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MALE-FEMALE DIFFERENCES IN HOURLY WAGES: THE ROLE OF HUMAN CAPITAL, WORKING CONDITIONS, AND HOUSEWORK

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This study uses a new data set from a 1986 survey of workers to examine simultaneously the wage effects of human capital, household responsibilities, working conditions, and on-the-job training. The analysis suggests that household responsibilities had a negative effect on women's earnings, but the unexplained difference between the earnings of men and women is not greatly reduced by inclusion in the explanatory model of information on either housework or working conditions. The presence of children appears to have had a positive effect on the wages of both men and women.

TWENTY years of research on gender differences in earnings have failed to explain the entire wage gap as a consequence of measured differences between male and female workers. Some researchers view the unexplained residual as evidence of discrimination against female workers; others take the position that the entire wage gap is potentially explicable by differences in labor supply. According to the latter view, an unexplained wage gap remains because the data sets in use do not contain adequate information on all productivity-related characteristics. This view implies that the unexplained wage gap will be reduced by more comprehensive information or better data on productivity-related characteristics.

In this paper, I use a new data set to estimate wage equations that account simultaneously for human capital, working conditions, and household responsibilities, as well as other relevant individual characteristics. Although many studies have examined the role of human capital differences, there is little empirical research on the roles of working conditions and housework in explaining earnings differences by gender, and no research that examines all factors simultaneously.

As hypothesized by Becker (1985), housework may affect wages by reducing the amount of effort available for market work. In addition, the theory of compensating differentials predicts wages will be lower in jobs with more desirable working conditions. Since women spend more time than men on household responsibilities and are generally in less risky and more pleasant jobs, including information on household responsibilities and working conditions may reduce the unexplained component of the wage gap.

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An important benefit of estimating wage equations with more comprehensive information is that we are able to address whether omitted variable bias is responsible for the observed structural difference between male and female wage equations. For instance, omitted variable bias may be responsible for the empirical finding that marital status and children have opposite effects on the wages of men and women. If omitted variable bias is responsible for differences in returns by gender, measurements of discrimination based on such decompositions are also biased. At one extreme, if there are no differences by gender in the "true" returns to worker and job characteristics, the entire wage gap can be attributed to differences in average qualifications. But if the estimated returns to the included variables are biased, the decomposition may erroneously suggest the presence of discrimination.

Household Roles and Earnings

Recent research has focused on household roles as a basis for gender differences in earnings.[1] Household roles may affect earnings for two reasons. First, if women bear most household and child care responsibilities, their labor market experience may differ from men's in several ways (see, for example, Mincer and Polachek 1974; Polachek 1975). Women may expect discontinuous labor market participation and fewer total years in the labor market than men. Thus, women will have less incentive than men to undertake human capital investments, particularly firm-specific training, since they will expect to reap the rewards of such investments over fewer years. Similarly, employers have less incentive to train female workers. Further, labor force withdrawals may lead to attrition of human capital (although empirical evidence suggests that wages "rebound" rapidly after re-entry).

Second, household responsibilities may have a direct effect on productivity by reducing the amount of physical energy or effort available for market work (Becker 1985; Hersch 1985). In this case, household responsibilities will have an independent effect on earnings after controlling for human capital.

Empirical evidence on the relation between household roles and earnings has been mixed. Whereas married men have been found to earn significantly higher wages than single men and both married and single women, marital status has generally not been found to adversely affect women's earnings (for example, Hill 1979; Blau and Beller 1988). Findings on the effect of children on wages have been mixed for both men and women. For instance, Mincer and Polachek (1974) find that the number of children has negative but insignificant effects on women's wages. Hill (1979) finds a positive wage effect of children for white men and black women in her specifications that include detailed worker characteristics, with insignificant effects in the corresponding equations for black men and white women. She finds, however, a negative wage effect of children for white women in her specifications that employ cruder measures of work experience. Blau and Beller (1988) find that the number of children has significant negative effects on women's earnings and positive effects on the earnings of white men. Filer (1985), in a specification allowing for compensating differentials, finds no wage effect of the number of dependents for men, but positive wage effects for women.

A potential problem with estimates that exclude household responsibilities from wage equations is that omitted variable bias may be responsible for the finding that marital status and the presence or number of children have opposite effects on the wages of men and women. If household responsibilities are positively correlated with marital status and children, but negatively correlated with wages, then the returns to marital status and children will be biased downward in equations that exclude household responsibilities. This bias is more likely to be

[1] An excellent survey of issues related to gender differences in the labor market is Blau and Ferber (1986).

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significant for women than for men, if women do in fact assume a greater share of household responsibilities than men.[2]

Working Conditions and Earnings

Compensating differentials may also explain earnings differences between men and women. Men and women may, on average, choose jobs with different attributes that require compensating differentials, either as a consequence of different household responsibilities or because of differences in tastes that are highly correlated with gender. For instance, women may choose jobs with more flexible hours because of household responsibilities, and they may choose jobs that involve working with people because of a female preference.

