〈Research Paper〉

Journal of the Korean Institute of Industrial Engineers
Vol. 4, No. 1, June 1978

Determinants of Hourly Earnings for Employed Women

Soo-kon Kim*

Abstract

Hourly earnings of the employed U. S. women are regressed upon a set of independent variables, separately for white and nonwhite women. In support of the human capitalist's point of view higher hourly earnings are positively associated with number of years of education completed, attainment of vocational training either at the company or/and non company training. In addition to education one's obtainment of certain occupational certificate and one's assignment of occupation in the order of the Duncan prestige index and years of work experience since leaving school are also significantly related to hourly earnings. Women workers employed at the government sector or employed in an industry where proportion of female is smaller than average earn more than those at private sector or at industries of high female composition.

Introduction

While labor force participation rate of women has increased dramatically during the past two decades, female workers in general are notoriously underpaid relative to their male counterparts. Some take this fact as prima facie evidence of discrimination against females, and others attribute such sex-related pay differentials to the conglomeration of women workers in typically low paying occupations. (See 2, 4, 6 and 7). However, relatively little attention has been given to the economic return to investment in womanpower, or to what factors determine variations in the rates of earnings among women workers at aspoint in time. The purpose of this paper is to answer the latter question, and to shed some light on how the economic position of working women can be enhanced. Some policy implications are presented at the end of the paper.

This study utilizes survey data from interviews with the U.S. national sample of women who were 30 to 44 years of age in 1967. The interviews were conducted by career personnel of the Bureau of the Census.[1] To permit a more confident analysis of racial differences, black women were overrepresented in the sample by a 3:1 ratio. For this reason regression analyses are performed separately for whites and blacks.[2] In this paper, the subjects in the sample are

* Visiting Professor at Korea Advanced Institute of Science and Senior Fellow at Korea Development Institute. This research was conducted while the author was Research Associate at the Center for Human Resource Research, the Ohio State University. The author would like to acknowledge his indebtedness to Herbert G. Heneman, Jr., Thomas A. Mahoney, Andrew Kohen, and James A. Murphy for their critical comments and assistance. As usual, the author alone is responsible for any error in the paper.

1) The data were collected as a part of a longitudinal study of labor maket behavior, being carried out under contract with the Manpower Administration of the U.S. Department of Labor by the Center for Human Resource Research of The Ohio State University. See 9 in the reference.

2) "Blacks" here refers exclusively to Negroes.

restricted to wage or salary workers employed in nonfarm industries on a full-time basis (working 35 hours or more during the survey week). As thus defined, our sample consists of 725 white and 347 black women.

Conceptual Framework

Variations in hourly rates of pay among workers reflect multiple forces operating in the employment situation. These sources may be largely grouped into three categories: (1) market conditions of demand for labor relative to its supply, (2) differential return to varying types and levels of investment in human capital, and (3) institutional forces of various types operating in the economic environment. In the following mathematical expression wages are assumed to be a linear additive function of the nine explanatory variables to be operationalized shortly:[3]

$$Y=a_0+b_1E+b_2D+b_3U+b_4R+b_5T_1+b_6T_2+b_7C+b_8L+b_9P+e$$

Where Y: Hourly earnings in cents
E: Years of education completed
D: Duncan Socioeconomic index of current occupation
U: Degree of urbanization of the local labor market area
R: Number of years worked since leaving school
T_1: Number of months of training received from company training school
T_2: Number of months of training received from other than company training school
C: Professional or trade certificate received: 1 if received, 0 otherwise
L: Class of worker: 1 if government employee; 0 otherwise
P: Proportion of employees who are female in the industry where respondent is employed

Human capital theorists have convincingly demonstrated the monetary payoff to educational investment. (See 1). It is therefore only reasonable to expect that women with more years of education completed will be paid at a higher rate, thus yielding a positive sign for the coefficient of E. It is also well known that there is a high positive correlation between education and occupational level.[4] With the same level of educational attainment, a subject employed in an occupation with a higher Duncan index would be expected to earn at a higher rate than one employed at a lower level occupation. In other words, controlling for education one's occupational assignment is expected to determine some of the wage differentials. This wage differential may reflect interoccupational differences in demand for and supply of labor in the market. It may also reflect personal differences in market information because one with superior information on the labor market is likely to be hired in an occupation of higher pay. At any rate, one's occupational assignment is an additional determinant of wages after controlling for education. However, because of existing intercollinearity between the Duncan index and education, regressions are performed with and without the Duncan index in the equation.

In general, wage rates are positively related to the size of the community, as a result of higher living costs in urban areas. (See 5). Respondents are coded by the size of the community of

3) For those subjects who did not report their rate of pay in dollars per hour, the hourly wage rate was computed by converting the reported earnings before deductions into a weekly rate and dividing by the usual number of hours worked per week.

4) In the present study, we found simple correlation coefficients between education and the Duncan Indexes for white and black women to be .57 and .67, respectively. For the index construction see 3, pp. 109-161.

residence, ranging from 1 through 8.[5] The expected sign of the coefficient is positive.

Other things being equal, a worker with greater work experience may be expected to earn a higher rate of pay. Therefore, the number of years during which the respondents worked at least six months since leaving school is used as an independent variable. The expected sign of the coefficient is positive. As work experience may be regarded as one type of investment in human capital, so would be the various types of formal training. Respondents were first asked if they had received any training "lasting two weeks or more at a company training school," and, if so, for how many months. The number of months of company training received by the respondent (T_1) is used as one of the two training variables. Respondents were also asked if they had ever taken any "technical, commercial, vocational or skill training," and, if so, for how many months. The number of months of this type of training is entered as another independent variable (T_2). The latter is called "non-company training" to distinguish it from the former, "company training." The expected sign of the coefficients for both T_1 and T_2 is positive.

There are a number of occupations for which it is necessary to have a certificate in order to practice the profession or trade. Some training is involved in granting these certificates, in order to raise the subject's proficiency to a standard level. However, not infrequently professional and trade associations also exert powerful institutional forces upon wage determination by restricting the supply of labor to the market. (See 8). Respondents were asked if they had "ever obtained a certificate required for practicing any profession or trade such as teacher, registered nurse, practical nurse, or beautician." If the answer is affirmative, it is coded as 1, otherwise, as 0. The expected sign of the coefficient is positive.

Another institutional force that may influence the wage rate is whether the worker is in the private or public sector. Fuchs argues that governments are relatively insensitive to customers' discrimination against females. Consequently, governments as employers are less apt to discriminate against women employees, thus achieving a higher female/male earnings ratio in the public sector as compared with the private sector. (See 5, p. 11). This ratio may simply reflect a generally lower wage rate for male workers in the public sector reltive to their private sector counterparts. We are not certain that customer discrimination against females actually exists. However, we tend to believe that nondiscriminatory personnel practices of governments permit a larger proportion of women to reach the upper occupational and organizational levels. The expected sign of the coefficient is positive with those employed in government coded as 1, and all others as 0.

Based on his aggregated data over 46 industries, Fuchs found a tendency for women employed in predominantly male industries to have relativeln high earnings, and wome in industries with more females to have lower earnings. (See 5). In line with Fuchs, we hypothesize that, ceteris paribus, a woman employed in an industry with a high level of female employment will earn at a lower wage rate. The expected sign of the coefficient is negative.

---

5) Areas of residence are coded as follows: "1" for a rural area; "2" for an area of 2,500-9,999 population; "3" for an area of 10,000-24,999; "4" for an area of 25,000 or more; "5" for an urbanized area under 250'000; "6" for an urbanized area of 250,000-999,999; "7" for an urbanized area of 1,000,000-2,999,999; and "8" for an urbanized area of 3,000,000 or more.

Table 1 **Cross-Sectional Regression Results of Hourly Rate of Pay by Color: Respondents Employed Full Time as Wage or Salary Workers**

Independent Variable	Unit of measurement	WHITES			BLACKS		
		Mean Value	Coefficient (standard error)	Percent σ^2 explained order entered	Mean Value	Coefficient (standard error)	Percent σ^2 explained order entered
Constant			74.07			19.69	
U: Residence (population size)	Rank order	4.19	5.17 (.83)	4.76 II	5.19	10.59 (1.26)	12.17 II
E: Education completed	Years	11.38	7.18 (1.19)	9.69 III	10.74	7.01 (1.54)	13.49 III
D: Duncan index	Score	39.23	.81 (.15)	9.72 I	26.91	1.14 (.23)	16.24 I
L: Class of worker	"1"=government "0"=private	.17	14.59 (6.42)	1.22 IX	.31	34.90 (8.43)	8.54 V
R: Years worked since school	Years	12.22	1.98 (.34)	4.91 IV	13.16	.70 (.43*)	.05 VII
T_1: Company training	Month	.55	2.35 (.68)	1.33 VII	.50	−1.04 (1.15*)	.11 IX
T_2: Non-company training	Month	2.59	1.19 (.34)	1.71 VIII	2.43	−.56 (.56*)	.20 VIII
C: Certificate	"1"=yes "0"=no	.15	29.03 (7.11)	3.24 VI	.20	40.43 (9.25)	7.36 IV
P: Proportion female	Proportion	.46	−73.69 (11.26)	4.65 V	.59	−60.48 (16.70)	4.00 VI
F ratio			55.73			59.93	
R^2 unadjusted			.41			.62	
R^2 adjusted for d.f.			.40			.61	
Dependent variable							
1066 wage rate in cents			210.53			171.31	
Number of cases			725			347	

