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# AN ANALYSIS OF INDUSTRIAL WAGE DIFFERENTIALS*

YOKO SANO

## I. THE TREND OF WAGE DIFFERENTIALS

Many studies have been made of industrial wage differentials as a long run proposition, enlightening up with various findings. Here we shall briefly survey the subject using Kerr's work which deals with examples from different countries up to the first half of the 1950's,[1] and Japanese experience up to 1955 as treated in the studies by Shōwa Dōjinkai[2].

To review the changes and tendencies of wage differentials, Clark Kerr classified them into five groupings: (1) inter-personal, (2) inter-firm, (3) inter-area, (4) inter-occupational, and (5) inter-industry. Since the tendensies in inter-personal or inter-firm differentials are becoming less marked and matter very little, they are omitted in this discussion. The inter-area, the inter-occupational and the inter-industry wage differentials are examined here and related to their causal factors.

1. Inter-area wage differentials. According to the results of analytical studies made in the United States, Australia and West Germany, it is clear that inter-area wage differentials are diminishing within a narrowly defined industry. Among the factors that have caused this tendency, the dispersion of factories over a wider area, and the enlargement and inter-action of product markets may be mentioned. Concerning the influence exerted by the labor union on the inter-area wage differentials, nothing definite can be said at the present.

2. Inter-occupational differentials. Among the various wage differentials, the inter-occupational wage differential has undergone the largest shrinkage in the United States, western European countries, Australia and New Zealand. Coming to the question of the factors that have brought about this tendency, the analyists vary as to the weights which should be given to the different factors such as the wage equalizing policies of labor unions, the diffusion of education, the technical progress, the minimum wage laws, immigration restric-

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(1) Clark Kerr: "Wage Relationships—The Comparative Impact of Market and Power Forces, John T. Dunlop, ed. by: *The Theory of Wage Determination*, London, MacMillan & Co., 1957.

(2) Showa Dojinkai, ed. by: *A Historical Consideration of Wage Structure in Japan*, (Shisei-do, 1960).

tions, the continuous rise in wages and prices, etc.

3. Inter-industry wage differentials. The diminution of inter-industry wage differentials is a generally recognized fact in the United States, Australia, and western European countries. This narrowing tendency seems to have nothing to do with the extent of unionization in an industry.

Different, however from the conclusion of Kerr, Reynolds[3] holds that there is no basis for assuming that inter-industry wage differentials tend toward an inevitable diminution. Rather, he emphatically states that a noticeable aggravation of inter-industry wage differentials looks to be forthcoming because unions act on the basis of each industry.

The inter-industry differentials are generally considered in terms of the average wage of an industry. But these average wages are often compounded by other factors such as the inter-area or the inter-occupational wage differentials. Additionally, it is very difficult to compare the average wage of an industry with those of other industries over a long period of time, for the content of an industry often becomes transformed in that time period.

Concerning those factors and influences which affect inter-industry wage differentials, we notice that they often work concomitantly with inter-occupational wage differential factors. On the influence of unionism as a factor in the wage differentials, we can say nothing definite in spite of the number of studies which have been made.

Now, we turn to the situation in Japan. The three wage differentials discussed above will be examined in connection with the study by the Shōwa Dōjinkai:

1. Inter-area wage differentials. The inter-area wage differentials remained unvaried during the Meiji Era (1868-1912) and the first part of the Taishō Era (1912-1926), but tended to narrow during the second half of the Taishō Era and the prewar shōwa period (1926-1937). These narrowing tendencies became especially marked after World War II.

2. Inter-occupational wage differentials. The inter-occupational wage differential in the period from the 27th year of Meiji (1894) to the 14th year of Shōwa (1939) showed no particular change, although the occupational rank-order relating to high and low wages underwent some changes. The differentials became rather marked during the war, and were not particularly narrowed after the War.

3. Inter-industry wage differentials. Historically considered, inter-

(3) Lloyd G. Reynolds: "The Impact of Collective Bargaining on the Wage Structure in the United States," John T. Dunlop, ed. by: *The Theory of Wage Determination*, London, MacMillan & Co., 1957.

industry wage differentials exhibit very little change in Japan. As with the other differentials, they were enlarged in an economic depression, and were narrowed when the labor market was tight. No noticeable tendency has been shown since the last part of the Meiji Era, and after the last war, they remained unchanged.

When comparing the situation of Japan with other countries (mainly, advanced countries), we are unable to make any positive observation on the inter-industry wage differentials of Japan as there exists a wide difference between Japan and the other countries in the structure of employment and the way in which data are classed and collected, as well as in the scale of investigation. Thus with the exception of agreement on the narrowing trend of inter-area wage differentials, the problem of wage differentials in Japan seems to be somewhat different from those of other countries.

Of the three major differentials discussed here, inter-area differentials seem to tend toward narrowing. This is generally recognized, as accompanying progress in the development of rural areas, and the tendency toward the equalization of the living standard between rural and urban areas.

Further, inter-occupational wage differentials in the long run seem to be mainly determined by the demand and supply of labor over the period, inclusive of the training period, for each different occupation, as explained by traditional economists. To clarify, the last item of wage differentials, the inter-industry wage differentials, it is important that we give consideration to what is generally called the imperfect nature of the labor market, that is, such a condition as the friction, the inertia and the manner in which a labor market is organized.

On the other hand, it is well known that the rank-order of wages by industry is very similar in different countries including the United States, Canada, England, Sweden, Switzerland, Russia and Japan. This fact has led Rothbaum to observe that inter-industry wage differentials have nothing to do with the so-called level of economic attainment, the type of industrialization or the wage determination system, but should rather be understood in connection with market structure, technology, labor force composition and unionization.[4]

Thus this paper aims at establishing an approach to a wage determination theory, mainly through the study of inter-industry wage differentials.

(4) Melvin Rothbaum: "National Wage-Structure Comparisons" in *New Concepts in Wage Determination*, edited by George W. Taylor and Frank C. Pierson, New York, McGraw-Hill, 1957, pp. 299-328.

## II.  SOME HYPOTHESES ON INTER-INDUSTRY WAGE DIFFERENTIALS

M. W. Reder states that inter-industry wage differentials as a long-run proposition are to be explained in terms of skill-mix (combination percentage of occupations) and the inter-area wage differentials, but that as a short period question, various other factors causing wage differentials come into play.[5]  In fact, there would be no such thing as a pure inter-industry wage differential, if any probable inter-industry wage differential could be explained exhaustively by occupational characteristics and area conditions.  In actuality, however, very often occur inter-industry wage differentials even when the industries in question are practically the same in terms as occupational and area conditions.  Reder calls a case like this a short period wage differential, but at the same time he cites cases where wage differentials of this sort lasted steadily for 10 or 20 years.

To explain the inter-industry wage differentials described above, various hypotheses have been set forth by a number of researchers. Generally speaking, they offer the following factors to account for it.

1.  Increase of employment.  Since the short period labor supply is inelastic, it is necessary for an industry to pay a higher wage than other industries in order to enlarge its employment.  This is called by Reder the competitive hypothesis.

2.  Ability to pay.  Prosperity, economic depression, the rise or fall in trade, all greatly affect the size of profits.  It is generally admitted that the larger the profit of an industry, the higher will be the wage it pays.  Ability to pay and wages do not directly and inevitably influence each other so long as their inter-action works through the natural process of the competitive labor market, since a high profit industry is not necessarily obliged to pay for labor at a rate higher than the prevailing market price.

Summarizing from what is generally said in this connection, there are two positive points: (a) there will occur an apparent rise in wages as high profit industries which can afford to pay higher wages do so in order to obtain labor of superior quality, and (b) since the labor market operates rather slowly, workers would not easily shift from one sector of an industry with less profit to another with more profit. Especially when labor unions are well organized, their demand for higher wages tends to be in proportion to the size of an industry's profits.

(5)  Mevin, W. Reder: Wage Differentials: Theory and Measurement," in the *Aspects of Labor Economics*, by National Burean of Economic Research, Princeton, Princeton University Press, 1962, pp. 257-318.

3. Physical labor productivity. Even when the increasing rate of productivity of the whole economy is in line with the rise of wages in general, there will exist discrepancies among different industries with reference to the rise in wage rate. In other words, within the industry, in which productivity grows rapidly, wages tend to rise faster than wages in other industries.

It is important to note that the productivity in this case serves to influence the time series of wage movements, not the cross-section of wage differentials among various industries. In other words, it is essential to be aware that the wage level and wage movements are two different things. Since physical productivity is an index expression of productivity as conceived at a base year, it is by no means indicative of a comparative level of productivity among different industries.

To search, into the causal relationship between the productivity of different industries and their wages is not so simple as in the case of an economy as a whole, for there is no way of knowing that a rise in wages following an increase of productivity is due to any of the following facts: an enhanced ability to pay resulting from an increased value productivity, the use of the increased physical productivity by a labor union as the basis upon which to demand a wage increase, or the technological improvement which generated the productivity increase and a consequent efficient application of labor. Further, there often occurs a situation which is rather important; an industry endeavors to increase its productivity in order to cover the cost caused by a rise in wages. This is an inverse case of cause and effect.

Involved with the processes discussed above it is doubtful if we are justified in using physical productivity as the decisive variable in explaining wage movements.

4. The concentration of monopolistic power. In proportion as a product market deals with a scarcity or a monopoly good, a rise in wages can be easily shifted to the commodity price. But even a firm producing an oligopolistic or a monopolistic good would not raise its wages unless it is forced to do so. In other words, no rise in wages would occur unless a firm is pressed by the trade union for its effectuation so long as the quality of labor remains the same.

The aim of concentrating monopolistic power is, after all, in the enhancement of profits which also means the ability to pay. Thus industries with low profits. But increasing monopolistic power will have the perspective of an increased ability to pay to be realized in near future by raising the current commodity price. Consequently, profits alone are not the appropriate measure as ability to pay. It is,

however, very difficult to represent the extents of monopolistic nature of various industries by a single quantitative measurement.

5.  Trade unionism or the power of trade unions.  To be specific, in proportion to the extent that collective bargaining is effectively practiced, an industry succeeds in obtaining a high wage.  As to how different an industry placed under the pressure of a powerful trade union is from one which is not so placed, in terms of the wages which it pays, all sorts of studies have been made.  For example, Chamberlain seems to think that the power of a union works most effectively when it is coordinated with the ability of a firm (to pay); and Reynolds emphatically makes the point that the trade union effectively functions to minimize the imperfection of the labor maket and to strengthen its competitive phase.

The above are factors which influence wage differencials among different industries, and a number of empirical analysis of them have been made.  For example, H. G. Lewis[6] made an intensive study to ascertain the extent and the size of the union influence on industrial wage differentials.

Another powerful factor accounting for industrial wage differentials is the linkage of wages within an industry.  This is a fact indicated by a number of researchers.  As Reder states, industrial wage differentials as a short run proposition should be explained by various factors as well as job mix and area differentials.  Thus, the differentials which we consider here are all due to short run influences; as to the distinction between the short run and the long run, researchers are not clear in defining it.

This narrowing tendency of short term wage differentials within an industry was explained by S. H. Slichter by citing the case where the wages of unskilled workers, who were connected with the skilled workers who received high wages were also high.  H. F. Harbinson calls a wage group like this a "wage constellation," R. M. Ross calls them, "orbits of coercive comparison", and J. T. Dunlop uses "wage contours."  The researchers, who theorize on "orbits" stress the importance of institutional factors such as organized collective bargaining, union organization, government intervention, etc., whereas the concept of "wage contours" gives weight to the relations of product markets, and refers to such elements as the labor supply source and the union system.  These ideas were not necessarily introduced to

(6)  H. G. Lewis: *Unionism and Relative Wage in the United States, An Empirical Inquiry*, Chicago, University of Chicago Press, 1963.

explain industrial wage differentials alone. They are the ideas used to make up for the general insufficiency of the productivity or the the employment shift theory to account properly for wage differentials.

The wage relationship described above is called "spillover of wages," and is added to other variables in the clarification of industrial wage differentials. As indicated by many researchers, there is no evidence that the variables causing the "spillover of wages" are unrelated to each other. Also these variables are often involved with some dependent variables in their functioning. Take for example the influence which a trade union exerts on wages; it goes through many routes or steps.

Thus, the effect of different variables was examined as a preliminary step, as there are very few examples where a researcher has tried quantitatively and multi-demensionally to illuminate an industrial wage differentials by the use of a number of variables, and to measure the influence of "spillover of wages" by controlling the influences of other variables, although we do not consider the statistical method to be the only effective approach in such a case. The fact that there are very few examples of this sort is because there are very few opportunitives for their use at the present time.

Fourtunately the *General Wage Structure Survey*, 1961 (*Showa*-36-*nen Chingin Jittai Sōgo-chosa Kekka Hōkokushō*) by the Statistical Research Department, Ministry of Labor gives the wages for common jobs in different industries. We made a five-fold classification of them on that basis: chauffeur (male), guard (male), Kanji typist (female), switch board operator (female) and key-puncher (female). Out of these 5 jobs, the chauffeurs and the typists in Japanese (Kanji typists), who are rather large in number are presented in Table I, according to their wage, average age, and length of service. Studying Table I, we are impressed by the close resemblance in the industrial wage differentials between these two jobs. The correlation coefficient of average hourly earnings (here after called wages) between the chauffeurs and the typists is 0.928 which is significant at the 1% level. (In order to omit the inter-industrial differentials in working hours, earnings per hour are computed from the data.) There is very little difference in average age are among industries, and they are fairly of parallel in average length of service and average number of years in experience. The correlation coefficient between the wages and the number of years experience is 0.508 for chauffeurs, and 0.082 for typists. These are not significant. Here we raise the question, what were

TABLE I: ONE-DIGIT INDUSTRIAL CLASSIFICATION OF CHAUFFEURS AND KANJI
TYPISTS, ACCORDING TO THEIR LENGTH OF SERVICE, NUMBER OF YEARS IN
EXPERIENCE, AND THE AMOUNT OF CASH EARNINGS

| Job and Industry | Average Age (1) | Average Length of Years in Service (2) | Average Number of Years in Experience (3) | Average Number of Working Hours per Month (4) | Monthly Paid Earnings (yen) (5) | Amount of Earnings per Hour (yen) (5)÷(4) |
|---|---|---|---|---|---|---|
| Chauffers: | | | | | | |
| D. Mining | 36.1 | 7.9 | 12.4 | 225 | 23,759 | 105.6 |
| E. Construction | 33.8 | 5.8 | 10.5 | 227 | 22,993 | 101.3 |
| F. Manufacturing | 33.1 | 5.8 | 9.7 | 233 | 25,890 | 111.1 |
| G. Wholesale, Retail | 31.9 | 4.4 | 8.5 | 219 | 23,370 | 106.7 |
| H. Financing, Insurance | 35.5 | 5.2 | 11.5 | 218 | 29,527 | 135.4 |
| I. Real Estate | 35.3 | 3.6 | 11.9 | 221 | 27,837 | 126.0 |
| J. Transportation, Communication | 35.8 | 7.5 | 12.2 | 223 | 29.552 | 132.5 |
| K. Electricity, Gas, Water Supply | 37.6 | 10.5 | 13.9 | 209 | 32,275 | 154.4 |
| Kanji Typists | | | | | | |
| D. Mining | 27.4 | 6.1 | 6.6 | 175 | 11,526 | 65.9 |
| E. Construction | 25.7 | 3.8 | 5.8 | 192 | 12,272 | 63.9 |
| F. Manufacturing | 25.9 | 5.5 | 6.1 | 190 | 14,991 | 78.9 |
| G. Wholesale, Retail | 24.9 | 4.3 | 4.9 | 188 | 13,574 | 72.2 |
| H. Financing, Insurance | 25.4 | 5.9 | 5.7 | 172 | 16,032 | 93.2 |
| I. Real Estate | 26.1 | 3.7 | 6.0 | 180 | 13,611 | 75.6 |
| J. Transportation, Communication | 27.4 | 6.7 | 6.9 | 183 | 14,875 | 81.3 |
| K. Electricity, Gas, Water Supply | 28.7 | 7.9 | 8.0 | 172 | 17,212 | 100.1 |

