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JOB CHARACTERISTICS, GRADING SYSTEMS AND COMPARABLE WORTH

by

Mario M. Covo

A THESIS SUBMITTED
IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE

Doctor of Philosophy

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FEBRUARY 1985

Abstract

Job Characteristics, Grading Systems
and Comparable Worth

Mario M. Covo

Utilizing a unique and comprehensive data set on the personal and job characteristics of workers from three firms, we test the equalizing wage differential theory and study the determinants of the persistent male-female earnings gap. Access to information on the point-grading systems used by the three firms to set their wages, permits us to expose the methodology behind the systems which are being considered by Comparable Worth advocates as potential substitutes for the market in the determination of wages.

Our data on grades, and on directly observed job characteristics that are homogeneous across firms, reduce the biases of the traditional wage hedonic estimators and enhances their efficiency. Our results show systematic support for the theory of equalizing wage differentials.

The inclusion of grade information increases the flexibility of traditional models by complementing human capital theory with important administrative constraints that usually accompany internal labor markets. Our model reduces the unexplained portion of the observed earnings gap between males and females and highlights the difficulties associated with using inter-firm data from national samples.

Using an arbitrary set of job characteristics we explain approximately 80 percent of the grades used in the firms under study. By constructing a variable to simulate the job analyst's estimate of the sex of the worker, we show that analysts

can. by choosing the appropriate weights. set wages and manipulate grades to perpetuate the earnings gap. A high correlation between market wages and grades is found. which confirms that it is impossible to escape market realities using grading systems in their present form. Therefore, if, as Comparable Worth advocates desire. grading system are to be used to set wages for all workers across the country in a way that market distortions are not reflected by the grades, the existing systems are not adequate. We show that if analysts were forced to use the same weights across firms the flexibility of their system to adapt to local market conditions would be severely hindered.

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This document is the culmination of many years of work and enjoyment at Rice University. Innumerable friends and colleagues have provided me with stimulation and guidance throughout the different stages of my work : Patty and Lucas made Houston mean home; Decio de Maria, David Hahn, and Fred Wallace were always there to lift me when my stamina faltered; David Lane, Rick Stoll, Florence Fulton, Robert Dawson, and Vera Wallis gave to me unselfishly many hours of their time when I needed help; Dr. Blanco and Dr. Mieszkowski had great patience to stimulate me and direct me in the most important endeavor of my life; Claudia proofread and edited the manuscript, and gave me the most important push to finalize the project while teaching me to keep it in perspective; and my parents , to whom I dedicate this work, taught me the importance of finishing what one commences.

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INTRODUCTION

Overview

In this paper we study three interrelated topics. First, the role of grading systems used by firms in appraising jobs, and their influence in wage determination. Second, we analyze and satisfy the data requirements on job characteristics for testing the equalizing wage differential theory. Third, we study the role of grades and job characteristics in models used to detect discrimination and to explain the persistent male-female earnings gap.

To our knowledge, this is the first empirical study whose data include direct access to the grading systems of three different organizations. Equally significant is the fact that we complement our grade information with firm-specific data on a wide variety of job characteristics. Also, we include a set of personal characteristics from each worker that allows us to control for factors that affect productivity.

Our model incorporates the common administrative procedure of first obtaining grades and then basing wages on them. This model, coupled with our powerful data, reduces the biases found in traditional wage hedonic models and enhances their efficiency. Our results show systematic support for the theory of equalizing wage differentials.

Our model complements human capital theory with important institutional constraints, like the grading system, that accompany internal labor markets. The

unexplained portion of the observed male-female earnings gap, usually interpreted as the discrimination factor, is significantly lower with our model than in the traditional human capital formulations.

By constructing a variable to simulate the job analyst's estimate of the worker's sex, we show that job analysts can, by choosing the appropriate factor weights, set wages and manipulate grades to perpetuate the earnigs gap. A high correlation is found between market wages and grades, confirming that it is impossible to escape market realities if grading systems are used in their present form. Therefore, one of the principal objectives of the Comparable Worth doctrine--the homogeneous determination of wages using grading systems that are not biased toward the market--can only be attained if more research is devoted toward adapting the index to this objective.

The Issues

Although female workers have increased their participation in traditional male occupations during the last decade, little progress has occurred in eliminating the earnings gap between the two genders. Men and women are still, for the most part, concentrated in different jobs, and male-dominated jobs command higher wages than female-dominated jobs.

The fact that market wages for female-dominated jobs are, on average, lower than for male-dominated jobs can be a consequence of past discrimination against females, and to the strong degree of job segregation that has generated an excess

supply of workers in 'female-type' jobs. Advocates of the Comparable Worth doctrine feel that market wages are inherently discriminatory and perpetuate past injustices against females.

Comparable Worth advocates do not only want equal opportunities of education and employment, they want a 'fair' recognition of their present jobs. The claim is not only that there is a lack of equality in opportunities, but also that typically-female jobs are underpaid relative to jobs of *comparable worth*, that is, jobs requiring similar levels of skill, effort, responsibility, etc.

In order to enhance equity in compensation, Comparable Worth advocates are pursuing the generalized use of 'unbiased' point-grading systems to make work comparable across jobs. These point-grading systems, which we describe with more detail in the next section, attempt to measure the relative contribution of each job to the overall product of the firm. Point-grading systems are based on job evaluations, which are formal methods for determining the relative value of a job, they are used mostly to set compensation rates.

Unfortunately, the implementation of grading systems is not enough to eliminate inherently discriminatory market distortions. A number of job evaluation systems explicitly correlate their points with market wages in order to set the job characteristic weights. In fact, the main issue proponents of Comparable Worth have taken to court is that grading systems are often arbitrarily adjusted in a discriminatory manner. The issue, then, is that the market is biased against female-type jobs, therefore, grading systems are needed

to correct for compensation distortions, however, the grading system must be unbiased. Clearly, grading systems that explicitly use market wages will not serve the purpose. However, will grading systems that evaluate jobs before correlating points with the market work?

We hypothesize that there are other sources of bias in the evaluation process. Namely, biases can occur at the grade assignment level, represented by the choice of factors and factor weights, they can occur in the writing of job descriptions and, biases will be present when grades are regressed against market wages to set the internal grade-wage line.

Our data permit us to expose the methodology behind point-grading systems. We have access to two grading systems from three different organizations. The indexes in our data are both based on points, but have a very different conceptual approach. One of them is openly based on market wages and assigns points to different job characteristics by using market information. The second system evaluates all jobs before any reference is made to the market. This important distinction between the systems allows us to study, in depth, not only the role of the index in wage determination, but also its market dependence.

The market-free evaluation system is advocated by Comparable Worth repesentatives as the potential, official, compensation process for the United States. The only requirement is that final grades should not be regressed against the market to determine the wage of all jobs. If grades, however, are biased before reference is made to the market, the objective of using this system will not be

achieved.

In Chapter III, we study the market dependence of the 'market-free' system. The core of our analysis is the combination of a wide variety of job characteristics data and the grading information. We are capable of explaining a substantial portion of the indexes using our own job characteristics. Utilizing a variable created to measure the job analyst's estimate of the worker's sex, we model the grade determination process of the firms that make use of the market-free grading system and find a high correlation between grades and wages. Although causality is not infered from our model, we do show that analysts can choose job characteristics and weights to set wages and manipulate grades in a fashion that perpetuates the male-female earnings gap.

Developing a large, firm-specific, set of job characteristics enables us not only to understand better the sources behind the male-female earnings gap, but also to test the equalizing wage differential theory which states that disagreeable job characteristics are compensated for with higher wages.

To date, almost all papers studying the equalizing wage differentials have found inconclusive support for the theory. Our powerful data base allows us to test the theory using firm-specific data on job and personal characteristics. Previous work had focused on national samples from all industries. We find consistent support for the equalizing wage differential theory.

Organization of the Study

In the following section we introduce the two major roles that grading systems play in the wage determination process of firms--pricing of firm-specific jobs and screening efficiency gains.

In Chapter I we focus on the study of the equalizing wage differential theory. The first section of Chapter I comments on the direction that previous work has taken in efforts to test the theory. The next section contains a review of the literature as well as the presentation of the most relevant results attained to date. A detailed analysis of the data used in most previous studies is included in the second section. Section three introduces our models and data, and in section four we present our results , compare previous empirical results with our own, and contend that direct observation and measurement of job characteristics allow for reduced biases in the estimation procedures. The fourth section of Chapter I serves as a more formal introduction to grade-point systems and their role in the study of wage differentials. We present a model that utilizes information on personal and job characteristics and takes account of the effects that grading systems have in the determination of wages. We then use our model to re-estimate the effects of personal and job characteristics on wages and show how the efficiency of our estimates is increased .

Chapter II concentrates on the male-female earnings gap and discusses the different theories that have been tested empirically in efforts to explain the gap. As in Chapter I, the use of point-grade information is stressed and the model with

grade information is used to study the nature of the differences in the jobs held by males and females. We highlight and demonstrate the value of directly observed, detailed job characteristics as we verify that males and females hold different types of jobs, with different job characteristics and, most importantly, with different returns to the common job characteristics. The inclusion of job characteristics into models explaining earnings gaps increases our understanding of the sources of the gap as well as of the nature of the jobs held across the groups under study. This is a necessary step toward identifying whether there are any inherently 'attractive' or 'repelling' attributes to certain jobs that would justify non-homogeneous utlity functions across sex groups.

Chapter III is based on an application of the models presented earlier to the study of discrimination. We concentrate on the Comparable Worth doctrine and evaluate its premises. As we review the court cases in which grading systems have been utilized, we stress the role played by job analysts. The second and third sections of the chapter present a test to detect discriminatory behaviour on the part of the employer--when grading systems are used--as well as a model showing how analysts are a potential source of bias even if they obtain total points without explicitly referring to the market.

Role of Point-Grade Systems in Wage Determination

In this section we introduce the role of grading systems in the profit-maximizing behaviour of firms as a cost-reducing, efficiency-increasing information service. We also present an example that, although highly simplified, illustrates the information gains that can accompany the use of grading systems by firms. We begin by briefly reviewing what grading systems are and how they are used by most large corporations.

Firms using point-grading systems evaluate their jobs utilizing, as a first step, job descriptions. These contain all the information on the tasks that the job entails. Based on these descriptions the evaluators (from here on referred to as 'analysts') are able to determine the level of each 'compensable factor' that the job requires, for example, years of formal education, financial reponsibilities, amount of public contact, risks of injuries and death, working conditions, etc.

The analyst is then assumed to transform the levels of the compensable factors into point values: for example, if the job requires the worker to compile data the analyst may give the factor (job characteristic) 3 points, on the other hand, if the job entails transcribing data it may be awarded 5 points. There are no a-priori restrictions on the job characteristics chosen or on the points granted to them. As we will see, it is at this stage that an important correlation with market wages can surface. Once the points have been determined for each compensable factor, job analysts obtain a total point value and correlate it with wages in order to obtain an

internal grade-wage line and set wages for all non-key jobs (jobs whose wages are exogenous to the firm). In the method used to obtain total points there is considerable freedom to give more weight to some factors than to others. Analysts can not only arbitrarily select the compensable factors to be included in the point-setting process, but they can also determine, a-priori, the number of points that each job characteristic will command. The nature of the grading system makes it possible for biases to enter at three points: in the writing of the job description, in the evaluation of the description with respect to the compensable factors, and in the explicit correlation of grades with market wages.

The weight each compensable factor receives in the market is determined by estimating:

(I.1) $Wj = \alpha + \beta(Gj) + e$

where Wj is the wage, Gj is the matrix of points and e is the error term of the regression.

By selecting a few jobs for which the wage rate is exogenously determined (key jobs), the analyst can estimate the above equation, obtain values for the weights and proceed to set the wage rates for all non-key-jobs based on the estimated weights.

The mechanism presented above describes the first of the two most important objectives of grading systems- the pricing of firm or industry-specific jobs. The adequate pricing of jobs requires both internal and external 'equity' considerations. Internal equity means that workers will be rewarded according to

their contribution to the firm, relative to all other employees. External equity implies that workers will be rewarded in such a way that they have no pecuniary incentive to seek the same type of employment elsewhere.

A second objective of grading systems is the efficent selection of workers from a pool of applicants. This process involves matching the personal characteristics of the applicants to the required personal characteristics of the job. The required personal characteristics of any job can be obtained by regressing the personal characteristics of workers in that job (locally or throughout the economy) against the characteristics of their job. One can then predict the required personal characteristics of a worker given the characteristics of the job for which there is an opening.

Both of these objectives are attainable for any firm if it invests enough in developing its personnel department or, alternatively, if it hires the services of a private consulting firm to implement the grading system.

The conditions under which it will be profitable for a firm to incur in higher costs by implementing a grading system are determined by the increase in revenues that can be generated with the use of the system: Total revenues depend on the existence of the grading system via the increase in productivity generated by additional efficiency in matching workers to jobs. A second, and perhaps equally important, source of productivity gain stems from an overall rise in the 'morale' of workers who will enjoy the benefits of a cleary established, presumably equitable wage system. Total costs also depend on the existence of grading

systems. On the one hand, there are costs of implementation, but, on the other hand, there are gains in interviewing efficiency, that is, the 'matching' information allows firms to reduce the number of interviews by eliminating those applicants with the inappropriate credentials.

A final consideration includes the variation in wages that will come about as the firm implements the grading system. Presumably some wages will change when the system is introduced, eliminating previous wage distortions and adjusting the turnover rate of the firm. In Chapter I, we present a test of the pricing element of the grading system for one of the firms under study, that is, we verify whether the wages paid by the firm varied significantly after the system was implemented.

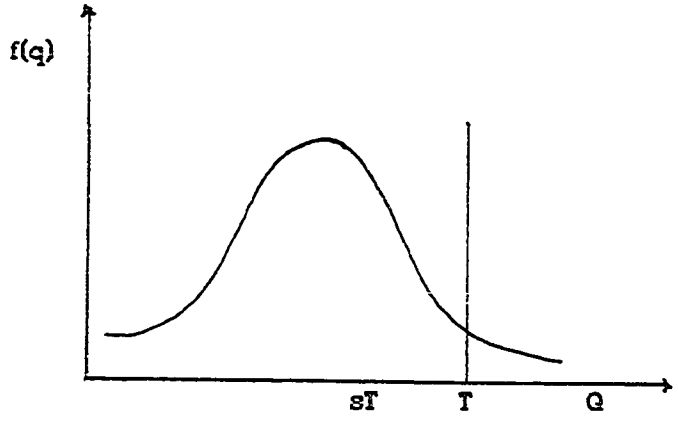
APPENDIX

Our data are very well suited for the study of the pricing aspects of grading systems. However, our lack of information on the companies' turnover rate, and on their accepted and rejected applications forbids us from empirically testing the effects that implementing a grading system has on administrative costs.

Nevertheless, in this Appendix we present an example to demonstrate how the inclusion of a grading system reduces the expected number of interviews the firm faces before filling a vacancy. We assume the firm knows the distribution of 'quality' among the labor pool from which it draws applicants, but that it cannot distinguish each applicant's quality solely from the application without hiring a consultant.

A firm will interview an applicant if the gain in expected quality (assume that the applicant's quality is monotonically related to revenues) is greater than the costs of the interview. Suppose that the maximum quality found after interviewing k candidates is Qk:

FIGURE 1



Let Qk = sT.

The expected maximum quality of interviewing applicant k+1 , given Qk, is

(I.2) $E_{max\, q_{k+1} | max\, q} = sT \int_{0 \text{ to } sT} f(q)dq + \int_{sT \text{ to } T} qf(q)dq$

The maximum cannot be lower than the Qk already found, so the expected quality of applicant k+1 , given the quality of applicant k, will always be at least Qk.

The interviewing rule is : interview the next candidate if

(I.3) $E_{max\, q(1...k+1)} | \, max\, q(1...k) - max\, q(1...k) \geq c$

where c = interviewing costs.

Assuming, for simplicity, a uniform distribution, the rule becomes

(I.4) $E_{max\, q_{k+1}} | \, max\, q_k = (sT)^2/2 + T^2/2$

This is the expected maximum quality of an additional search. The firm will stop interviewing when

(I.5) $(sT)^2/2 + T^2/2 - sT = c$

Solving for s:

(I.6) $(sT)^2 - 2sT + 2(T^2/2 - c) = 0$

(I.7) $s = (1 \pm \sqrt{(1 - T^2 + 2c)}) / T$

restricting $0 \leq s \leq 1$ and $0 \leq T \leq 1$ we eliminate the positive root. Setting T = 1,

(I.8) $s^{*} = 1 - \sqrt{2c}$

This is the expected maximum quality for a firm given T and c. The probability of obtaining a quality lower then s^* is

(I. 9)

# Interviews	Probability
1	$1 - \sqrt{2c}$
2	$(1 - \sqrt{2c})^2$
.	.
.	.
.	.
m	$(1 - \sqrt{2c})^m$

Therefore, the expected number of interviews is

(I. 10) $Em = \sum_{n=1 \text{ to } m} n(1 - \sqrt{2c})^n$

Solving,

Set $1 - \sqrt{2c} = a$

Let $Em = \Phi = a + 2a^2 + \ldots$

$a\Phi = a^2 + 2a^3 + \ldots$

define $\Psi = \Phi - a\Phi = a + a^2 + \ldots$

$a\Psi = a^2 + a^3 + \ldots$

then, $\Psi - a\Psi = a$

$\Psi = a / (1 - a)$

$$\Phi = a/(1-a)^2$$

(I.11) $$Em = a/(1-a)^2 = (1-\sqrt{2c})/2c$$

The logical consistency of the model can be easily verified by noting that the expected number of interviews falls if the cost per interview - c - increases:

(I.12) $$Em_c = -2^{-1}c^{-2} + (1/2)2^{-(1/2)}c^{-(3/2)}$$

where Em_c is the partial derivative of Em with respect to c.

Em_c is negative if $\sqrt{c} < \sqrt{2}$, and we know that is the case since c is normalized and less than 1. Therefore,

(I.13) $$Em_c < 0$$

In order to study the effects of implementing a grading system, we assume, following the arguments presented above, that the grading system permits screening from the application based on the applicants' 'relevant' credentials, given the analysts' knowledge of the job requirements. This implies that the firm can eliminate a certain number of applicants from the interviewing process by going through the application without incurring interview costs.

Having solved for the expected maximum quality, given T and c, the firm now

faces a lower probability of finding someone of a quality lower than s^*. The inclusion of the grading system has screened out a number of workers with low quality through the required personal characteristics estimated by the consulting firm.

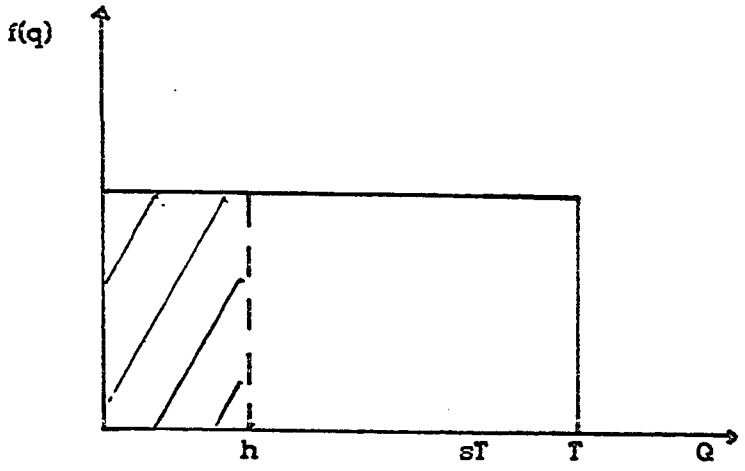
The probability of finding an applicant of a quality lower than s^* is:

(I. 14)

# Interviews	Without Grading System	With Grading System
1	$1 - \sqrt{2c}$	$1 - \sqrt{2c} - h$
2	$(1 - \sqrt{2c})^2$	$(1 - \sqrt{2c} - h)^2$
.	.	.
.	.	.
.	.	.
v	$(1 - \sqrt{2c})^v$	$(1 - \sqrt{2c} - h)^v$

where h represents the decrease in probability associated with the implementation of the grading system. This can be seen graphically in Figure 2.

FIGURE 2



Solving for the expected number of interviews,

Let $b = 1 - \sqrt{2c - h}$. Then,

(I. 15) $Ev = \sum_{n=1 \text{ to } v} n(b)^n$

Following the same procedure as above,

(I. 16) $Ev = b / (1 - b)^2 < a / (1 - a)^2 = Em$

given that $b < a$.

This example has shown how the enhanced information obtained with the job analysis allowed the firm to reduce one element in its cost function by lowering the number of people they interview for a given vacancy.

CHAPTER I

TESTS OF THE THEORY OF EQUALIZING WAGE DIFFERENTIALS

Overview

Adam Smith originated the theory of equalizing wage differentials over two hundred years ago. The theory states that workers receive compensating wage premiums when they take jobs that are characterized by undesirable tasks. To date there is still inconclusive evidence regarding the empirical validity of his widely accepted theoretical observations .

In 1970, Albert Rees and George Schultz published the results of what has become a seminal study of wage differentials (1). The authors explain wage differentials by using two sets of variables: personal characteristics--education, race, age , seniority, sex, marital status, training and commuting distances--and establishment characteristics--location of firm within the city, industry code, degree of unionization and size of firm. In contrast to our work , their study concentrates on inter-firm differentials and uses homogeneous occupational groups. We, on the other hand, focus on intra-firm wage differentials across jobs that have different titles but have similar job characteristics. The parallel between the two approaches arises when point grades are used to compare non-homogeneous jobs.

As a result of stratifying their sample by job title , Rees and Shultz find that the major determinants of wage differentials are the worker's personal characteristics, such as sex and race, and industry variables like degree of

unionization. The stratification chosen by the authors, however, does not allow for the identification of specific job characteristics that command wage premiums or penalties.

The issue we analyze in this chapter is the effect of job characteristics on worker's compensation. We use a set of job characteristics that are common to most jobs under study and, to facilitate methodology comparisons with other papers, we include several job characteristics that have been found to be relevant in previous studies .

In addressing the issue under study, we attempt to control all other variables that affect wages. As the principal unit of study is the firm we are not concerned with establishment variables. