemical* | *Civil* | *Electrical* | *Mechanical* | *Mining and Metallurgical* |
|---|---|---|---|---|---|---|
| | | | | *Salary Rates* | | |
| 1939 | Less than 1 | $130 | $144 | $127 | $129 | $134 |
| | 9–11 | 299 | 218 | 240 | 261 | 284 |
| | 30–34 | 545 | 337 | 423 | 423 | 488 |
| 1943 | Less than 1 | 177 | 183 | 186 | 179 | 203 |
| | 9–11 | 346 | 272 | 307 | 344 | 338 |
| | 30–34 | 595 | 372 | 482 | 456 | 526 |
| 1943 [a] | Less than 1 | 214 | 204 | 214 | 219 | 219 |
| | 9–11 | 361 | 302 | 332 | 369 | 358 |
| | 30–34 | 620 | 378 | 490 | 479 | 520 |
| 1946 | Less than 1 | 242 | 247 | 228 | 226 | 247 |
| | 9–11 | 399 | 345 | 366 | 408 | 404 |
| | 30–34 | 655 | 427 | 513 | 514 | 608 |
| | | | | *Indexes of Salary Rates (1939 = 100)* | | |
| 1939 | Less than 1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| | 9–11 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| | 30–34 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1943 | Less than 1 | 136.2 | 127.1 | 146.5 | 138.8 | 151.5 |
| | 9–11 | 115.7 | 124.8 | 127.9 | 131.8 | 119.0 |
| | 30–34 | 109.2 | 110.4 | 113.9 | 107.8 | 107.8 |
| 1943 [a] | Less than 1 | 164.6 | 141.7 | 168.5 | 169.8 | 163.4 |
| | 9–11 | 120.7 | 138.5 | 138.3 | 141.4 | 126.1 |
| | 30–34 | 110.1 | 112.1 | 115.8 | 113.2 | 106.6 |
| 1946 | Less than 1 | 186.2 | 171.5 | 179.5 | 175.2 | 184.3 |
| | 9–11 | 133.4 | 158.3 | 152.5 | 156.3 | 142.3 |
| | 30–34 | 120.2 | 126.7 | 121.3 | 121.5 | 124.6 |

[a] Base salary plus overtime.

Source: *1939–1943, 1946: Employment Outlook for Engineers,* Bureau of Labor Statistics, Bull. 968, 1949, p. 108. *1943* [a]*: Ibid.,* p. 109.

However, it was pointed out earlier that the dispersion of salary increases was small for the younger engineers for both 1929–1946 and 1939–1946 and for older engineers, for 1939–1946. Hence, any important effect of differential salary movements on the supply of

engineers in the several specialties will stem from changes in salaries among intermediate engineers.

## Census Data

The 1940 census presented data (in the form of frequency distributions) on wage and salary income of persons in various occupations who worked twelve months in 1939. The median annual salary income for engineers, derived from the full distribution, was $2,636, or $220 per month. However, the first class in the distribution comprised persons who received between zero and $99 in salary in

TABLE A-12

Ranking [a] of Engineering Fields by Percentage Increase in Salary Rates, 1929–1946 and 1939–1946

| | | YEARS OF EXPERIENCE | | |
|---|---|---|---|---|
| | ALL ENGINEERS | *Less than 1* | *9–11* | *30–34* |
| 1929–1946 | Electrical | Electrical | Mechanical | Mining |
| | Civil | Chemical | Civil | Chemical |
| | Mechanical | Mechanical | Electrical | Electrical |
| | Mining | Civil | Mining | Mechanical |
| | Chemical | Mining | Chemical | Civil |
| 1939–1946 | Chemical | Chemical | Civil | Civil |
| | Mechanical | Mining | Mechanical | Mining |
| | Mining | Electrical | Electrical | Mechanical |
| | Electrical | Mechanical | Mining | Electrical |
| | Civil | Civil | Chemical | Chemical |

[a] From high to low.
Source: Tables A-8 through A-10.

1939; about 9,600 engineers (or five per cent of the engineers who worked twelve months in 1939) fell into this class. Nearly all of these presumably were self-employed engineers and thus received no wages or salaries in 1939 even though they worked throughout the year.[26] Exclusion of this class from the distribution restricts the data chiefly to those engineers who were salaried employees. The median salary income for these engineers was $2,718, or $227 per month. Median salaries for the various engineering specialties, calculated in the same way, are presented in Table A-13 (column 1).

