Starting Salaries of Engineers and Scientists

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This paper examines changes in starting salaries of engineers and scientists during the postwar period. Starting salaries are an indicator of changes in the level of excess demand or excess supply in a labor market because new entrants to an occupation are quite mobile. Employers seldom have a protected pool of applicants to draw from so they must compete in salary or other advantages if they are to get as many new entrants as they wish.

I first discuss some of the patterns of demand that have affected the market for engineers and scientists since World War II and then examine the changes in starting salaries of engineers relative to other occupations and the changes within engineering itself. Finally, I consider changes in the structure of engineers' salaries.

I. Introduction

A major part of the annual increase in demand for engineers and scientists consists of demand for new graduates. /1 New graduates usually have a large number of alternative job opportunities to consider and starting salaries are far more uniform than are salary rates for any other experience group. Employers must adjust their offers to the prevailing market pattern

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/1 A survey of recruiting goals for engineers in 1964 showed that 46 percent of the total was for new graduates. See Engineering Manpower Commission of Engineers Joint Council [1964], p. 58.

if they are to gain a reasonable number of acceptances of their offers. /2 A firm can hope to hold a large fraction of its experienced engineers at salaries considerably below market levels, but it cannot expect to have a noticeable fraction of substandard offers to new graduates accepted. In short, the penalty for refusing to follow the market starting rate is far swifter and surer than the penalty for failing to meet market rates for experienced engineers. As a result, the starting salary is a good indicator of changes in demand for engineers.

The starting salary of engineers reflects not only the special situation of the market for engineers but also general movements of wages and salaries. A large increase in engineering starting salaries may simply reflect an upward movement in all wages and salaries. A year in which the ratio of starting salaries of engineers to all starting salaries decreased might indicate a lessening of the shortage of engineers even though engineering starting showed a large increase. /3

Data on starting salaries for engineers, scientists, and other college occupations is far from complete. I shall use data from diverse sources without commenting specifically on problems of definition and comparability. Usually the surveys used cover a very large fraction of the designated population, but the sample designs leave much to be desired. On the whole, the

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/2 This does not mean that employers must all offer the same base salary. Economic and noneconomic benefits differ between employers and are not always proportional to base pay. Employers also differ in wage policy. Some prefer to lead the market by offering a premium, and these firms might be expected to have a higher than average acceptance ratio to offers. Others may offer less than average salaries and have a lower than average ratio.

/3 Throughout the paper I will use the term "shortage" in the sense used by Blank and Stigler [1957], i.e. as indicating a rise in relative salary.

conclusions that can be drawn from these diverse data are consistent with one another. The data suggest there has been a significant shortage of engineers since the Korean War, but there has not been a shortage of scientists. The shortage of engineers has largely been a shortage of aeronautical, electrical, and mechanical engineers, but the shortage has also been reflected in rising salaries for other engineering specialties. The shortage does not seem to have been especially severe for Ph.D.'s either in engineering or in science.

Most of the growth in demand for engineers during the late 1950's and early 1960's originated in the aircraft and electrical industries. Engineering employment in these industries is composed largely of aeronautical, electrical, and mechanical engineers. These specialties had large number of vacancies during the period, while other specialties such as civil, chemical, and mining engineering were in relatively plentiful supply. /4

Even though the demand increases were largest in the industries that were engaged in military work, the labor market communicated the demands to all industries. Engineers trained in one specialty can work in others, so that the interconnected sub-market for engineering specialties all reflected the increased demand for engineers in the military industries. As a result of the apparently high cross-elasticities of demand and of supply between engineering specialties, starting salaries even in engineering specialties which were not in high demand tended to increase more rapidly than nonengineering starting salaries. Starting salaries for engineers in various

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/4 For data on vacancies see Folk [1965].

industries and specialties have increased at different rates in recent years. Moreover, the rates of increase of salaries in the several industries and specialties are correlated with rates of change of employment of engineers in the various industries and specialties. Thus industries in which engineering employment has grown rapidly have also experienced larger than average increases in starting salaries.