Source: *General Wage Structure Survey*, 1961.

the factors which caused these differentials, and how large were the
effects which these factors brought about.

### III. MEASUREMENT OF THE EFFECTS OF THE DETERMINANT FACTORS ON INDUSTRIAL WAGE DIFFERENTIALS

Here we examine those factors that were assumed or identified as
determinants of industrial wage differentials, and those that proved
powerful enough to be decisive in this study.

1. The increase rate of employment: this is a "competitive hypo-
thesis." Reder[8] reviews both the affirmative and negative for

(8) Melvin W. Reder: *op. cit.*

this theory, and considers it not effective in the short run.

2. Value-added productivity: this is a hypothesis based on the idea of the ability to pay, which embraces the concepts of physical productivity, profit, and the degree of concentration. For example, Levinson explains the value added productivity by profit, and Bowen, by profit and the degree of concentration (including the pressure from the trade union). Reder[9] refers to Bowen's attempt, indicating that the latter came out with a positive correlation. Many of these works, however, are not concerned with the level of industrial wage differentials, but are the analyses of the changes in wage differentials over time.

3. The rate of unionization. This is represented by the so-called union pressure hypothesis. As commented upon by Lewis, many of the results based upon this hypothesis do not conflict with this theory, but their effects have not always been clearly observed as compared with other variables.

4. The linkage with the wages of other workers: this is a spillover hypothesis. Very little is known concerning the extent of the influence of this factor.

The above are the hypotheses which we are now ready to test. The evidence, which will satisfactorily meet the requirement of our attempt can not necessarily be obtained. Because of this limited availability of data, we classified the industries into six groups as presented in Table II. The reason why we pooled the two jobs, chauffeur and Kanji typist, is that we wanted to increase the size of the sample. We managed the wage level differences between these two jobs by the use of a dummy variable. We now proceed to explain the data, according to the order of the variables.

$X_1$: National income per worker: this is the substitute for value-added productivity, showing the ability to pay. It is represented by the national income by industry as origin in the 1960 fiscal year (it is national income classified by industry of origin corresponding to value-added per industry) divided by the number of workers as shown in *Census*.

$X_2$: Collective agreement application rate: since the trade unionization rate by industry is unavailable, this application rate is used, as it is assumed to be roughly proportional to the unionization rate. This is the rate of the workers covered by the collective agreement against the total membership of trade unions. The application rate is not necessarily expressive of the unionization rate, but in the "one-digit classification of industry," it appears likely that it