The 1950 census published distributions of total income of persons in various occupations in 1949. The median annual income

[26] Thus only 49 engineers were reported in the second income class ($100 to $199) and only 1,819 (or less than one per cent of the total) were reported in the second through the sixth classes ($100 to $999).

for engineers, derived from these data, was $4,688, or $391 per month. These data differ from those for 1939 in Table A-13 in two regards. First, they are not restricted to persons who worked throughout 1949; they therefore include some engineers who worked for only a portion of the year. Second, the data relate to total income, rather than wage or salary income; thus, self-employed engineers are included in the distributions and nonsalary income of employed engineers is included. The first difference lowers the median derived from the 1950 census volumes below what it would have been had definitions comparable to those used in the 1940 census been employed. The second difference raises the level of the median.

TABLE A-13

Median Monthly Incomes and Salaries of All Engineers, 1939 and 1949

| | *Salary, 1939* (1) | *Income, 1949* (2) | *Salary, 1949* (3) | *Salary, Engineers who worked 50 weeks or more, 1949* (4) |
|---|---|---|---|---|
| All engineers | $227 | $391 | | |
| Civil | 215 | 377 | $371 | $391 |
| Electrical | 232 | 391 | 383 | 402 |
| Mechanical | 237 | 386 | 384 | 408 |
| Aeronautical | | 404 | | |
| Other | 221 | 403 | | |

Column — Source

1 *Census of Population, 1940,* Volume III, Part 1, Table 72. Median salary income of all engineers who worked 12 months in 1939, excluding those who received less than $100 in salary for the year.

2 *Census of Population, 1950,* Volume II, Part 1, Table 129.

3, 4 Herman P. Miller, *Income of the American People,* John Wiley, 1955, Tables C-2, C-4.

Data based on unpublished 1950 census tabulations and comparable in definition to data presented in the 1940 census are available from another source.[27] Median salary or wage income is presented there for the three largest engineering specialties (comprising about three quarters of all engineers in 1950) but not for engineers as a whole (Table A-13, columns 3 and 4). In these tabulations, the data are restricted to engineers who received $1 or more in salary in 1949; thus, the problem of excluding self-employed engineers, encountered in the 1940 census data, is virtually eliminated here.

[27] Herman P. Miller, *Income of the American People,* John Wiley, 1955.

Median salaries for the three groups of employed engineers in 1949 were 1 to 2 per cent lower than median incomes for all engineers in the same specialties (column 3). But median salaries for those employed engineers who worked 50 or more weeks in 1949 (comparable to the 1940 restriction to engineers who worked 12 months in 1939) were about 1 to 4 per cent higher than median incomes (column 4). Presumably, then, median monthly salaries for all engineers who were employed for 50 or more weeks in 1949 were about 1 to 4 per cent higher than median monthly incomes of all engineers in 1949, or slightly above $400.

For the three engineering fields median monthly salaries increased 72 to 82 per cent between 1939 and 1949. For employed engineers as a whole, we may estimate that the increase was about 74 per cent.

The census definition of the engineering field was broader than that employed in the sample surveys; this is corroborated by the fact that census data on median engineering salaries are typically lower than estimates derived from such surveys. Thus, the Bureau of Labor Statistics study of engineering incomes, which attempted to cover all engineers, indicated median salaries in 1939 for the three largest engineering fields which were between 9 and 13 per cent higher than shown by the census for that year (Table A-13, column 1).[28] The EJC study, which was restricted to members of the six principal engineering societies, showed a median monthly salary in 1939 for all engineering fields combined of $277, or 22 per cent higher than that shown by the census.[29]

There are no survey data for 1949. Crude interpolations between the BLS survey data for 1946 and the 1953 EJC data, however, suggest that had a survey been taken covering 1949, with coverage equivalent to the BLS and EJC surveys, the resulting estimates of median engineering salaries would again have been somewhat higher than that obtained by the census.

### Annual Salary Data, 1947–1956

There are two sources of data on annual salaries of engineers during recent years. The first consists of the surveys of starting salaries and expected hirings of college graduates in various fields

[28] The BLS estimates of median monthly salaries were $244 for civil engineers, $253 for electrical engineers, and $258 for mechanical engineers (*Employment Outlook for Engineers*, p. 63).

[29] Fraser, *op. cit.*, p. 75. Base salary.

(including engineering), conducted annually since 1947 by Frank S. Endicott, Director of Placement at Northwestern University (Table A-14). These surveys, covering from 100 to 200 or more large and medium-sized business firms, are undertaken during the last months of the calendar year, i.e. during the middle of the academic year. The reported data apparently represent planned hiring and salary schedules for these companies with regard to the current graduating class. Thus, salary data gathered in November or December 1949 are shown by Endicott as applying to 1950. We follow this practice here.

TABLE A-14

Average Starting Monthly Salaries for College Graduates in Various Specialties, 1947–1956

| | *In Engineering* | *In Accounting* | *In Sales* | *General Business Trainees* | *All Fields* |
|---|---|---|---|---|---|
| 1947 | $244 | $231 | $225 | $223 | — |
| 1948 | 250 | 215 | 226 | 221 | $235 |
| 1949 | 261 | 240 | 240 | 236 | 245 |
| 1950 | 260 | 238 | 240 | 234 | 245 |
| 1951 | 270 | 246 | 247 | 241 | 251 |
| 1952 | 305 | 275 | 275 | 271 | 283 |
| 1953 | 325 | 297 | 301 | 292 | 304 |
| 1954 | 345 | 315 | 314 | 310 | 323 |
| 1955 | 361 | 332 | 336 | 327 | 341 |
| 1956 | 394 | 352 | 358 | 348 | 366 |

Source: Frank S. Endicott, "Trends in the Employment of College and University Graduates in Business and Industry," *Journal of College Placement*, May 1952, pp. 44, 45, March 1953, p. 56, March 1954, p. 60, March 1955, p. 41; National Industrial Conference Board, *Management Record*, January 1956.

Presumably, actual starting salaries for a given graduating class may vary somewhat from these salary scales, which are forecast six months before graduation, especially during periods of rapid salary change. But the relative changes in expected starting salaries should approximate quite closely changes in actual starting salaries over a several year period.

The second source of annual data on engineering salaries is the set of surveys of average salaries of research scientists and engineers, published annually since 1948 by the Los Alamos Scientific Laboratory. These surveys are conducted for the purpose of aiding the Laboratory in setting salaries for its scientific employees. While the 1948 survey gathered data on both scientists engaged in

research and engineers employed in nonresearch activities, the differences in salary at all experience levels were so small that, beginning with 1949, nonresearch engineers were excluded and the survey coverage was restricted to the combined group of scientists and engineers engaged in research. By 1954, the survey covered 221 organizations, including government laboratories, contractors of the Atomic Energy Commission, research institutions, private consulting firms, and manufacturing firms having research programs, which in total employed more than 50,000 research scientists and engineers.

Salary data are collected on engineers and scientists with bachelor's degrees and on those with doctorates.[30] Since relatively few engineers have acquired doctorates, we restrict our analysis to the salary experience of first degree holders.

TABLE A-15

Annual Percentage Changes in Average Monthly Salaries of Research Engineers and Scientists with B.S. Degree, by Years of Experience, 1948–1955

| | PERCENTAGE CHANGES | | | | |
|---|---|---|---|---|---|
| | *0* | *1* | *9* | *10* | *11* |
| 1948–1949 | —3.2 | —0.3 | 2.8 | 1.1 | 0.9 |
| 1949–1950 | 1.8 | 1.7 | 2.0 | 3.5 | 3.2 |
| 1950–1951 | 6.9 | 5.0 | 7.6 | 6.7 | 6.9 |
| 1951–1952 | 11.3 | 12.7 | 8.2 | 9.4 | 8.1 |
| 1952–1953 | 6.8 | 6.7 | 3.8 | 4.0 | 4.4 |
| 1953–1954 | 3.7 | 5.5 | 1.6 | 2.1 | 3.4 |
| 1954–1955 | 7.2 | 5.0 | 16.6 | 8.9 | 8.0 |

Source: *National Survey of Professional Scientific Salaries,* Los Alamos Scientific Laboratory of the University of California, 1949 through 1955. Each set of percentages derived from data collected in a single survey, to avoid the effects of changes in coverage.

In Table A-15 are shown annual percentage changes in average monthly salaries for starting engineers and scientists and for those with one year of experience, as well as in salaries for engineers and scientists with 9–11 years' experience, for each year 1948–1955.

A summary analysis of both the Endicott and Los Alamos data is given in Chapter II.

[30] Data on engineers and scientists with master's degrees are included in those for first degree recipients. The Laboratory data classify persons by the number of years since acquisition of the bachelor's degree. In Table A-15 we treat this classification as equivalent to number of years of experience.