While there is some correlation between starting salary rates of increase and employment rates of increase, the relationship is not close. Thus an industry which employs only a few engineers would ordinarily not have to raise salaries very much to attract additional engineers. A very large industry increasing by the same percentage would have a substantial monopsonistic effect on the market.

Demand for engineers is ordinarily for specific kinds of engineers, but even in the most specialized industries (such as chemicals and electronics) the demand is not limited to the related specialties. Thus industry demand for engineers is specialized but some substitution is ordinarily possible. If aeronautical engineers are receiving a premium in the market over mechanical engineers of the same subjective "quality" to the employer, then the employer may hire a mechanical engineer to do the job for which he would prefer an aeronautical engineer if starting salaries were the same. In much the same way, if a company has a standard starting rate or range and it is not able to hire enough aeronautical engineers of satisfactory quality to fill its openings, it may hire non-aeronautical engineers. Thus on the demand side there are trade-offs between specialty demands. The cross-elasticity of demand between engineering specialties is likely to be quite high but finite.

New graduate supply is also somewhat specialized. By choosing to major in a particular engineering specialty, the engineering student expresses a preference (sometimes a forced choice) to be, for instance, a chemical engineer. This occupational preference in most specialties is equivalent to an industrial preference. Thus, in a sense, the mining industry has a "captive" supply of mining engineers, the chemical industry a "captive" supply of chemical engineers, and the construction industry a "captive" supply of civil engineers. Since the engineering graduate has a trade-off between his occupational or industrial preference and starting salary, the "captives" may escape. Cross-elasticity of supply is also likely to be high and finite.

Given the lack of specialization in demand and the lack of specialization in supply, we should expect that an increase in demand for any one engineering specialty would spill over into other engineering specialties or that an increased demand for engineers in any industry would spill over into all other industries.

The existence of specialized but related demands and supplies, however, does not eliminate the possibility that one engineering specialty might be subject to a marked shortage, while others are subject to surpluses, and that some industries because of their specialized demands might experience sharply rising salaries while others were not experiencing such increases.

If the expansion of industry demand for engineers (whether derived from production or R&D demand) was unbalanced or specialized, the impact on the labor market would be unbalanced. As it happened, demand for engineers in aircraft, parts, and missiles industries grew rapidly and during the 1950's and 1960's. A large proportion of engineers in these industries are electrical, aeronautical, and mechanical engineers. As a result, the increase in demand for these specialties was particularly sharp. In order to recruit additional engineers, the companies in the industries bid salaries up. This bidding up was transmitted to other industries only to the extent that there was spillover or that the industries had demands for the same specialties.

We would predict that an increase in demand for engineers that was concentrated in one industry would result in a more than average increase in starting salaries in that industry. Similarly, an industry with low employment growth and high demand for specialties not directly used by the growing industry should have less than average increases. Similar observations hold for engineering specialties.

As a result of an unbalanced expansion of demand for engineers, we would expect a divergence in starting salaries starting from a time in which starting salaries for specialties were approximately equal. The return of starting salaries to a new long-run equilibrium would occur only when the specialties by engineering students adjusted sufficiently to reduce the supply going into the slowly growing occupations and industries and to increase the supply going into rapidly growing occupations and industries.

II. Engineering and Other Occupations

Starting salaries for engineers increased by 78 percent from 1952 to 1962 according to Endicott's data (Table V-1). This increase was much greater than the increases in starting salaries for accountants, salesmen, or general business trainees. Engineers not only received higher starting salaries in each year than the other occupations, but the premium grew over the decade.

Table V-1

Proposed Monthly Starting Salaries for Engineers and Business Occupations, 1947-1964[a]

Year	Engineering	Accounting	Sales	General business trainees	Engineering as % of: Accounting	Sales	General business trainees
1947	$244	$231	$225	$223	105.6	108.4	109.4
1948	250	215	226	221	116.3	110.6	113.1
1949	261	240	240	236	108.7	108.7	110.6
1950	260	238	240	234	109.2	108.3	111.1
1951	270	246	247	241	109.8	109.3	112.0
1952	305	275	275	271	110.9	110.9	112.5
1953	325	297	301	292	109.4	108.0	111.3
1954	345	315	312	310	109.5	110.6	111.3
1955	361	332	336	327	108.7	107.4	110.4
1956	394	352	358	348	111.9	110.1	113.2
1957	433	389	385	382	111.3	112.5	113.4
1958	468	416	412	408	112.5	113.6	114.7
1959	480	422	419	413	113.7	114.6	116.2
1960	504	444	434	424	113.5	116.1	118.9
1961	520	458	451	429	113.5	115.3	121.2
1962	542	472	460	448	114.8	117.8	121.0
1963	568	500	481	478	113.6	118.1	118.8
1964	596	520	503	493	114.6	118.5	120.9

a. Actual salaries are not available for the whole period but are usually one or two percent higher than these salaries that firms planned to pay.

Source: Annual surveys conducted by Frank S. Endicott, "Trends in Employment of College and University Graduates in Business and Industry," Journal of College Placement, May, 1952; March, 1953; March, 1954; March, 1955; and 12th through 18th Annual Reports (mimeo.).

It is possible to identify the period of the Korean War (1950-1953), 1956, 1959, and 1962 as periods of "shortage of engineers" in terms of unfilled vacancies and recruitment difficulties (see Folk [1965]). The starting salaries of engineers do not show large increases relative to other occupations until 1956. Before this there are small year-to-year variations in the starting salary ratios but no large movements. During the period 1956-1960, the engineers starting salary ratios increased rather sharply and then stabilized. This behavior is not highly responsive to changing labor market conditions. The lagged response to the initial Korean War shortage shows how major movements in demand for an occupation can occur without noticeable changes in salaries. Starting salaries cannot be considered a sensitive indicator of labor market conditions.

The findings of a miscellany of studies allows us to draw some limited conclusions about changes in starting salaries of some scientific and engineering specialties. The National Science Foundation has published two studies of college graduates: (1) 1952 earnings of 1951 graduates classified by college major subject; and (2) 1960 earnings of 1958 graduates classified by occupation. For engineers, but not for scientists, the mixture of occupation and major classification causes little trouble. To the limited extent that the two studies are comparable, we can conclude that engineers' earnings have increased more rapidly than any other group (Table V-2). Scientists' starting salaries do not appear to have increased particularly rapidly.

Starting salaries accepted by science and engineering graduates of the University of California, Berkeley, are roughly equal for the periods 1958-65 and 1961-64 (Table V-3). Starting salaries for metropolitan New York

Table V-2

Median Earnings in 1952 of June 1951 Bachelors Graduates in Education-Related Employment, and Median Earnings of 1958 Bachelors Graduates in 1960 by Occupation, by Sex

Major subject (1951) or occupation (1958)	Men			Women		
	1952	1960	% Change	1952	1960	% Change
Total	$3,700	NA	NA	$2,700	NA	NA
Natural sciences	3,700	$4,740	28	2,900	$4,240	46
Chemistry	3,900	5,110	31	3,300	4,460	35
Physics	4,300	6,240	45	NA	4,170	NA
Mathematics	3,400	4,890	44	2,800	4,420	58
Earth Sciences	3,600	5,330	48	NA	4,250	NA
Biological sciences	3,300	4,260	29	2,700	4,080	51
Engineering	4,400	6,800	55	NA	$4,870	NA
Chemical	4,200	6,770	61	NA	NA	NA
Civil	4,300	6,340	47	NA	NA	NA
Electrical	4,400	7,350	67	NA	NA	NA
Mechanical	4,400	6,960	58	NA	NA	NA
All other	4,000	NA	NA	NA	NA	NA
Industrial	NA	6,720	NA	NA	NA	NA
Social sciences	3,400	4,720	39	2,600	4,190	61
Economics	3,500	5,220	49	NA	4,540	NA
History	3,100	4,520	46	2,600	4,140	59
Humanities and arts	3,200	4,440	39	2,600	4,050	56
English	3,200	4,470	40	2,600	4,070	56
Language	NA	4,230	NA	2,700	4,210	56
Education	3,200	4,610	44	2,800	4,320	54
General	3,200	4,600	44	2,800	4,350	55
Physical	3,200	4,610	44	2,600	4,320	66
Business and commerce	3,700	5,420	46	2,700	4,080	51
Psychology	3,500	4,700	34	2,700	4,260	58
All other fields	3,900	5,180	33	2,900	4,180	44
Law	4,200	4,830	15	NA	4,250	NA
Social work	NA	4,500	NA	NA	3,890	NA
All other	3,700	NA	NA	2,800	NA	NA
Health fields	3,100	NA	NA	3,100	4,380	41
Medicine (pre-med)	2,000	3,000	NA	NA	NA	NA
Dentistry	NA	NA	NA	NA	NA	NA
All other	4,600	NA	NA	2,900	NA	NA
Applied biology	3,600	4,810	34	2,700	4,220	56
Agriculture	3,700	4,780	29	NA	4,200	NA
Home economics	NA	5,080	NA	2,700	4,220	56

Source: 1952: Education and Employment Specialization in 1952 of June 1951 College Graduates, National Science Foundation, Washington, 1955.
1960: Two Years After the College Degree, National Science Foundation, NSF 63-26, Washington, 1963.

Table V-3

Median Starting Salaries Accepted by Bachelor Degrees, University of California, Berkeley, 1958-1965

Major field	1958	1959	1960	1961	1962	1963	1964	1965	Percentage Increase 1961-64	Percentage Increase 1958-65
Engineering										
Chemical	$465	$500	$526	$540	$545	$590	$600	$627	11.1	34.8
Civil	481	481	517	530	563	590	644	644	17.0	33.9
Electrical	500	545	565	575	603	625	633	640	10.1	28.0
Industrial	470	500	500	540	563	600	600	650	11.1	38.3
Mechanical	490	515	526	550	573	600	625	635	13.6	29.6
Mineral Technology and Engineering Physics	475	495	545	530	550	625	625	650	17.9	36.8
Science										
Biological	NA	358	410	395	395	NA	NA	NA	NA	NA
Chemistry and Biochemistry	390	470	450	500	529	540	517	525	3.4	34.6
Geology and Paleontology	425	442	520	490	NA	NA	NA	NA	NA	NA
Mathematics and Statistics	450	500	475	500	540	550	550	600	10.0	33.3
Physics	500	515	505	565	529	623	577	598	2.1	17.6

Source: Annual surveys furnished by Student and Alumni Placement Center, University of California, Berkeley.

suggest that science starting salaries increased much more rapidly over the period 1961-64 than did engineering starting salaries (Table V-4). Engineering starting salaries are close in these two surveys, but the Berkeley science salaries were much higher in 1961 and slightly lower in 1964 than the New York salaries. Surveys by the American Chemical Society show chemical engineering salaries increasing somewhat more rapidly than chemists' starting salaries over the period 1952-62 (Table V-5). It is rash to draw any conclusions from these data, but I think it is clear that engineering starting salaries are considerably higher than starting salaries for science. It seems likely that more complete data would show much greater increases in starting salaries for engineering than for science during the period since the Korean War, although science salaries may have tended to catch up somewhat in the last few years. This would be the result of the increase in the proportion of scientists working in industry rather than teaching.

II. Differentials Within Engineering

Engineering starting salaries have increased more rapidly than starting salaries in other occupations, but not all engineering starting salaries have increased at the same rate. This section examines changes in starting salaries classified by

(1) engineering specialty

(2) degree level

(3) function

(4) industry

Engineering specialty. Data presented above show that electrical and mechanical engineers had higher starting salaries than other engineers in

Table V-4

Average Monthly Starting Salaries of Male Bachelors Graduates, Metropolitan New York College Placement Officers Association, 1961-1964

Major field	1961	1962	1963	1964	Percentage increase 1961-1964
Engineering	NA	NA	$596	$614	NA
Aeronautical	$541	$581	584	623	15.2
Chemical	544	562	587	615	13.1
Civil	536	558	561	592	10.4
Electrical	564	582	604	619	9.8
Industrial	542	567	589	605	11.6
Mechanical	545	569	593	608	11.6
Metallurgical	NA	568	586	603	NA
Science	NA	NA	NA	NA	NA
Biology	404	434	NA	NA	NA
Chemistry	465	509	545	564	21.3
Mathematics	470	491	554	583	24.0
Physics	491	519	592	610	24.2

Source: 1961-1964 Reports of the Metropolitan New York College Placement Association (mimeo.).

Table V-5

Monthly Starting Salaries of Inexperienced Graduates in Chemistry and Chemical Engineering, 1952-1962

	Bachelors		Masters		Doctors	
Year	Chemistry (men)	Chemical Engineering	Chemistry	Chemical Engineering	Chemistry	Chemical Engineering
1952	$325[a]	$343	$384	$390	$512	$512
1953	352	360	404	405	525[b]	540
1954	370	375	416	425	550	575
1955	NA	398[b]	NA	NA	NA	NA
1956	407	425	443	485	600	604
1957	440	460[c]	485	525	650	675
1958	440	475	511	541	675	700
1959	450	490	525	560	700	725
1960	490	520	550	585	750	775
1961	500	535	563	613	791	830
1962	525	560	578	645	825	875

a. men and women.

b. Industry only.

c. 4-year graduates only.

Source:
Chemical and Engineering News: 30: 5435-36, Dec. 29, 1952
31: 5058-59, July 27, 1953
34: 4266-69, Sept. 3, 1956
35: 76-79, Oct. 28, 1957
36: 94-97, Oct. 20, 1958
37: 64-69, Oct. 19, 1959
38: 106-111, Oct. 31, 1960
40: 104-112, Nov. 5, 1962

most years. This is in contrast to 1946 when the average monthly base salaries of engineers with less than one year experience were:

Chemical	$242
Civil	247
Electrical	228
Mechanical	226 /5

These data suggest that electrical and mechanical engineers' starting salaries have increased much more rapidly during the postwar period than the starting salaries of chemical and civil engineers. The data from the American Chemical Society also suggests that chemical engineers starting salaries have increased more slowly over the period 1952-1962 (63 percent) than the starting salary of all engineers (78 percent).

Degree level. There is no consistent pattern of changes in relative salaries in the various degree levels. Chemical engineers in the period 1952-1962 had a 71 percent increase for doctors, 65 percent for masters, and 63 percent for bachelors. For chemists over the same period the increases were 61 percent for doctors, 51 percent for masters, and 62 percent for bachelors. For all research and development scientists and engineers the increases were 68 percent for doctors, and 76 percent for bachelors and masters combined. While the data is quite limited it does not bear out the frequently heard assertion that there has been an especially severe shortage of doctors in engineering and science.

There is no clear pattern of change in the ratio of starting salaries of scientists and engineers in R&D with Ph.D.'s to starting salaries of R&D scientists and engineers with B.S. or M.S. degrees (Table V-6). There was an irregular but marked reduction in the ratio up to 1956, but thereafter the

/5 Bureau of Labor Statistics, Employment Outlook for Engineers, 1949, p. 108.

Table V-6

Monthly Starting Salaries of Nonsupervisory Research Scientists and Engineers, 1949-63

	Bachelors, 0 Years Since B.S.	Ph.D. 5 Years Since B.S.	Ph.D. as Percent of Bachelors	Chemical Engineering Ph.D. as Percent of Bachelor's Starting Pay[a]
1949	$268	$460	171.6	NA
1950	273	460	168.5	NA
1951	292	508	174.0	NA
1952	327	539	164.8	149.3
1953	350	565	161.4	150.0
1954	361	586	162.3	153.3
1955	387	611	157.9	NA
1956	439	661	150.6	142.1
1957	465	711	152.9	146.7
1958	476	742	155.9	147.4
1959	515	773	150.1	148.0
1960	536	823	153.5	149.0
1961	553	870	157.3	155.1
1962	575	903	157.0	156.2
1963	603	946	156.9	NA

a. Derived from data in Table V-5.

Source: Los Alamos National Laboratory, National Survey of Professional Scientific Salaries, 1951-1963.

ratio varied very little. The corresponding ratio for chemical engineers behaves somewhat differently, and in higher in the 1960's than it was in the early 1950's. Even so there is no evidence in either of these series to suggest that there has been a marked shortage of Ph.D.'s.

Function. Data on starting salaries by function is not available except for R&D engineers. The data cited above suggests that over the period 1952-62 the starting salaries of all engineers increased by 78 percent while starting salaries for R&D scientists and engineers with bachelors' or masters' degrees increased by 76 percent. These data are not exactly comparable, but there is little reason to believe that R&D salaries have outstripped non-R&D salaries, at least within engineering specialties. This suggests that despite the very rapid rate of increase of R&D employment of engineers there has not been an especially large shortage of engineers suitable for R&D work.

Industry. Starting salaries are available for R&D scientists and engineers by industry. There is no clear pattern of relationship between change in starting salaries and employment by industry (Table V-7). Both aircraft and parts and machinery showed large absolute and percentage increases in employment, but starting salaries increased by less than average percentages. Drugs and petroleum both grew slowly and by small amounts, and their starting salaries increased rather slowly. Both of these industries had relatively high salaries in 1952. Despite the large size of the sample on which the starting salaries are based there are some anomalies. The starting salary for the food industry was higher in 1962 than in 1963, and the starting salary for aircraft and parts was much lower than the average in 1962 and much higher than the average in 1963.

Table V-7

Starting Salaries of Research and Development Scientists and Engineers, by Industry, 1952-62

Industry	Starting Salary[c]			Research and Development Scientists and Engineers[d]			
	1952	1962	Percent Change	1952[e]	1962	Diff-erence	Percent Change
Total private industry	$337	$593	76	91.6	312.1	220.5	241
Chemical and allied products[a]	329	579	76	10.2	31.1	20.9	205
Petroleum	357	567	59	5.0	8.8	3.8	76
Aircraft and parts	341	584	71	20.2	83.4	63.2	313
Machinery	332	563	70	5.4	31.5	26.1	483
Electrical equipment	336	611	82	17.2	71.9	54.7	318
Rubber	331	564	70	1.8	5.5	3.7	206
Drugs[b]	335	494	47	3.0	6.2	3.3	110
Food	315	562	78	1.4	5.1	3.7	264

a. excludes drugs.

b. salaries for biological and pharmaceutical industry.

c. Los Alamos National Laboratory survey.

d. 1952 employment from U.S. Department of Labor, Bureau of Labor Statistics, Scientific Research and Development in American Industry, table C-5, p. 62. 1962 employment from National Science Foundation, Reviews of Data on Science Resources, No. 7, January, 1966.

e. The 1952 survey was not complete and 1952 employment is underestimated with the result that the difference and percentage changes are too large.

Starting salaries for government are considerably below those of private industry (Table V-8). Salaries for NASA and for all Federal government laboratories for 1959 and 1963 are close, except for a large difference for Ph.D.'s in 1959 in the 90th percentile of starting salaries. NASA salaries are below private industry salaries both in averages and in the 90th percentile. The differences between NASA and the industries with which it competes are particularly marked. In 1963, the starting Ph.D. salary for aeronautical industry was $350 a month higher than the NASA starting salary, but the difference at the 90th percentile was less. The differences in each group show that Federal salaries are relatively low. The rapid expansion of NASA in the face of these salary differentials points out the importance of noneconomic attractions of some jobs. It seems likely that NASA's mission contributed to its recruiting success.

V. Salary Structure

In a competitive labor market the differentials associated with experience should reflect perceived productivity. Starting salaries typically show relatively little dispersion, suggesting that employers are unable to predict productivity or to perceive quality differences. Relative dispersion of salaries increases with length of experience, but there is always far too little variation in salaries to reflect productivity differences, especially in an activity like research where productivity varies enormously. If experience differentials do not reflect productivity differentials what do they reflect? To say they reflect supply and demand in a number of closely related markets is not to dodge the issue wholly. The firm's demand for various experience groups may reflect the current distribution of experience.

Table V-8

Starting Salaries of B.S. or M.S. and Ph.D. R&D Scientists and Engineers, Selected Industries, 1959-1963

Industry or group	Average monthly starting salary				90th percentile of starting salaries			
	B.S. or M.S.		Ph.D.[b]		B.S. or M.S.		Ph.D.[b]	
	1959	1963	1959	1963	1959	1963	1959	1963
Total survey	$515	$603	$780	$946	$587	$687	$919	$1,121
Total private	531	623	791	973	591	698	912	1,134
Government laboratories	449	543	767	811	495	593	1,020	1,080
Aeronautical industry	532	642	862	1,146[c]	586	724	1,030	1,265[c]
Electronics and electrical	538	643	862	1,077	594	723	1,015	1,235
NASA[a]	472	563	675	792	496	594	740	1,070

a. Computed from NASA establishment reports furnished by NASA.

b. 5 years since B.S.

c. 3-4 years since B.S.

Source: Los Alamos National Laboratory, National Survey of Professional Scientific Salaries, 1959 and 1963.

A firm with many highly experienced workers may want to hire only inexperienced workers. If it is unsuccessful in hiring such workers it is likely to increase its starting salaries relative to salaries for experienced workers. The inexperienced engineer or scientist is likely to be quite mobile, while the experienced worker is much less mobile. Firms must be responsive to the market if they wish to hire younger workers, but they need not act swiftly to hold their experienced workers.

An increase in the ratio of starting salary to average (or lifetime salary) is termed "salary compression" and a decrease in the ratio is termed "salary decompression." There are a large number of other ways of measuring salary structure, but all are more or less arbitrary. I have chosen to use lifetime earnings in an occupation as an average salary that holds age distribution constant. /6

According to this measure of salary structure engineers experienced salary compression at least up to 1958 (Table V-9). Similar conclusions can be drawn from other scientist and engineers series. It is obvious that the decompression of engineers salaries in the period 1929-32 resulted from the precipitous drop in starting salaries. The salaries of experienced groups responded much more slowly than starting salaries. The compression that occurred during and after World War II might be interpreted as another lagged response (see Hansen [1963]). It is hard to believe that the compression is a temporary or disequilibrium phenomenon when it persists for a decade. While no conclusive answer is possible, I think the current pattern

/6 Lifetime earnings is $L = \sum_{t=1}^{R} E_t p_t$ where E_t is earnings in year t, p_t is the probability of survival through year t, and R is year of retirement.

of salary differentials represents a situation of balance between experience groups. There is no evidence that experienced engineers are in especially high demand relative to supply. If anything, inexperienced engineers are in relatively short supply, and this would suggest that some further compression might be expected.

Table V-9

Starting Salaries, Lifetime Earnings, and Ratio of Starting Salaries to Lifetime Earnings for Engineers, Chemists, Chemical Engineers, and R.& D. Scientists and Engineers, 1929-1963

	Starting salaries							Lifetime earnings (in thousands)							Starting salary as percent of lifetime earnings						
		Chemists		Chemical engineers		R. & D. scientists & engineers			Chemists		Chemical engineers		R. & D. scientists & engineers			Chemists		Chemical engineers		R. & D. scientists & engineers	
Year	Engineers	B.S.	Ph.D.	B.S.	Ph.D.	B.S.	Ph.D.	Engineers	B.S.	Ph.D.	B.S.	Ph.D.	B.S.	Ph.D.	Engineers	B.S.	Ph.D.	B.S.	Ph.D.	B.S.	Ph.D.
1929	1,313	---	---	---	---	---	---	159	---	---	---	---	---	---	0.8	---	---	---	---	---	---
1932	645	---	---	---	---	---	---	123	---	---	---	---	---	---	0.5	---	---	---	---	---	---
1934	598	---	---	---	---	---	---	107	---	---	---	---	---	---	0.6	---	---	---	---	---	---
1939	1,580	---	---	---	---	---	---	164	---	---	---	---	---	---	1.0	---	---	---	---	---	---
1941	---	1,956	2,676	2,232	3,048	---	---	---	137	144	148	156	---	---	---	1.4	1.9	1.5	2.0	---	---
1943	2,196	2,208	3,036	2,352	3,264	---	---	177	154	154	185	193	---	---	1.2	1.4	2.0	1.3	1.7	---	---
1946	2,772	---	---	---	---	---	---	201	---	---	---	---	---	---	1.4	---	---	---	---	---	---
1949	---	---	---	---	---	3,420	5,520	---	---	---	---	---	233	263	---	---	---	---	---	1.5	2.1
1950	---	---	---	---	---	3,360	5,520	---	---	---	---	---	241	264	---	---	---	---	---	1.4	2.1
1951	---	---	---	---	---	3,732	6,096	---	---	---	---	---	262	292	---	---	---	---	---	1.4	2.1
1952	---	---	---	---	---	4,044	6,468	---	---	---	---	---	287	309	---	---	---	---	---	1.4	2.1
1953	4,050	---	---	---	---	4,260	6,780	277	---	---	---	---	298	323	1.5	---	---	---	---	1.4	2.1
1954	---	---	---	---	---	4,536	7,032	---	---	---	---	---	290	329	---	---	---	---	---	1.6	2.1
1955	---	4,464	6,696	4,920	6,900	4,752	7,332	---	284	338	331	392	316	346	---	1.6	2.0	1.5	1.8	1.5	2.1
1956	5,000	---	---	---	---	5,412	7,932	334	---	---	---	---	319	356	1.5	---	---	---	---	1.7	2.2
1957	---	---	---	---	---	5,820	8,532	---	---	---	---	---	332	372	---	---	---	---	---	1.8	2.3
1958	5,850	---	---	---	---	5,940	8,904	369	---	---	---	---	359	394	1.6	---	---	---	---	1.7	2.3
1959	---	---	---	---	---	6,372	9,276	---	---	---	---	---	375	410	---	---	---	---	---	1.7	2.3
1960	6,300	6,000	9,000	6,000	10,000	6,636	9,876	411	387	402	437	452	395	435	1.5	1.6	2.2	1.4	2.2	1.7	2.3
1961	---	---	---	---	---	6,816	10,440	---	---	---	---	---	420	465	---	---	---	---	---	1.6	2.3
1962	6,750	6,000	8,000	7,000	10,000	7,116	10,836	430	399	436	454	467	438	480	1.6	1.5	1.8	1.5	2.1	1.6	2.3
1963	---	---	---	---	---	7,416	11,352	---	---	---	---	---	462	504	---	---	---	---	---	1.6	2.3

Sources: Data derived
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