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INFORMATION IN THE LABOR MARKET

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THE young person entering the labor market for the first time has an immense number of potential employers, scarce as they may seem the first day. If he is an unskilled or a semiskilled worker, the number of potential employers is strictly in the millions. Even if he has a specialized training, the number of potential employers will be in the thousands: the young Ph.D. in economics, for example, has scores of colleges and universities, dozens of governmental agencies, hundreds of business firms, and the Ford Foundation as potential employers. As the worker becomes older the number of potential employers may shrink more often than it grows, but the number will seldom fall to even a thousand.

No worker, unless his degree of specialization is pathological, will ever be able to become informed on the prospective earnings which would be obtained from every one of these potential employers at any given time, let alone keep this information up to date. He faces the problem of how to acquire information on the wage rates, stability of employment, conditions of employment, and other determinants of job choice, and how to keep this information current. I shall concentrate attention on the determination of wage rates.

I. THE DISPERSION OF WAGE RATES

Even with strict homogeneity of commodities, we usually find some dispersion in the prices which are offered by sellers or buyers. Only if either buyers have complete knowledge of all sellers' offers, or all sellers have complete knowledge of all buyers' offers, will there be a single price. Complete knowledge, however, is seldom possessed, simply because it costs more to learn of alternative prices than (at the margin) this information yields.[2]

The labor markets display the same characteristics, but their analysis is much complicated by the lack of homogeneity of the workers (and, to a much lesser extent, of non-wage conditions of employment). In order to form some estimate of the nature of the "pure" dispersion of wages due to imperfect knowledge, we shall begin with a very special class of college graduates.

A tolerably pure estimate of the dispersion of wage offers to homogeneous labor is provided by the contemporary offers to the same person. For forty-four graduates of the Graduate School of Business at the University of Chicago who received 144 offers (in 1960 and 1961) from corporations, the standard deviation of monthly rates was $43. The mean offer was $540.7, so the coefficient of variation was 7.9 per cent.[3]

[2] The argument is elaborated in my "The Economics of Information," *Journal of Political Economy*, June 1961.

[3] There was no systematic or significant difference in the standard deviations for those who received 2, 3, 4, or 5 or more offers:

No. of Offers	No. of Students	Standard Deviation
2	17	$46
3	13	35
4	7	49
5 or more	7	43

[1] I am deeply indebted to Claire Friedland for the statistical work in this paper. H. Gregg Lewis made very helpful comments on an earlier version.

The basic data were made available by courtesy of David Huntington of the Placement Bureau of the Graduate School of Business.

Since this job market was completely localized in one office, and there is considerable intercommunication among the national companies whose representatives solicit prospective employees (and among prospective employees), this appears to be a conservative estimate of the gross dispersion for given quality. The fact that each student on average solicited only 2.25 offers works in the same direction. The differences in the attractiveness of non-wage elements of the various jobs, however, are impossible to discover.[4] On balance it appears that the true dispersion is substantially underestimated, and later evidence suggests that it may be much larger in less organized markets.

Unfortunately, distributions of offers to given individuals are not available for any large occupational group or any extended geographical market. One must deal with offers (or wage rates paid) by individual employers or groups of employers, and the dispersion of such offers may be either larger or smaller than the true distribution we desire. The dispersion of distributions of company average offers will be larger insofar as they reflect differences in quality of workers (or of jobs),[5] or cover several labor markets; the dispersion will be smaller insofar as intracompany dispersion is eliminated. In our sample of business graduates, the standard deviation of the average offers of companies is $40, compared with that of $43 for given students. Although no unique relationship between these dispersions can be assumed, we can and will assume that for similar labor markets they are reasonably well correlated.

[4] The extent to which initial wage rates are reliable indexes of subsequent wage rates is investigated below.

[5] The variance of offers, within a given specialty, is usually much larger between than "within" individuals who have received multiple offers.

The dispersion of wage offers in the small Chicago sample is approximately equal to that of the national sample of wage offers made each year by Frank Endicott.[6] The coefficients of variation of groups other than engineers range from 6.4 per cent to 9.1 per cent (Table 1); the corresponding figure for our sample was 7.3 per cent.