* Not significant at $\alpha = .05$ two tails.

Empirical Results

The regrssion results generally support the hypothesis. In the equation all nine independent variables together explain about 40 percent of the variance in wage rates for whites and about 60 percent for blacks. (See Table 1). In the case of white women coefficients of all nine independent variables show the expected sign and are statistically significant at the 95 percent confidence level or higher. For the blacks, however, three of the nine independent variables are not statistically significant at the 90 percent confidence level. Initially a stepwise regression was performed without forcing the order in which the independent variables entered the regression so that the most powerful independent variable entered the regression first, the next most powerful second, and so on.

As indicated by a Roman numeral, the Duncan index variable entered first for both white and black women. The coefficient of the respondent's occupation is positive and statistically significant. The residence variable entered at the second step. Its coefficient is positive and statistically significant for both colors, indicating that those living in the larger population areas tend to earn

Table 2 Cross-Sectional Regression Results of Hourly Rate of Pay Without the Duncan Index by Color: Respondents Employed Full Time as Wage or Salary Workers

Independent variable	Unit of measurement	WHITES			BLACKS		
		Mean value	Coefficient standard error	Percent σ^2 explained order entered	Mean value	Coefficient standard error	Percent σ^2 explained order entered
Constant			62.96			6.57	
U: Residence (population size)	Rank order	4.19	5.49 (.85)	5.05 III	5.19	11.18 (1.29)	12.85 II
E: Education completed	Years	11.38	10.68 (1.03)	14.41 I	10.74	10.84 (1.37)	20.87 I
L: Class of worker	"1"=government "0"=private	.17	21.11 (6.44)	1.76 VIII	.31	51.91 (7.95)	12.71 III
R: Years worked since school	Years	12.22	2.30 (.34)	5.72 II	13.16	.74 (.44*)	.06 VI
T_1: Company training	Months	.55	2.70 (.69)	1.53 VII	.50	−1.39 (1.19*)	.15 VII
T_2: Non-company training	Months	2.59	1.43 (.35)	2.05 VI	2.43	−.66 (.58*)	.23 VIII
C: Certificate	"1"=yes "0"=no	.15	26.93 (7.25)	3.00 V	.20	43.67 (9.54)	7.95 IV
P: Proportion females employed by industry	Proportion	.46	−81.73 (11.40)	5.16 IV	.59	−71.20 (17.12)	4.71 V
F ratio			56.47			60.19	
R^2 unadjusted			.39			.59	
R^2 adjusted for d.f.			.38			.58	
Dependent variable:							
1967 wage rate in cents			210.53			171.31	
Number of cases			725			347	

* Not significant at $\alpha=.05$ two tails.

higher rates of pay (in money wages).

The education variable was the next to enter the regresson. The coefficient of years of school completed is positive and statistically significant for both color groups. Note that the size of the coefficients for whites and blacks is about the same, 7.18 and 7.01, respectively. The percentage of variance in wage rate explained by the education variable, after taking into account the effects of other independent variables, is about 10 percent for whites and almost 14 percent for blacks.[6]

Because of the problem of multicollinearity between education and occupation, the same regression is performed without the Duncan index variable (Table 2). Without this variable the magnitude of the education coefficients for whites and blacks increased substantially; to 10.68 and 10.84, respectively, and education entered the regression at the first step. In other words, in this form of the model, one additional year of schooling is associated with an increase in hourly earnings of almost 11 cents for both whites and blacks.