Using data from the Quality of Employment Survey, Filer (1985) investigated the role of compensating differentials in explaining wage differences between men and women, and he found that including job conditions reduces the unexplained component of the wage gap. Most of the working conditions examined by Filer, such as "task identification" and "role clarity," have not been examined by other researchers and do not permit an economic interpretation. It would be useful to see if Filer's findings can be replicated using more conventional working conditions and a different data set.

Empirical Model

Since a goal of this paper is to investigate whether earnings equations still exhibit structural differences when omitted variables bias is reduced, I estimate separately for men and women equations of the form:

$$(1) \qquad W = \beta' HC + \gamma' J + \delta' Z + \epsilon$$

W is the natural logarithm of hourly wages, HC is a vector of human capital characteristics such as work history and education, and J is a vector of nonpecuniary job attributes. Z is a vector of individual characteristics (such as marital status, children, and housework) that may affect productivity in ways that are not measured by the human capital variables, or may affect preferences for nonpecuniary characteristics over money wages in ways that are not measured by job conditions.

If working conditions are measured as negative amenities, theory predicts a positive relation between wages and job conditions, as well as a positive relation between wages and human capital. In this context, women will earn less than men if, on average, their stock of human capital is lower than men's or their jobs are more pleasant.

Data and Variable Definitions

I use original data collected in the Eugene, Oregon, area in 1986. The survey I employed contains more complete information on work history, training, job characteristics, and household responsibilities than any other survey I know of. Similar questions regarding attributes of the worker's job have appeared in the three waves of the Quality of Employment Survey (formerly the Survey of Working Conditions), but the wording of these questions prohibits granting a cardinal interpretation to the answers. In addition, the data on work history available in the Quality of Employment Survey are insufficiently precise, since the questions asking for tenure on the job and with the employer directed the respondent to select years of tenure from eight broad categories of unequal length. The Panel Study of Income Dynamics, in particular the ninth wave, contains detailed work history and training information, but has limited in-

[2] Wages also affect time spent in housework or child care, with higher wages making market substitutes for own time more affordable. Thus, the household variables in the wage equation may be correlated with the error term, yielding biased estimates in the OLS estimation. If household production time is inversely related to wages, then the return to household responsibilities is biased upward in the OLS wage equation. A possible solution is to estimate a joint wage–household production system. Such an analysis, however, is hindered by serious identification problems.

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formation on job attributes and household responsibilities. The range of ages available in the National Longitudinal Surveys limits the usefulness of those data for examining gender differences in wages, and also lacks information on training, job characteristics, and household responsibilities. The Current Population Surveys lack information on job tenure, years of work experience, training, job characteristics, and household responsibilities.

The sample was drawn from employees of eighteen firms: twelve manufacturing firms, five wholesale warehouses, and one large commercial laundry. The surveyed firms ranged in size from 40 to 400 employees. I selected firms in these industries because workers and jobs in these industries are similar, and because there is significant worker mobility across these industries. The sample consists of 414 male and 217 female wage and salary workers. The data appendix discusses the procedure for generating the sample and presents comparisons of this sample with national data sets.

Selectivity bias is a potentially serious problem that may occur if wage equations are estimated based on samples of workers only. Since we observe wages only of those individuals who chose to participate in the labor market, the observed distribution of wage offers is truncated by the reservation wage. Wage equations estimated without correcting for this selectivity bias may yield inconsistent estimates. The technique suggested by Heckman (1979) to correct for selectivity bias is to include the inverse Mill's ratio, estimated from a probit equation that predicts inclusion of an individual in the sample of wage-earners, as a regressor in the wage equation.

Since the data available in my sample are for workers only, not for the population at large, it is not possible to correct for selectivity bias using my data set only. Instead, I use data from the 1988 May Current Population Survey to estimate a probit equation for inclusion in the wage-earning sample. Using the estimated coefficients from the probit equation, I calculate the inverse Mill's ratio for each individual in my sample. I then use this value as a regressor in the wage equation. This procedure of imputing Mill's ratios derived from another data source is comparable to the procedure frequently used in empirical research on compensating differentials, in which job conditions are imputed from an outside source such as actuarial tables or the Dictionary of Occupational Titles. As in the compensating differentials case, this imputation will bias against finding the coefficient on the imputed variable statistically significant.

Table 1 summarizes the variable definitions and sample characteristics. The mean logarithms of hourly wages (and corresponding mean wages) are 2.21 ($9.98) for men and 1.95 ($7.49) for women. Following the specification of the preceding section, the variables can be grouped into three broad categories: human capital characteristics, individual characteristics and household responsibilities, and working conditions. A discussion of the specific variables used in the analysis follows.

Human capital. The data set contains detailed information on work history and education. Work history is measured by years of full-time work experience (EXPERIENCE) and tenure with current employer (TENURE), as well as the squares of these variables to allow for diminishing returns. Formal education (EDUCATION) is measured in years.

The sample means presented in Table 1 indicate that men have significantly more years of work experience, tenure with employer, and education than women in the sample.

Individual characteristics and household responsibilities. The variables included in this category are dummy variables for race (WHITE), handicapped status (HANDICAPPED), and marital status (MARRIED). Additional variables are the number of children under 18 who live at home (NUMBER OF CHILDREN) and time allocated to household responsibilities.

To directly investigate the effect of household responsibilities on wages, I include four variables that measure the time spent on household work and child

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Table 1. Variable Definitions and Sample Means.
(Standard Deviations in Parentheses)

Variable		*Men*	*Women*
Human Capital			
EXPERIENCE	= years of full-time work experience since age 18.	14.43**	12.09
		(10.79)	(9.47)
TENURE	= years of experience with present employer.	7.32**	5.42
		(7.93)	(5.85)
EDUCATION	= years of school completed.	13.32**	12.92
		(2.10)	(1.58)
Individual Characteristics and Household Responsibilities			
WHITE	= 1 if worker is white; 0 if nonwhite.	.95	.94
		(.22)	(.24)
HANDICAPPED	= 1 if physical condition limits work; 0 otherwise.	.07	.08
		(.26)	(.27)
MARRIED	= 1 if marrried; 0 otherwise.	.72**	.56
		(.45)	(.50)
NUMBER OF CHILDREN	= number of children under age 18 who live at home.	.98*	.79
		(1.21)	(.99)
HOUSEWORK ON JOB DAYS	= hours spent on housework on work days.	2.22	2.61**
		(1.61)	(1.56)
CHILD CARE ON JOB DAYS	= hours spent on child care on work days (if worker has children under age 18).	2.41	2.90*
		(1.64)	(1.94)
HOUSEWORK ON NON-JOB DAYS	= hours spent on housework on non-work days.	4.01	5.19**
		(2.54)	(3.33)
CHILD CARE ON NON-JOB DAYS	= hours spent on child care on non-work days (if worker has children under age 18)	5.86	7.70**
		(3.57)	(5.31)
Working Conditions			
GAS	= percentage of time worker is exposed to gas, dust, or smoke.	43.45**	26.65
		(39.36)	(37.02)
SHAKE	= percentage of time worker is exposed to strong shaking or vibration.	15.21**	7.42
		(25.54)	(19.51)
POISON	= percentage of time worker is exposed to poisons, acids, etc.	26.23	9.73
		(34.27)	(24.13)
NUMBER SUPERVISED	= number of other workers supervised.	1.77**	.85
		(5.15)	(3.36)
PURCHASE	= 1 if worker has authority to make decisions about purchases and other expenditures; 0 otherwise.	.28	.24
		(.45)	(.42)
FREEDOM	= percentage of time worker is free to decide how to do own work.	63.76*	58.29
		(32.24)	(34.25)
REPETITIVE	= percentage of time work is repetitive.	68.72	68.62
		(29.40)	(29.55)
TRAINING REQUIREMENT	= years it would take the average person to learn to do the job reasonably well.	.59**	.20
		(1.04)	(.39)
STRESS	= percentage of time work is mentally stressful.	45.50	53.55**
		(31.59)	(33.40)
MACHINE	= percentage of time worker uses machines (other than computers).	55.13**	43.58
		(39.36)	(38.29)
LIFTING	= percentage of time work requires heavy lifting.	31.98**	17.35
		(30.38)	(27.51)
WEATHER	= percentage of time worker is exposed to bad weather conditions.	15.72**	8.13
		(25.15)	(19.73)
HOURS	= hours worked per week.	38.62**	37.37
		(4.40)	(5.82)
PUNCH	= 1 if worker is required to punch or sign in and out when beginning and ending work; 0 otherwise.	.65**	.45
		(.48)	(.50)
SIZE	= number of employees.	155.08	170.56
		(114.30)	(128.86)
UNION	= 1 if worker's job is covered by a union contract; 0 otherwise.	.33	.35
		(.47)	(.48)
TRAVEL TIME	= commuting time in minutes.	16.00	16.17
		(9.71)	(10.53)
WAGE	= hourly wage.	9.98**	7.49
		(4.06)	(2.80)
Sample Size		414	217

* Significantly different means at the 5% level; ** at the 1% level (two-tailed tests).

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care on work days and non-work days. Respondents were asked, "On days when you are working, about how much time on average do you spend on home chores—things like cooking, cleaning, repairs, shopping, yardwork, and keeping track of money and bills?" This question, which is similar to that on the Quality of Employment Survey, was intentionally worded to minimize male underreporting by including in the list of examples tasks like yardwork and repairs that are considered "men's work." A second question asked respondents with children under age 18 how much time they spend on working days "taking care of or doing things with" their children. The responses to these two questions form the variables HOUSEWORK ON JOB DAYS and CHILD CARE ON JOB DAYS. The same two questions were also asked separately for non-working days, and the responses to these questions form the variables HOUSEWORK ON NON-JOB DAYS and CHILD CARE ON NON-JOB DAYS. On average, women report spending significantly more time than men on both housework and child care.[3]

Working conditions. The data set includes a number of variables that may yield compensating differentials and have been investigated by previous researchers. These include measures of the riskiness of the job, the worker's job responsibilities, control over time at work, training requirements of the job, and the mental and physical requirements of the job.

In particular, the job's riskiness is indicated by the percentage of time the worker reports exposure to gas, dust, and smoke (GAS), strong shaking or vibrations (SHAKE), and poisons, acids, explosives, or other potentially harmful materials (POISON). Theory predicts a positive relation between job risk and wages. The worker's responsibilities are measured by the number of other workers supervised (NUMBER SUPERVISED) and whether the worker has the authority to make decisions about purchases for his or her employer (PURCHASE). Control over time is indicated by the percentage of time the worker is free to decide how to do his or her own work (FREEDOM) and the percentage of time the work is repetitive (REPETITIVE). Wages are expected to be higher for workers with more responsibilities and more discretion over work time.

Workers were asked how long it would take the average new person (who has enough education to do their job) to learn to do their job reasonably well (TRAINING REQUIREMENT).[4] This question is similar to that included in the 1976 Panel Study of Income Dynamics and examined by Duncan and Hoffman (1979). The wording of the question, which asked about the "average new person" rather than about the respondent, was designed to mitigate the effects of special abilities or background the respondent possessed. The question in my survey differed from the Panel Study of Income Dynamics question by asking the length of time it would take the worker to do the job reasonably well, rather than how long it would take to be fully trained and qualified. Nonetheless,

[3] Although the differences in reported household responsibilities between men and women are statistically significant at the 5% level, the magnitude of the differences is fairly small. In order to compare the household time values in my sample to the corresponding values in a national sample, I calculated the average weekly values for married workers in my sample. The average values of household time per week (and standard deviations) are 34.8 (21.8) for men and 42.2 (28.2) for women. The corresponding values reported by Coverman (1983) using the Quality of Employment Survey 1977 Cross Section are 25.09 (18.2) for men and 47.12 (27.43) for women.

The difference between the average values for women in the QES and my sample is not significant. The average values for men in my sample are significantly higher than in the QES sample. This difference may be due to male overreporting in my sample, but it may also be due to the difference in the time of year the two data sets were collected. Most of my data were collected in summer, when yardwork demands are at their peak, whereas the QES data were collected in the last three months of 1977. In addition, it is possible that the share of household responsibilities assumed by men increased during the nine years between the two surveys.

[4] Since at least a portion of training is transferable, categorizing training as a job condition rather than a human capital variable is somewhat arbitrary. Of course, the regression results are unaffected by the categorization.

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the pattern of responses, both for men and women on average and across occupations, is similar to that reported by Duncan and Hoffman (1979).

The mental demands of the job are indicated by the percentage of time the work is mentally stressful (STRESS). This variable is included to capture typical sources of stress in white-collar jobs. Physical conditions are measured by the percentage of time the worker uses machines (MACHINE), the percentage of time the work requires heavy lifting (LIFTING), and the percentage of time the worker is exposed to bad weather conditions (WEATHER). The data set also has information on whether the worker is required to punch or sign in and out of work (PUNCH), the number of hours worked per week (HOURS), the number of employees in the firm (SIZE), and time spent commuting to work (TRAVEL). In addition, the survey ascertained whether the worker's job was covered by a union contract (UNION).

On average, at the 5% level in two-tailed tests, a significantly greater percentage of time on the job working with gas, shaking, poison, bad weather, and machines is reported by men than by women. In addition, the responses indicate that men work more hours per week, supervise more workers, are more likely to be required to punch a time clock or lift heavy objects, have jobs requiring more training, and have greater freedom to decide how to do their own work. Significantly more stress on the job is reported by women than by men, but both sexes consider their jobs stressful about half of the time.[5]

Regression Results

The first two columns of Table 2 provide estimates of wage equations separately by gender, controlling for human capital characteristics, race, handicapped status, marital status, and number of children. This approach is the conventional one and thus provides a reference point for the results to follow, which add in household responsibilities and working conditions. Specifically, the equation is modified by including household responsibilities in columns 3 and 4, and including working conditions in addition to human capital and individual characteristics in columns 5 and 6. The dependent variable in each equation is the natural logarithm of the worker's hourly wage. Since the inverse Mill's ratio was not significant in any of the equations, the results presented in Table 2 are based on estimates that omit the inverse Mill's ratio.[6]

In all specifications, the human capital variables performed in the expected manner. In both the male and female equations, tenure with employer has a positive but diminishing effect on hourly wage, with women receiving a significantly higher return to tenure (at the 1% level) than men. Total work experience, however, is significantly related to men's wages but not to women's. Years of education is positively related to wages for both men and women. White workers earn more than non-white workers, but this result is insignificant after controlling for working conditions.