TABLE 1

MONTHLY HIRING RATES OF LARGE CORPORATIONS FOR COLLEGE GRADUATES, 1958–60

Occupation	No. of Companies	1958	1959	1960
	1. Mean Salaries			
Engineers	66	$472	$493	$515
Accountants	40	421	435	457
Salesmen	29	410	426	447
General business	41	403	416	431
	2. Coefficient of Variation (Per Cent)			
Engineers	66	4.04	4.22	4.26
Accountants	40	6.45	6.93	6.42
Salesmen	29	8.78	8.18	9.11
General business	41	8.60	8.96	8.64

Source: Endicott Survey worksheets. All companies here included reported in each of the three years.

If the expected period of employment exceeds one year (as it does), the worker must also make an estimate of future wage differences among employers. Endicott's data permit an estimate of the correlation of successive annual rates (Table 2). The correlations are high, and—what is more surprising—two of the four cases show no tendency to diminish when the time period is lengthened to two years. If the correlations were to remain high for long periods, the

[6] We are indebted to Endicott for permission to examine the company reports for three years.

differences in wages would presumably reflect compensating differences in the non-wage terms of employment. But the normal pattern surely is one of declining correlation coefficients as the period is lengthened, if only as a Galton regression phenomenon.

Differences in initial wage rates would also be offset by different rates of increase in wages, so the present values of different jobs could still be equal. Endicott's survey for 1960 reported the

TABLE 2

CORRELATION COEFFICIENTS OF SALARY RATES IN 1958, 1959, AND 1960 FOR COLLEGE GRADUATES

OCCUPATION	NO. OF COMPANIES	CORRELATION COEFFICIENT		
		1958 and 1959	1959 and 1960	1958 and 1960
Engineers.....	66	.660	.761	.577
Accountants....	40	.723	.872	.720
Sales.....	29	.849	.885	.871
General business.	41	.853	.891	.873

Source: Same as Table 1.

average salary paid to college graduates after one year of service, and these salaries may be compared with those paid initially. The relationship for accountants was

$$W_2 = 24.71 + 1.039W_1, \qquad (N = 67),$$
$$(.062)$$

where W_2 was the wage in 1960 and W_1 the wage in 1959; the relationship is close ($r = .900$). So far as these data go, they suggest that initial wage rates are a good predictor of wage rates in the following year.

These fragments illustrate rather than prove the existence of substantial dispersion in hiring rates for homogeneous labor. This dispersion cannot be measured precisely, but is of the order of magnitude of 5–10 per cent even in so well organized a market as that of college graduates at a single university.

II. THE PROBLEM OF INFORMATION

A worker will search for wage offers (and an employer will search for wage demands) until the expected marginal return equals the marginal cost of search. Under what conditions will this search eliminate all dispersion of wage rates for homogeneous labor?

The conditions are severe. It is not sufficient for demand and supply to have been stable indefinitely long, and hence "the" equilibrium wage not to have changed for an indefinitely long period, in order to eliminate all dispersion. If workers were to change employment (perhaps because of improving skills) or employers were to change identity (because of the turnover of firms), it still would not pay to search enough to eliminate all dispersion. But if these changes were infrequent—say, once every three years or more—the dispersion of wage rates would be fairly small, although not negligible.[7] Changes in jobs due to

[7] With a rectangular wage offer distribution between 0 and 1, the average maximum wage encountered in n searches is $n/(n+1)$, so the expected marginal wage rate gain from $(n+1)$ searches is

$$\frac{n+1}{n+2} - \frac{n}{n+1} = \frac{1}{(n+1)(n+2)},$$

which, multiplied by the expected duration of employment, is the marginal income gain from search. If employment is expected to last m days, and the cost of search is k days, the amount of search will be given by

$$\frac{m}{(n+1)(n+2)} = \frac{kn}{n+1},$$

or n is approximately $\sqrt{m/k}$, or (say) 25 with three years of expected employment, and $k = 1$. The coef-

changes in workers' tastes and abilities and employers' identities therefore set some minimum on the dispersion of wage rates. If the market has appreciable geographical extent, transportation costs of workers (and plants) add to this minimum dispersion.

The fluctuations of supply-and-demand conditions add a new source of dispersion. The information of the worker (and employer) now becomes obsolete with time: there will be changes in the level of wages and in the relative wage rates of different employers (and workers) which call for additional search. The more rapidly "the" equilibrium wage rate changes, the smaller the returns from search and hence the smaller the amount of search that will be undertaken—and the larger the resulting wage dispersion.

The subsequent analysis is devoted to an application of this approach to the costs and returns from search for various types of workers. The unavailability of a temporal sequence of closely spaced wage distributions makes it impossible to explore the effects of rates of change of equilibrium prices on the amount of dispersion.

THE RETURNS FROM SEARCH BY WORKERS

We shall begin our analysis of the returns from search by forming some estimate of the magnitude of the return as a function of the amount of search. To this end, let us assume that the wage offers by all possible employers are normally distributed.[8] Then the expected maximum wage offer (w_m) a man will encounter in n searches is approximately[9]

$$w_m = .65n^{.37}\,\sigma_w + \bar{w},$$

and the marginal wage rate increase from one additional search is

$$\frac{\partial w_n}{\partial n} = \frac{.24\sigma_w}{n^{.63}}.$$

If $\sigma_w = \bar{w}/10$, the marginal wage rate gain from additional search is:

Search (n)	Marginal Wage Rate Gain
5	.0087 $\bar{w}$
10	.0056 $\bar{w}$
15	.0044 $\bar{w}$
20	.0036 $\bar{w}$

If the annual wage rate is \$6,000, the marginal wage rate gain is therefore of the order of \$20 to \$50 in this range of search.

If the structure of employer wage offers were permanently fixed, and if the worker lived forever, the marginal income gain from additional search would be simply the capitalized value of the marginal *wage-rate* gain. If the structure were permanent and the duration of employment t_o years, the marginal *income* gain would be the value of the corresponding annuity, namely,

$$\frac{\partial w_n}{\partial n}\,\frac{(1+i)^{t_o}-1}{i(1+i)^{t_o}}.$$

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ficient of variation of wages is

$$\sqrt{\frac{n}{(n+1)^2(n+2)}}\,\frac{n+1}{n} = \frac{1}{\sqrt{n(n+2)}} = \sqrt{\frac{k}{m}},$$

which would be 4 per cent in our example. This argument is an adaptation of that in "The Economics of Information," *op. cit.*, p. 215.

[8] The Chicago student wage offers are consistent with this assumption, and it seems intuitively more plausible than the rectangular distribution which was used (for algebraic convenience) in "The Economics of Information" and in n. 7.

[9] The expression is simply an approximation (for $3 < n < 20$) to the mean maximum observation from a normal population in random samples of size n; the precise values are given in W. J. Dixon and F. J. Massey, *Introduction to Statistical Analysis* (New York, 1957), p. 407.

In this extreme case of a permanent wage structure, the order of magnitude of the marginal income gain from search is illustrated by the following table, where $\sigma_w = \bar{w}/10$ and $i = 6$ per cent.

Prospective Years of Employment	Amount of Search	
	5 Employers	15 Employers
3.....	$.023\,\bar{w}$	$.012\,\bar{w}$
5.....	$.037\,\bar{w}$	$.018\,\bar{w}$
10.....	$.064\,\bar{w}$	$.032\,\bar{w}$

For the $6,000 salary level, these marginal income gains run from $66 (fifteen employers, three years) to $384 (five employers, ten years).

But these gains are exaggerated because there is not a perfect correlation between the wage offers of employers in successive time periods. The employers themselves do not know wage offers sufficiently well to preserve a perfect correlation, even if they mysteriously wished it, and the appearance of new employers adds a further reason for continued search by the worker.

When the correlation of successive wage offers is positive but less than unity it will still pay the worker to search more intensively in the earlier periods because this search will have some value in subsequent periods. In a simple two-period model, the details of which are given in the appendix, the increased search in the first period due to correlation of wage rates will increase the expected maximum wage offer in the proportion $br^2/(1-b)$, or approximately $r^2/2$. If $r = .5$, the amount of search in period 1 will be increased by 20 per cent, with roughly a 12 per cent increase in salary.

It would be possible to analyze a variety of phenomena in the light of the correlation of successive wage offers. For example, the higher the correlation, the longer the expected tenure of a worker with a company, and therefore the lower the quit rate. Unfortunately there are no published data, so far as I know, which allow calculation of the correlations, although of course these data dwell in the worksheets of numerous wage surveys.