Since it is difficult to ascertain the relative strength of the explanatory power of the variables,

6) In order to compare the explanatory power of each independent variable in tems of the percentage of variance in the dependent variable explained, each standard beta weight is multiplied by the corresponding simple correlation coefficient with the dependent variable. In general form it would be

$$R^2=\beta_{12}\cdot r_{12}+\beta_{13}\cdot r_{13}+\cdots+\beta_{1n}\cdot r_{1n}$$

we combined the variance explained by education and occupation. Almost 20 percent of the whites' and 30 percent of blacks' wage variations are explained by these two combined. From these values, the variance explained by education alone (in Table 1), 14 percent for white and 21 percent for blacks, is subtracted to obtain residuals of about 5 and 9 percent. These residuals are attributable to the effects of occupational assignments upon wage rate variation.

The implication of this exercise is not so much the precision of these percentages but the fact it demonstrates that the simple existence of high collinerarity between two independent variables should not automatically deter one from using them in a regression analysis, especially if there is a clear temporal ordering. Although there exists a positive correlation between education and occupation, they obviously are not the same attributes.

As anticipated, the coefficient of number of years since leaving school in which the respondent worked at least six months is positive and statistically significant for whites but not for black. Among the whites one additional year of work experience is associated with almost two cents increase in hourly wage rate. Number of months spent in two types of training were used to explain variation in wage rates. Among the white women the coefficients of both types of training are statistically significant with the sign in the expected direction. But for black women neither type of training yields a statistcally significant coefficient.

As expected, the holder of a professional or trade certificate is at a considerable advantage, enjoying a higher rate of pay among both whites and blacks. Also advantageous is a woman's employment in the public sector as opposed to the private sector. The sizes of regression coefficients seem to indicate that, ceteris paribus, the possession of a certificate is a much more effective way of raising rates of pay than is securing a government job. Finally, the coefficient of the variable repesenting the proportion of women in the industry in 1960 is found to be highly significant, with the sign in the expected direction. The larger the proportion of females employed in the industry, the lower the respondent's wage rate.

Summation

We are not certain as to the reasons for the observed intercolor differences in the effects of work experience and training upon wage variation. We tend to think that characteristics of occupation held by black women may be somewhat responsible for not obtaining a statistical significance for the coefficient of work experience. The accumulation of years of work experience in domestic service where blacks are more frequently employed, is unlikely to increase a woman's wage rate. Also discrimination against blacks may have prevented them from obtaining higher paying jobs even with the additional months of training.

While there are many ways of enhancing women's economic status in the labor market, our analysis of the data seems to suggest that personal investment in human capital, such as more education, accumulated years of work experienie, increased training, obtaining a certificate to practice a profession or trade, are all helpful in achieving a higher wage for white women. This is true in general for black women, with the exceptions that for them additional work experience and participation in training programs are not as effective. However, if a woman of either color is employed in the public sector her chances of earning at a higher rate of pay are substantially in creased. Finally, we offer the suggestion that the woman who manages to penetrate a predo-

minantly male in dustry can expect a better rate of pay.

Reference

(1) Becker, Gary S, *Human Capital* (New York: Columbia University Press, 1964).

(2) Cohen, Malcolm S., "Sex Differences in Compensation," *Journal of Human Resource* 6, No. 4(Fall 1971) :434-447.

(3) Duncan, Otis Dudley, "A Socioeconomic Index for All Occupations," in Albert J. Reiss, Jr., *Occupations and Social Status* (New York: Free Press, 1961), pp. 109—161.

(4) Fuchs, Victor R., "Differences in Hourly Earnings Between Men and Women," *Monthly Labor Review* 94, No. 5 (May 1971), pp. 9~15.

(5) _____, "Differential in Hourly Earnings by Region and City Size, 1959," Occasional Papar 101 (New York: National Bureau of Economic Research, 1967).

(6) Kreps, Juanita, *Sex in the Market Place: American Women at Work* (Baltimore: Johns Hopkins press, 1971): U.S. Department of Labor Women's Bureau, *Handbook on Women Workers*, (Bulletin 294) (Washington, D.C.: U.S. Goverment Printing Office, 1969).

(7) Oppenheimer, Valerie K., *The Female labor force in the United States*, (Berkeley: Institute of International Studies, University of California), Chapter 3.

(8) Rottenberg, Simon, "The Economics of Occupational Licensing," *Aspects of Labor Ecnomics* (Princeton: Princeton Uuiversity Press, 1962), pp. 3—20.

(9) Shea, John R., Spitz, Ruths., Zeller, Frederick A. and Associates, *Dual Careers: A Longitudinal Study of Labor Market Experience of Women*, Vol. I, Manpower Research Monograph No. 21 (Washington, D.C.: U.S. Government Printing Office, 1970).