(9) Melvin W. Reder: *Ibid.*

## TABLE II: DATA

| Date | April 1961 | Oct. 1960 | June 1961 | April 1960— Apr. 1961 | Oct. 1960 | |
|---|---|---|---|---|---|---|
| Jobs \ Variables \ Industries | Y Average Hourly Earning | $X_1$ National Income per Worker | $X_2$ Collective Agreement Application Rate* | $X_3$ Employment Increase Rate | $X_4$ Ratio of Male Employees to Total Employees | $X_5$ Dummy Variable Chauffeurs: 1 Kanji Typists:0 |
| | Yen | 1,000 Yen | % | % | % | |
| Chauffeurs — D. Mining | 105.6 | 384 | 89.7 | −5.2 | 91.1 | 1 |
| E. Construction | 101.3 | 273 | 13.6 | 17.4 | 86.7 | 1 |
| F. Manufacturing | 111.1 | 382 | 81.1 | 11.4 | 67.7 | 1 |
| G. Wholesale, Retail | 106.7 | 279 | 72.3 | 12.9 | 58.9 | 1 |
| H. & I. F.I.R.-E. | 134.7 | 1,101 | 88.9 | 8.3 | 63.3 | 1 |
| J. & K. T.C.E.G.W. | 136.2 | 481 | 90.9 | 6.8 | 86.5 | 1 |
| Kanji Typists — D. Mining | 65.9 | 384 | 89.7 | −5.2 | 91.1 | 0 |
| E. Construction | 63.9 | 273 | 13.6 | 17.4 | 86.7 | 0 |
| F. Manufacturing | 78.9 | 382 | 81.1 | 11.4 | 67.7 | 0 |
| G. Wholesale, Retail | 72.2 | 279 | 72.3 | 12.9 | 58.9 | 0 |
| H. & I. F.I.R.-E. | 92.2 | 1,101 | 88.9 | 8.3 | 63.3 | 0 |
| J. & K. T.C.E.G.W. | 83.3 | 481 | 90.0 | 6.8 | 86.5 | 0 |
| Sources | *General Wage Structure Survey 1961* | *White Paper on National Income 1960 & Census of Population 1960* | *Basic Survey on Labor Unions 1961* | *Annual Labor Statistics 1960 & Monthly Wage Survey* | *Census of Population 1960* | |

\* Collective agreement application rate $= \dfrac{\text{Members covered by collective agreement}}{\text{Total union members}}$

represents the unionization rate fairly well.

$X_3$: The employment increase rate: since the survey of wages was made in April 1961, the rates used here are the employment increase rates of the workers regularily employed during the year from April 1960 to April 1961.

$X_4$: The male employment ratio: in selecting a variable which will properly support the spillover hypothesis of wages, we first went over such items as the average wages by industry (expressive of the wage level and the employment composition),

the average wage by sex (as chauffeurs make a major item among the male jobs, and the typists among female jobs respectively), and the wages of the large scale firms within an industry (as workers always aim at a high wage), but dismissed them as they showed a high correlation with $X$ (national income per worker) and are apt to cause multi-collinearity. Finally we adopted the ratio of male employees to total employees, as we could find no better index than this one to show the ability to pay. Let me explain the point in more detail. Generally, the larger the number of male employees in an industry, the higher are their wages as compared with female employees, for the degree of skill and the kinds of jobs required of the former ensures them higher wages. Also, because of a stronger wage tie among the males than among the females, the wages of chauffeurs and typists, who comprise no pivotal labor force in an industry, would be raised. This is the reason why we use the ratio of all male employees against the total number of workers appearing in the *Census* for each industry.

$X_5$:  To the chauffeurs is assigned 1, and to the typists, 0. Since this assignment has been made merely to distinguish job varieties, it is not necessary to take its effects into consideration.

In sptie of our scrupulous elucidation of the indices, they seem to contain a considerable number of weaknesses. For example, the national income by industry is an extremely rough estimate, the collective agreement application rate seems to fail to show the comprehensive strength of the manifoldly organized labor union, the employment increase rate is not the one for chauffeurs and typists, the employment increase rate for the whole of an industry has also based on limited number of the workers who are regularly employed, and the ratio of males as the index for the spillover of wages can not be called sufficiently representative.

Despite the difficulties involved with the adopted indices, we shall now see to what extent they are useful in the clarification of the industrial wage differentials through the use of simple correlation coefficients between each pair of the variables. The computed simple correlation coefficients are shown below. In order to calculate without including the dummy variable $X_5$, the dependent variable $Y$ has been divided into two: chauffeurs and typists. (Otherwise, the correlation coefficients are to be largely affected, as the wage difference between the chauffeurs and typists is great. It may be better to

calculate partial correlation coefficients or multiple correlation coefficients including $X_5$. But we adopted this method to save time in calculation.)

Simple correlation coefficients

$N = 6$,   * Significant at 5% level

|   |            |     | $X_1$   | $X_2$  | $X_3$    | $X_4$    |
|---|------------|-----|---------|--------|----------|----------|
| $Y$ | Chauffeurs | ··· | 0.7475  | 0.5755 | $-0.4049$ | $-0.1298$ |
|   | Typists    | ··· | 0.8287* | 0.5971 | $-0.1935$ | $-0.4895$ |
| $X_1$ |          |     |         | 0.0428 | $-0.2817$ | $-0.3341$ |
| $X_2$ |          |     |         |        | $-0.5961$ | $-0.2176$ |
| $X_3$ |          |     |         |        |          | $-0.5930$ |

According to the above, the correlation between $X_1$ and $Y$ is relatively high, but other correlations are low. The correlations of $X_3$ and $X_4$ with the other variables do not show significant, and they are all negative. And every one of these variables has practically no explanatory significance.

Assuming that $Y$,—the wages by job, is assumed to be determined by the linear combination of $X_1$, $X_2$, $X_3$, $X_4$ and $X_5$, we conceive the relationship presented below:

$$Y = a_1X_1 + a_2X_2 + a_3X_3 + a_4X_4 + a_5X_5 + a_0$$

Applying the above equation to the data by the least square method, we now measure the effects of each variable on $Y$ by the size of the partial regression coefficient. The results are as follows:

|       | Partial regression coefficient | Standard deviation of regression coefficient | Beta coefficient (normalized coefficient) |
|-------|--------------------------------|----------------------------------------------|-------------------------------------------|
| $a_1$ | 0.0279                         | 0.0060                                       | 0.340                                     |
| $a_2$ | 0.514                          | 0.112                                        | 0.599                                     |
| $a_3$ | 1.843                          | 0.455                                        | 0.556                                     |
| $a_4$ | 0.613                          | 0.195                                        | 0.335                                     |
| $a_5$ | 39.87                          | 2.97                                         | 0.853                                     |
| $a_0$ | $-37.08$                       | 5.15                                         | —                                         |

Degree of freedom: 6

Multiple correlation coefficient: 0.988** (significant at 1% level)

Multiple correlation coefficient adjusted by degree of freedom: 0.977

Examining the standard deviations of the regression coefficients, we find the large one at 1/3, and the small one at 1/13, that is, we observe that the multiple correlation coefficient far exceeds the 1%

level, and thus its fitness can be said very good, although the sample size is small. What we are interested in here is the size of the relative effects exerted by each variable. This is shown by the normalized coefficients of $a_5$, which shows the job difference between chauffeur and typist is the largest, but it means nothing as it is the coefficient of the variables which were used merely to enlarge the sample size. So, comparing the four other coefficients, we observe the following facts:

(1) $a_2$ and $a_3$ are large. (The difference between $a_2$ and $a_3$ is not significant.)

(2) $a_1$ and $a_4$ are small. (The difference between $a_1$ and $a_4$ is not significant.)

(3) $a_2$ and $a_3$ are about 1.4 times as large as $a_1$ and $a_4$ respectively. Further, and in contrast to the previously presented simple correlations, we notice that all the coefficients, including the cases of the variables whose simple correlation coefficients showed negative, turned to positive, and $a_1$ is not very large, although its simble correlations are high.

Next, we find that the residuals ($Y - \hat{Y}$, that is, the observed values minus the estimated values) are as follows:

|  | Chauffeurs yen | Typists yen |
|---|---|---|
| Mining | −0.293 | −0.126 |
| Construction | −1.309 | 1.158 |
| Manufacturing | −6.557 | 1.109 |
| Wholesale, Retail | −0.929 | 4.438 |
| Finance, Insurance, Real Estate | 1.395 | −1.238 |
| Electricity, Gas, Water Supply | 7.693 | −5.340 |

Studying these residurls we find this difference of 1/4 yen per hour between the largest,—chauffeurs: electricity-gas-water-supply with the underestimated value of 7.7 yen,—and the smallest,—chauffeurs: manufuring with an overestimated value of −6.6 yen. This 14 yen per hour is a little over 5% of the chauffeurs' wage. Further, we find the rank order of residuals by industry is quite different between the chauffeurs and the typists. In other words, these independent variables seem definitely to explain the existence of common industrial wage differentials between the chauffeurs and the typists.

IV. SUMMARY AND CONCLUSIONS

The four hypotheses: (1) the competitive hypothesis, (2) the ability

to pay hypothesis, (3) the union pressure hypothesis, and (4) the spill-over of wage hypothesis have been examined in this work. It has been proved that industrial wage differentials can be fully explained by these hypotheses. It has been found that a large number of cases can be taken care of by the competitive hypothesis and the union pressure hypothesis. The ability to pay hypothesis and the spillover of wage hypothesis respectively take about the same weight in the explanation of industrial wage differentials. Their importance, together is about 70% of the first two.

Our findings can not be compared with findings in the United States, for they differ from each other in the objects of survey, data, and the method of research. But we can summarize the following as derived from this multiple regression analysis study, provided that we are aware that this work is a cross-section analysis of the level of industrial wage differentials, and not a time series analysis aiming at the studying the change in wage movements.

(1) The competitive hypothesis seems to play important role in Japan.

(2) The ability to pay hypothesis can be considered to be supported, but its influence is not very great.

(3) The union pressure hypothesis has been proved to be an important tool in the study of wage differentials in Japan.

(4) The spillover of wage hypothesis has been definitely established as having significance, but its importance is about the same as the ability to pay hypothesis. On the question of whether or not the male ratio in the industrial labor force is wholly the reflection of the spill-over effect of wages, we still have many doubts.

The principal object of this research was to clarify the linkages among industrial workers on the basis of a large group such as the one-digit industrial classification. To look into a wage question on the basis of an industry unit requires the consideration of the factors which make Dunlop's "wage contours," such as the common product market, the supply source of labor force, the labor union and other organizations. Even within an industry, the large firms, the medium size and small firms have their own markets. Concerning their labor force too, we find that its characteristics are often overlapping or common among them, and they can not be particularized on an industrial basis. Broadly speaking, however, mining is different from manufacturing, while a wholesale firm has much more in common with firms in retail trade as compared with firms in any other industry.

The influence of the trade union has proved rather large, as measured

statistically or quantitatively, but its effect on the whole of the economy is too complex to be inferred from this fact. Take for example, the question of a union establishing the appropriate wage level which it should seek is one of the important decisions a trade union makes. A trade union often makes a comparative study of the wage standards which prevail in other establishments within the firm, in other firms within an industry, and in other industries at large with the object of seeing if the wage level of its members is too low, or if the rate of wage increase which it wants to demand is too high. Ross takes up the structure of wage linkage especially from the standpoint of the labor union organization. He makes an emphatic reference to the importance of the comparison of wages by the trade union, and indicates the significance of the spillover of wages which results from such a "comparative behavior." Thus some or most of the effect of the wage spillover theoretically considered, seems to be in the influence of the trade union that has been studied and estimated by this work.