As a poor substitute, one can examine the average wage rates (measured by earnings per worker) on a geographical basis. The average earnings per worker in a state will be an index of wage rates in the given industry, and it will be a better index the more similar the occupational and wage structures of the industry in various states. A sample of such calculations is reported in Table 3.

Several features of these geographical patterns are noteworthy. The dispersion of earnings among states is much smaller in the recent period, and the decline occurred in twenty-one of twenty-five industries. The inference is that the national market has become more perfect, and the inference is commended by the fact that costs of movement have fallen substantially relative to wage rates over the period. The correlation coefficients reveal a slight decline on average, although they are based upon a seven-year interval in the later period (including a year of turbulent demobilization) as against a five-year interval in the earlier period.[10] The comparison timidly suggests that the difference in earnings increasingly represents differences in the quality of labor rather than in its compensation.

The most direct implication of the formal analysis is that the gains from search are larger the longer the prospective period of employment. When search is more extensive, however, the disper-

[10] The industries are also more homogeneous in the later period, and this serves to increase the correlation coefficients.

sion of maximum wage rates will be smaller—the lowest wage offers will more often be rejected for known better offers.[11] So the realized dispersion of wage rates should be smaller the longer the prospective period of employment. Several tests of this implication can be made.

Women generally expect to stay in the labor force a shorter period than men do, so among homogeneous groups of men and women we should expect that the latter have larger dispersions. The occupational wage surveys do reveal this expected difference.[12] The major difficulty in making extensive tests of this prediction is that the tabulated Census

[11] Or, more precisely, the distribution of maximum offers has a variance that decreases as the number of searches increases.

[12] For example, hourly earnings of shipping packers in manufacturing in Chicago have the following characteristics:

	1952	1957
Males:		
Interquartile range	23.4¢	43.8¢
Median rate	144.2	182.0
Interquartile ratio (per cent)	16.2	24.1
Females:		
Interquartile range	28.4¢	45.8¢
Median rate	109.8	175.7
Interquartile ratio (per cent)	25.9	26.1

Source: Bureau of Labor Statistics, Bulls. 1105 and 1202–15.

With normally distributed variates, the interquartile ratio is 1.35 times the coefficient of variation.

TABLE 3

CHARACTERISTICS OF AVERAGE EARNINGS IN SELECTED MANUFACTURING INDUSTRIES, 1904–9 AND 1947–54

(Identical States)

INDUSTRY	NO. OF STATES	CORRELATION COEFFICIENTS		AVERAGE COEFFICIENT OF VARIATION (PER CENT)	
		1904 and 1909	1947 and 1954	1904 and 1909	1947 and 1954
Non-ferrous foundries	8	.895	.663	15.3	8.7
Motor vehicles and equipment	9	.349	.106	8.9	4.9
Structural clay products	23	.982	.938	29.4	19.3
Ship and boat building	9	.894	.703	17.6	10.6
Rubber products	8	.270	.672	8.1	6.4
Musical instruments and parts	7	.953	.460	25.7	8.7
Confectionery products	17	.819	.876	15.3	17.8
Beer and ale	12	.921	.834	15.4	10.8
Mattresses and bedsprings	9	.830	.906	22.0	22.9
Furniture and fixtures, excluding mattresses and bedsprings	33	.941	.912	26.2	17.0
Fertilizers	13	.905	.952	20.4	20.4
Meat products	29	.728	.922	18.5	15.8
Flour and meal	14	.935	.530	21.8	12.0
Bakery products	20	.952	.918	18.2	12.6
Bottled soft drinks	15	.954	.874	20.1	18.4
Manufactured ice	21	.926	.854	22.8	25.5
Woolen and worsted fabrics	8	.987	.844	17.6	8.7
Knitting mills	17	.955	.774	23.5	11.2
Paperboard containers	18	.906	.926	17.1	14.0
Printing and publishing	47	.912	.906	21.3	11.8
Drugs and medicines	13	.725	.924	16.2	14.0
Soap and related products	10	.950	.681	14.8	12.0
Paints and allied products	15	.742	.870	18.4	11.2
Leather tanning and finishing	9	.968	.906	19.0	13.8
Footwear (except rubber)	12	.932	.703	13.1	9.2
Average		.853	.786	18.7	13.5

data on earnings (in 1940 and 1950) do not allow the removal of the effects of age (men have a much wider dispersion of ages) and of race (Negro women are a larger fraction of the female labor force than Negro men are of the male labor force).[13]