Consistent with other studies, being married is positively related to men's earnings and not significant for women. Household responsibilities are not significantly related to men's wages in any specification, and the number of children, although positively related to men's wages, is significant at the 5% level in only one specification. The results for women indicate that number of children is positively related to wages at the 5% level when household responsibilities are included in

[5] Multicollinearity did not seem to be an important problem, since the correlations between these job conditions were fairly low. The highest correlation for men was between GAS and SHAKE, with a correlation coefficient of .46. The highest correlation for women was between HOURS and SIZE, with a correlation coefficient of −.45.

[6] Probit equations were estimated separately by gender, using data from the 1988 Current Population Survey, for 3,932 men and 4,242 women in the Pacific region. The variables used in the probit equation are age, marital status, education, race, and number of children. Results of the probit estimates and wage equations corrected for selectivity bias are available on request to the author.

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Table 2. Regression Coefficients for Ln (Wage) Equations. (Standard Errors in Parentheses)

Variable	*(1) Male*	*(2) Female*	*(3) Male*	*(4) Female*	*(5) Male*	*(6) Female*
Human Capital						
EXPERIENCE	.026**	.011	.025**	.011	.016**	.006
	(.006)	(.007)	(.006)	(.007)	(.005)	(.007)
EXPERIENCE SQUARED	−.0004**	−.0001	−.0004**	−.0001	−.0002*	−.000002
	(.0002)	(.0002)	(.0002)	(.0002)	(.0001)	(.0007)
TENURE	.039**	.066**	.038**	.065**	.027**	.057**
	(.006)	(.008)	(.006)	(.008)	(.005)	(.008)
TENURE SQUARED	−.0008**	−.002**	−.0008**	−.002**	−.0006**	−.002**
	(.0002)	(.0003)	(.0002)	(.0003)	(.0002)	(.0003)
EDUCATION	.041**	.056**	.042**	.053**	.030**	.041**
	(.007)	(.013)	(.007)	(.013)	(.006)	(.012)
Individual Characteristics and Household Responsibilities						
WHITE	.198**	.141*	.197**	.177*	.072	.119
	(.070)	(.083)	(.071)	(.086)	(.059)	(.081)
HANDICAPPED	−.008	−.042	−.011	−.035	−.048	−.039
	(.060)	(.074)	(.060)	(.074)	(.049)	(.065)
MARRIED	.168**	.048	.165**	.048	.108**	.036
	(.043)	(.043)	(.044)	(.043)	(.036)	(.038)
NUMBER OF CHILDREN	.023	.028	.022	.041*	.027*	.037*
	(.015)	(.023)	(.017)	(.026)	(.014)	(.022)
HOUSEWORK ON JOB DAYS			.007	−.029*	.003	−.021
			(.011)	(.015)	(.009)	(.013)
CHILD CARE ON JOB DAYS			−.005	.014	−.008	.003
			(.017)	(.016)	(.013)	(.015)
HOUSEWORK ON NON-JOB DAYS			.004	.006	.004	.003
			(.007)	(.007)	(.006)	(.007)
CHILD CARE ON NON-JOB DAYS			.002	−.008	.006	−.003
			(.007)	(.006)	(.006)	(.005)
Job Conditions						
GAS					.001**	−.0009
					(.0004)	(.0006)
SHAKE					−.0006	.002
					(.0007)	(.001)
POISON					−.0007*	−.0003
					(.0004)	(.0009)
NUMBER SUPERVISED					.006**	−.008
					(.003)	(.005)
PURCHASE					.140**	.114**
					(.033)	(.044)
FREEDOM					.001**	.001**
					(.0004)	(.0006)
REPETITIVE					−.002**	−.002**
					(.0005)	(.0006)
TRAINING REQUIREMENT					.029*	.179**
					(.013)	(.048)
STRESS					.001**	.0009*
					(.0004)	(.0005)
MACHINE					.0002	−.001*
					(.0004)	(.0005)
LIFTING					−.00005	.001*
					(.0005)	(.0008)
WEATHER					−.002**	−.0005
					(.0005)	(.001)
HOURS					.006*	.004
					(.003)	(.004)
PUNCH					.133**	.080*
					(.033)	(.042)
SIZE					.0007**	.0007**
					(.0001)	(.0002)
UNION					.182**	.015
					(.031)	(.040)
TRAVEL					.001*	.002
					(.001)	(.002)
CONSTANT	.900**	.719**	.861**	.757**	.754**	.600**
	(.183)	(.261)	(.172)	(.255)	(.185)	(.198)
R^2	.51	.39	.51	.41	.70	.61
Adjusted R^2	.50	.36	.50	.37	.68	.55

* Significant at the 5% level; ** at the 1% level (one-tailed tests).

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the specification. Further, housework is negatively related to earnings (although significant at the 5% level in only one of the two specifications reported). Although caution should certainly be applied in interpreting these results because of the large standard errors, these findings suggest that omitted variable bias may indeed be a factor in studies that find a negative effect of children on women's earnings.

The working conditions examined here are similar to working conditions examined in previous research on compensating differentials. The expected signs of these working conditions are summarized by Brown (1980), and Smith (1979) and Brown (1980) provide excellent summaries of previous empirical findings. As Smith and Brown point out, the results have often been insignificant, or significant but with a sign opposite that predicted. The unexpected findings are too numerous to list, but some examples are significant negative coefficients found for bad working conditions and repetitive work (Brown 1980) and for difficulty in running errands and heavy lifting (Duncan and Holmlund 1983).

Including working conditions in columns 5 and 6 significantly increases the explanatory power of the models. The hypothesis that the coefficients on working conditions are jointly equal to zero can be rejected by an F test at the .001 level for both men and women. Further, the estimated effects generally accord with expectations, although there are exceptions.

Hourly wages are positively associated with authority to make decisions about purchases, freedom to decide how to do one's own work, training, job stress, the requirement to punch a time clock, and firm size. Repetitive work, on the other hand, is associated with lower wages, suggesting that repetition may serve as an indicator of the mental ease of the job.

Although there are substantial differences between men and women in the average values for many job attributes, in many other cases the difference in returns to men and women is not significant. The job conditions for which the returns differ significantly by gender at the 5% level (two-tailed tests) are exposure to gas, exposure to shaking, number of workers supervised, amount of training required, working with machines, and union status. Men receive a positive return to exposure to gas, whereas women do not. Since men were more likely than women to be in blue-collar jobs that may involve exposure to hazardous gas, the positive return to gas for men is not surprising.

The return to women for machine work is negative and significant at the 5% level, and not significantly related to men's wages. This difference in returns may reflect differences in the types of machines used by men and women. Women may be more likely to use typewriters, for example, and men may use a wider mix of machines. In addition, women may be less productive if their work involves using machines designed for the physical characteristics of the average man.

Men also receive a statistically significant positive return to supervising workers. The return to training is significantly higher for women than for men at the 1% level, with the return for women about six times that for men.[7] Men receive a substantial return to unionization (20%) but unionization provides no wage advantage for women.

The bad weather and poison variables are significant for men, but their sign (negative) is opposite that predicted. Bad weather was included in a study by Hamermesh (1977), who found that it had no significant effect on wages. Duncan and Holmlund (1983) found that exposure to poison was negatively (but not significantly) linked to wages.

One should certainly be extremely cautious in evaluating evidence of compensating differentials for working conditions other than risk. As Smith (1979) points out, the heterogeneity of worker tastes makes it highly uncertain whether jobs that make physical demands, are repetitious, or have little freedom are unpleasant to the marginal worker. The findings

[7] Duncan and Hoffman (1979) also found a higher return to training for white women than for any other group.

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reported here, however, strongly support the theory of compensating differentials in comparison to previous studies, and most of the results seem reasonable. By design, the data used in this paper have several advantages in estimating compensating differentials over data commonly used in other studies.

First, the job conditions examined in this study are individual-specific and self-reported rather than average values of job conditions imputed from an outside source such as the Dictionary of Occupational Titles. Imputing average values to individuals will bias against finding evidence of compensating differentials. Second, the workers are employed in a small number of industries located in a single geographical area, and may be more likely to apply a common interpretation to job condition questions than a more heterogeneous sample. Third, the questions on the survey were worded to allow a continuous rather than simply an ordinal measurement of the variables. Research based on the Quality of Employment Survey is restricted to ordinal or dichotomous measures of the variables.

Decomposition of the Wage Gap

Following Oaxaca (1973) and Blinder (1973), it has become conventional to decompose wage gaps into differences in average worker and job characteristics and differences in returns to average characteristics. The portion of the wage gap not explained by differences in average characteristics has frequently been taken as a measure of discrimination. The question of interest here is whether controlling for more complete information reduces the unexplained component of the wage gap.

Table 3 presents the decomposition of the wage gap into the percentage attributable to differences in average qualifications, using both the male and female weights.[8] The remainder can be attributed to differences in returns to qualifications and the constant term. The decompositions based on equations 1 and 2, which control for human capital and individual characteristics but do not control for time allocated to household responsibilities or working conditions, indicate that roughly 40% of the wage gap is attributable to differences between men and women in average qualifications. Adding in time allocated to household responsibilities (equations 3 and 4) has a minor impact on the percentage of the wage gap attributable to differences in average qualifications. Controlling for working conditions, however, greatly increases the proportion of the wage gap explicable by differences in qualifications, based on the female weights (equation 6). These results indicate that 69.2% of the male wage advantage is due to differences in qualifications based on the female weights. The decomposition based on the male weights, however, does not increase the proportion of the residual wage gap. Based on the male wage

[8] The wage differential between men and women can be written as

$$\ln W^m - \ln W^f = \Sigma B^m (X^m - X^f) + \Sigma X^f (B^m - B^f)$$

or as

$$\ln W^m - \ln W^f = \Sigma B^f (X^m - X^f) + \Sigma X^m (B^m - B^f)$$

where W^m and W^f are average hourly wage rates of men and women, X^m and X^f are vectors of average values of the independent variables, and B^m and B^f are the estimated coefficients for the two groups. The first equation (which corresponds to the odd-numbered equations in Tables 2 and 3) decomposes the total wage gap into a part due to differences in the means of the independent variables "valued" at the male coefficients and a part due to differences in coefficients "valued" at the female means. The second (which corresponds to the even-numbered equations in Tables 2 and 3), an alternative procedure for decomposing the wage gap, evaluates differences in the means of the independent variables valued at the female coefficients, and differences in coefficients valued at the male means. Since the difference between the choice of weights is an example of the familiar index number problem, there is no theoretical reason for preferring one set of weights over the other. The decomposition of wages, however, has typically been based on the coefficients from the male wage equation as a representation of the nondiscriminatory structure. Both sets of results are included in this paper.

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Table 3. Percent of Wage Gap Attributable to Differences in Average Qualifications.

	Male Coefficients			*Female Coefficients*		
Category	*(1)*	*(3)*	*(5)*	*(2)*	*(4)*	*(6)*
Human Capital	30.4	30.5	20.7	31.4	31.3	28.2
Individual Characteristics	12.6	12.4	8.9	5.6	6.7	5.4
Time Allocated to Household Responsibilities	—	−3.0	−3.2	—	2.6	2.1
Working Conditions	—	—	10.5	—	—	33.5
Totals	43.0	40.0	36.8	37.0	40.6	69.2

Note: See text for explanation.

equation (equation 5), 36.8% of the male wage advantage is due to differences in average qualifications.

The great variability of the result depending on whether the male or female equation provides the weights is almost entirely due to the variable TRAINING REQUIREMENT. The average value of this variable for men is three times that for women, but the return to training for women is about six times that for men. The net effect of this one variable is to increase the proportion of the wage gap attributable to differences in average qualifications when the female weights are used.

As Table 3 indicates, differences between men and women in average human capital characteristics account for most of the wage gap explicable by differences in average qualifications (except in the decomposition using female weights and including working conditions). Including working conditions decreases the proportion explained by both human capital and individual characteristics. Differences in individual characteristics, including marital status and household responsibilities, explain a relatively minor proportion of the wage gap. Thus, men's wage advantage is largely due to the greater average values they have for work experience and for the working conditions GAS, NUMBER SUPERVISED, HOURS, and PUNCH, which receive positive compensating differentials.

Discussion and Concluding Remarks

Using a new data set, I have presented estimates of wage equations that include detailed human capital characteristics, time allocated to household responsibilities, working conditions, and on-the-job training. The data I used do not come from a random sample, however, and great caution should be exercised in extrapolating the conclusions presented here to the general population.

This study provides new evidence that household responsibilities affect the wages of women, not only by reducing human capital investments, but perhaps also by reducing the amount of effort available for market work. Household responsibilities apparently have no effect, however, on men's wages. There are two possible explanations for this result. First, the negative effects of housework on earnings may begin at a point beyond the number of hours typically spent by men on housework. Second, the timing of housework done by men and women may be different. For instance, women may be more involved than their husbands in getting children ready for school, or may be more likely than men to hurry home from work because of child care needs or meal preparation, whereas men may engage in their share of household responsibilities after work and on weekends. Any reduction of effort available for market work caused by housework should be more pronounced if housework is timed closely with market work.

In contrast to previous evidence, this study finds women's wages are positively related to the number of children, after controlling for the direct impact of housework on wages and for fairly detailed human capital characteristics and on-

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the-job training. If the number of children affects reservation wages by raising the value of time at home, we should find that children are positively related to observed wages, after controlling for any negative effect of housework on wages. Further, if the presence of children can be considered a proxy for personal traits such as motivation, then we should expect to see a similar impact of children for men and women, as women's labor force participation rates and divorce rates increase.

It is well known that women earn less than men largely because they are overrepresented in lower-paying jobs. If women choose lower-paying jobs because such jobs provide non-wage compensation, such as pleasant working conditions, we would expect to explain more of the wage gap by controlling for the attributes of jobs. Similarly, if women choose non-market activities (such as housework) that reduce market productivity, then controlling for these activities should also reduce the unexplained wage gap. This study finds, however, that although women spend more time on housework than men and are in more pleasant and safer jobs, including information on housework and job conditions does not reduce the unexplained gap between men and women's wages, based on the coefficients from the male wage equation. Further, even though potential omitted variable bias is greatly reduced by including more comprehensive information on variables expected to affect wages, men's and women's wage equations still exhibit structural differences.

Do the findings of this paper imply discrimination? One common view is that a large unexplained wage gap and differences by gender in returns to characteristics indicate the presence of discrimination. Since previous studies lacked information on a number of worker and job characteristics, many observers attributed the large unexplained gap to incomplete data rather than to discrimination. In this paper, however, a fairly comprehensive set of productivity-related factors and working conditions are included in the estimates, yet a large component of the wage gap is still left unexplained.[9]

There are other issues to consider, however, before concluding that this paper offers evidence of discriminatory treatment of women workers. First, differences in returns to job characteristics can arise in a nondiscriminatory fashion if tastes for job attributes differ, on average, between men and women (Killingsworth 1987). The empirical importance of individual differences in preferences in determining wage-risk trade-offs has been demonstrated by Hersch and Viscusi (1990). Second, interpreting an unexplained wage gap as discrimination requires the existence of barriers to mobility (Becker 1971). Yet, discrimination in employment on the basis of gender is prohibited by a number of laws, and there is evidence that firms that are sued for violations of Equal Employment Opportunity laws suffer a loss in the value of the firm (Hersch 1991). These facts suggest that market factors make it unlikely that discrimination will be sustained over a long period. Third, evidence reported by Kuhn (1987) and Filer (1985) based on the 1977 Quality of Employment Survey suggests that very few women feel they have been discriminated against in any way (13.1% in Kuhn's sample and 7.6% in Filer's).

In conclusion, some observers may interpret the findings of this paper as providing evidence of discrimination. Alternatively, we can view these results as evidence of the limitation of the residual

[9] Note that other characteristics that have been considered important by other researchers either are not relevant or are controlled for in this study. For instance, college major has been found to be an important determinant of earnings (Daymont and Andrisani 1984). This sample, however, is comprised of nonexempt employees, who are not employed in professional, managerial, and technical specialties in which college major is important. Differences in firm-specific human capital are accounted for by including on-the-job training in this study. Another possible characteristic is a measure of gender-role attitudes; but one's behavior in choosing time allocated to household responsibilities would seem to be a good indicator of such attitudes.

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approach to measuring discrimination. Since it is difficult to infer the existence of discrimination without evidence of barriers to mobility, future research efforts should be directed at determining whether such barriers exist.

Data Appendix

The following procedure was used to generate the sample. First, firms were asked permission to survey their workers. Then notices were posted at the cooperating firms to inform workers that a researcher would be in the employee lunchroom at particular times, that is, between shifts or during breaks or mealtimes, and employees who completed a twenty-minute questionnaire would be paid $5.00 for their time. All respondents were guaranteed confidentiality, with no names requested on the questionnaire.

The 18 surveyed firms employed a total of 2,043 workers. Not all of the workers were eligible for participation in the survey. Since it was important to have an accurate measure of the hourly wage rate, those excluded by design were company executives and workers paid by commission. In addition, I was not able to survey workers on every shift in every firm. Thus, the overall response rate is at least 31%, not adjusted for excluded workers.

The differences in participation appeared to depend mostly on the firm's support and the nature of the production process rather than on individual differences between workers. The highest response rates were in firms that distributed additional notices or made announcements over the intercom to remind workers that a researcher would be at the firm to collect data, and gave employees time off from work to complete the questionnaire. Several of the firms, however, employed a large number of off-site employees, and even though the firms were supportive, these workers were not available to complete the survey.

There are both advantages and disadvantages associated with using this data set. The most important advantage is that the questions were tailored to address precisely the issue of gender differences in earnings, thus permitting examination of a wider range of relevant variables than any previously studied data set has provided. Principal among the disadvantages is that the sample is not random. An additional limitation of the sample is its restricted locale and number of industries. Compared to a national sample, this sample has a smaller proportion of professional, managerial, sales, and service workers, and a larger proportion of crafts workers, operatives, laborers, and female clerical workers. These features of the sample will not bias the estimates but may reduce the generality of the results.

Although the sample is not random, its average characteristics are quite similar to those of the U.S. population. The sample means reported in Table 1 are almost the same as those reported in the *Statistical Abstract of the United States* for education, marital status, and hourly earnings of production workers, and are also very similar to the worker characteristics calculated from the Quality of Employment Survey, the Panel Study of Income Dynamics, and the National Longitudinal Survey. Further, standard wage regressions give parameter estimates very similar to those obtained using national data sets. (For examples, see Hersch and Stone [1985], using the PSID, and Blau and Beller [1988], using the CPS.)

Note that bias is possible in all data sets compiled by means of worker surveys. In fact, in data sets such as the Quality of Employment Survey, in which respondents were not paid for participation, the bias may be even more serious than it is in this study, since in that case we would expect participation only of individuals with a very low marginal value of time. Since the $5 payment for participation exceeded the wage rate for almost all employees of the surveyed firms, the possibility that there are systematic differences between those who did and did not respond based on the value of their time is reduced.

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