Similar comparisons can be made of younger and older workers. The coefficient of variation increases with age for engineers (see Table 4). The coefficient

TABLE 4

MONTHLY ENGINEERING EARNINGS, BY AGE, 1929

Age	Mean Monthly Earnings	Standard Deviation	Coefficient of Variation (Per Cent)
23	161.0	85.1*	52.9*
24–25	189.5	58.2	30.7
26–27	230.1	86.4	37.6
28–31	282.8	117.5	41.6
32–35	349.9	175.7	50.2
36–39	400.0	221.6	55.4
40–47	464.1	294.5	63.5
48–55	510.0	346.0	67.8
56–63	544.3	399.8	73.4
64 or more	487.6	356.3	73.1

Source: A. Fraser, Jr., "Employment and Earnings in the Engineering Profession, 1929 to 1934," Bureau of Labor Statistics, Bull. No. 682, 233, Table 2.

* This class appears to be heterogeneous: two of the respondents had salaries 20 standard deviations above the mean.

of variation of 1949 earnings of plumbers and pipefitters was 40.8 per cent; that of apprentices was 32.9 per cent.[14] The dispersion of salaries of college teachers is larger the higher the rank (and age) of the teacher.[15] A more powerful test would be provided by a comparison of wages of students in summer employment with young men of the same age who had permanently left school.

Our original estimate of the coefficient of variation of earnings in section 1 was of the order of 10 per cent. The differences cited above—for example, 60 per cent versus 30 per cent for engineers of fifty-five and twenty-five years of age—might suggest a much larger estimate of the effects of ignorance. These gross dispersions are due to at least three different components, however, only the first two of which involve information:

i. The dispersion of earnings of engineers increases with age because younger engineers make more extensive search than older engineers.

ii. The difference in ability of engineers becomes better known as they become older (and have worked longer for a given employer).[16]

[13] A moderately extensive analysis was made of dispersions of income in 1949 in large cities for selected occupations, and an analysis was made of earnings in 1939 for waiters and waitresses. The 1949 data showed larger dispersions for women than for men; the 1939 data for the one occupation showed the opposite. The heterogeneity of age and race (and in 1940 the inclusion of self-employed workers) are such that I believe the results are wholly inconclusive. For the same reason, the consistently smaller *average* wages of women (which are predicted by the theory) are not supporting evidence.

[14] On the other hand, the coefficients of variation for machinists and tool makers (30.1 per cent) and apprentices (29.7 per cent) were essentially identical. These are all United States data, influenced by extent of part-time work (which was much higher among apprentices than among machinists).

[15] The interquartile ratios $[(Q_3 - Q_1)/Q_2]$ of academic salaries in 1959–60 were:

Rank	Per Cent	
	Men	Women
Professor	33.0	31.8
Associate professor	23.3	26.2
Assistant professor	19.7	24.2
Instructor	19.3	21.7

These calculations are based upon National Education Association, Higher Education Series, Research Report, 1960–R3. See also my *Trends in Employment in the Service Industries* (New York: National Bureau of Economic Research, 1956), p. 128.

The smaller dispersion of salaries of women professors is found in every type of college and university reported. Women make up less than one-twelfth of the full professors and more than twice as large a fraction even of associate professors. The roles of ability and discrimination in producing this reversal of the basic pattern would be interesting to know.

[16] This increased dispersion in earnings due to better recognition of differences in ability (the search for information on the quality of workers) is of course to be reckoned as a reduction in the dispersion of earnings of homogeneous workers.

iii. The older engineers have made different amounts of "on-the-job" investment in training, which serves to increase their dispersion of abilities, a phenomenon discussed in Professor Mincer's paper.

The disentanglement of the second and third components of dispersion is especially difficult. We reach again the conclusion that the differences in quality of workers cast a deep shadow over all measures of pure dispersion due to differences in knowledge (or, for that matter, due to other forms of investment).

The effect of the absolute level of earnings, which may also enter into the determination of the gain from search, will be considered in the next section.

THE COSTS OF SEARCH

The larger the cost of search the less search will be undertaken by a worker at a given level of dispersion of employers' wage offers. These costs will vary systematically with various characteristics of occupations.

When prospective employers of a worker are readily identified—which is partly associated with how specialized a worker is—search for a job is more economical: one does not have to waste inquiries on wholly irrelevant possibilities. We should therefore expect the dispersion of actual wage rates to be less the more easily the employers are identified.

This prediction is supported by several analyses of earnings in the twenty metropolitan areas in 1950. Domestic servants have higher coefficients of variation than laundry operatives in nineteen of twenty areas (with means of 75.2 per cent and 54.0 per cent, respectively). The confirmation is less emphatic in the comparison of taxi drivers with truck drivers (the former have lower coefficients of variation in thirteen of twenty regions, but the means are virtually identical: 44.2 per cent and 45.7 per cent).[17]

The costs of search are also lower the higher the probability that a given, identified employer is taking on men. This would argue that in periods of expanding employment the dispersion of wages will be smaller. But unemployment among a class of workers also works in the opposite direction to reduce the cost of search. Within local markets the cost of search is primarily a cost in time, to be valued (at least approximately) by the mean wage rate, as a measure of the leisure value of time. But for the unemployed worker, this alternative cost of leisure is negligible. In the search in other labor markets, however, both transportation costs and foregone earnings must be incurred.[18]

The effects of the level of earnings on the amount of search are equally difficult to disentangle. If the absolute dispersion (σ_w) is proportional to the mean wage, the mean wage affects costs and returns from search proportionately, and there is no effect on the amount of search. On the other hand, it appears to have been the regular practice for employment agencies to charge a fee that is a higher percentage of larger initial salaries—the fee is progressive.[19] The simplest explanation would be that the expected duration of employment is greater the higher the initial wage rate. On the whole, this kind of evidence seems much more persuasive than that based on interoccupational comparisons.

[17] These Census data are moderately more persuasive than those rejected earlier because differences due to race, part-time work, and age are smaller.

[18] Hence the mean wage rates for given work should vary more among establishments in an extensive area than within a single labor market.

[19] P. H. Douglas and A. Director, *The Problem of Unemployment* (1931), p. 267.

The search for information may take forms other than direct solicitation: newspaper advertisements, employment agencies, employer search, and the myriad forms of pooling of information by workers. Some require little expenditure of time and—if used alone—would lead us to expect that the dispersion of wage rates should be equal in absolute terms (standard deviations, not coefficients of variation) for workers at different wage levels. Such information, however, is incomplete and limited, and if more is needed solicitation is eventually resorted to. The marginal cost of search may rise as search increases.

The private employment agencies offer a fertile field for investigation from this viewpoint. Their *raison d'être* is information, and they should have specialized in the occupations in which information is most difficult for the employer or worker to obtain. Their fees, indeed, would provide a direct estimate of the marginal cost of information in these occupations.

III. THE EMPLOYERS' SEARCH

There is direct search by employers, wholly comparable to that of workers, in certain industries. College teaching is an obvious example: the employer canvasses graduate schools, professional journals, and the like for potential employees and invites them in to be looked over. This kind of direct solicitation is most probable when the workers are highly specialized, of course.

The main reason for workers undertaking the burden of solicitation is that it is cheaper for them than for employers. When an employer has numerous employees the probability that a given employer needs additional workers is much greater than the probability that a given worker will accept a job offer. The identification problem is usually also less for a worker than for an employer—the fraction of wasted search will be much smaller for a steelworker than for a steel company. But where the number of employees per employer approaches unity (domestic service, vice-presidents in charge of marketing), the employer usually takes on some or all of the task of search.

The employers' search involves more than the identification of potential workers: they must be "processed" to a degree set by the personnel practices, and there are training costs (including low productivity) for a time. Walter Oi estimates that the initial hiring and training cost per worker was (in 1951) about $382 for International Harvester, the cost rising rapidly with the level of skill.[20]

One way to reduce hiring costs is to pay higher relative wages. Not only is the quit rate of existing workers reduced by high wages, but on average, more obviously high-quality workers will accept offers. Wage rates and skilled search are substitutes for the employer: the more efficiently he detects workers of superior quality the less he need pay for such quality.

The small company has distinct advantages in the hiring process, so far as judging the quality of workers is concerned. The employer can directly observe the performance of the new worker and need not resort to expensive and uncertain rating practices to estimate the workers' performance. It is well known that wage rates are less in small plants than in large, and the difference reflects at least in part (and perhaps in whole) the lower costs to the small-scale employer of judging quality. A similar result obtains with respect to dispersion of

[20] "Labor as a Quasi-Fixed Factor of Production" (unpublished Ph.D. dissertation, University of Chicago, 1961).

wages: a sample of such data is given in Table 5. Men should in general enter smaller companies the greater their ability.

These last remarks represent in a sense a contradiction to the main argument of this paper. For previously I have accepted wage dispersion as a measure of ignorance but now take it as a measure of ability (less dispersion implies greater ignorance). The contradiction is only superficial because the problem of information on quality has been replacing that of information on price, and heterogeneity of quality has replaced homogeneity. Yet this shift poses again the central difficulty with which we began: the entanglement of quality and price variation in labor markets.

TABLE 5

COEFFICIENTS OF VARIATION OF HOURLY WAGE RATES OF MALE EMPLOYEES IN SELECTED MANUFACTURING INDUSTRIES BY CLASS OF WORKER

INDUSTRY AND EMPLOYER	NO. OF PLANTS	COEFFICIENT OF VARIATION (PER CENT)		
		Skilled	Semiskilled	Unskilled
Radios:				
Two largest companies	2	12.8	16.7	13.8
Other companies	22	24.6	24.9	20.9
Soap:				
Large companies	13	15.1	16.8	17.2
Other companies	59	25.6	24.5	23.3
Explosives:				
Three largest companies	28	16.2	14.1	15.8
Other companies	23	19.8	17.4	19.5
Meatpacking:				
Four largest companies	59	.....	20.4	.....
Small companies	182	.....	28.1	.....

Source: *Hourly Earnings of Employees in Large and Small Enterprises* ("Temporary National Economic Committee Monograph," No. 14, 1948), pp. 21, 54, 59, 66, 70. The same pattern holds without exception for female employees. The meatpacking data refer to the northern wage district, and to all employees.

IV. INFORMATION AS CAPITAL

The information a man possesses on the labor market is capital: it was produced at the cost of search, and it yields a higher wage rate than on average would be received in its absence.

From the viewpoint of the individual worker, the capital value of his knowledge can be calculated by the usual method of valuing an asset; that is, discounting its future revenue. In section 1, above, we gave the marginal income gain from search as

$$\frac{\partial w_m}{\partial n}\,\frac{(1+i)^{t_o}-1}{i(1+i)^{t_o}}.$$

that is, the marginal wage-rate gain times the present value of an annuity of duration t_o. The total income gained is the integral of this expression over the range of search, or

$$(w_m-\bar{w})\frac{(1+i)^{t_o}-1}{i(1+i)^{t_o}}.$$

This formula, as we observed, is an overestimate to the extent that future wage rates paid by various employers are not perfectly correlated with present wage rates. Conversely, if the duration of work with one employer is t_o, there will be some value to the knowledge presently acquired, in the search for alternative employments after t_o. This offset will be

larger the larger the correlation of wage offers over time.

The duration of given jobs varies systematically with age and skill. Gladys Palmer's study suggested an average duration of a job of about three years for men between the ages of twenty-five and thirty-four, rising to six years for men over sixty-five.[21] The turnover of jobs is higher among unskilled workers than among skilled workers. If the worker has a prospective job duration of three years, and the coefficient of variation of wage offers is 10 per cent, the capital value of his knowledge, by the above formula (with $i = .06$), would be

$.32\ \bar{w}$ if 5 wage offers are found,

$.47\ \bar{w}$ if 15 wage offers are found.

If such numbers are applied to the entire labor force, one gets an aggregate of private capital in laborer's information on the order of $100 billion.

The employer has a corresponding capital value of information: it is equal to the present value of the savings in wage rates for given quality of workers (or the superior quality of workers at given wage rates). The larger the amount of search by workers, the less will be the opportunity (or the greater the cost) for the employer to achieve a given saving in wage rates. The division of the investment in information between employers and workers will be determined by institutional characteristics of the market: where it is more economical for one party to acquire the information, the other party will make relatively small investments.

From the social viewpoint, the return from investment in information consists in a more efficient allocation of the labor force: the better informed the labor market, the closer each worker's (marginal) product is to its maximum at any given time. From this viewpoint, the function of information is to prevent less efficient employers from obtaining labor, and inefficient workers from obtaining the better jobs. In a regime of ignorance, Enrico Fermi would have been a gardener, Von Neumann a checkout clerk at a drugstore.

The social capital is not necessarily equal to the sum of the private capitals. If most workers search intensively, employers who offer low wage rates will be unable to fill their jobs and will be forced either to close down or to raise wage rates—so if I enter the labor market and do not search, I nevertheless profit from others' knowledge of the market. This effect arises because of the existence of the economies of scale.

The amounts and kinds of information needed for the efficient allocation of labor, whether judged from the viewpoint of the laborer, the employer, or the community, extend far beyond the determination of wage rates. The kinds and amounts of skill men should acquire pose parallel informational problems, and so too do the non-monetary conditions of employment. The traditional literature has not done these problems justice. It is doubtful that justice would be more closely approached by making exaggerated claims of the importance of the problem of information. There is no exaggeration however, in the suggestion that the analysis of the precise problems of information and of the methods an economy uses to deal with them appears to be a highly rewarding area for future research.

[21] *Labor Mobility in Six Cities* (New York, 1954), p. 53. The durations are biased downward for the younger men because not all were in the labor force for an entire decade.

APPENDIX

Let n_1 and n_2 be the search in the two periods, λ the average cost of search. Then the "profit" of a worker from search, neglecting interest, is

$$\pi = w_1 + w_2 - \lambda(n_1 + n_2),$$

where

$$w_1 = a n_1^b,$$
$$w_2 = a(n_2 + r^2 n_1)^b.$$

For a maximum,

$$\frac{\partial \pi}{\partial n_1} = a\,b\,n_1^{b-1} + a\,b\,(n_2 + r^2 n_1)^{b-1} r^2 - \lambda = 0. \tag{1}$$

$$\frac{\partial \pi}{\partial n_2} = a\,b\,(n_2 + r^2 n_1)^{b-1} - \lambda = 0. \tag{2}$$

Equating values of λ,

$$n_2 = n_1\{(1 - r^2)^{1/(1-b)} - r^2\}. \tag{3}$$

It follows from (3) that $n_2 = n_1$ when $r = 0$. It can be shown that if $r = 1$, $n_2 = 0$,[22] and

$$n_1 = \left(\frac{\lambda}{2\,a\,b}\right)^{1/(b-1)}.$$

Search in period 1 makes a marginal wage contribution of

$$\frac{\partial w_2}{\partial n_1} = a\,b\,(n_2 + r^2 n_1)^{b-1} r^2$$

in period 2. The optimum amount of search in period 1, from equations (1) and (2), is

$$n_1 = \left(\frac{\lambda}{a\,b}\right)^{1/(b-1)} (1 - r^2)^{1/(b-1)}. \tag{4}$$

The wage rate in period 1 with a correlation of r exceeds that with no correlation in the proportion

$$\frac{a(\lambda/a\,b)^{b/(b-1)}(1 - r^2)^{b/(b-1)} - a(\lambda/a\,b)^{b/(b-1)}}{a(\lambda/a\,b)^{b/(b-1)}},$$

or by $(1 - r^2)^{b/(b-1)} - 1$, or approximately by $br^2/(1 - b)$.

[22] If r approaches unity, equations (1) and (2) yield

$$\frac{a\,b}{n_1^{1-b}} = 0,$$

or n_1 becomes infinite, and by equation (2),

$$n_2 + r^2 n_1 = \left(\frac{\lambda}{a\,b}\right)^{1/(b-1)}$$

so n_2/n_1 approaches $-r^2$ as n_1 approaches infinity. Since n_2 has a minimum of zero, n_1 is fixed by (1) at the expression in the text.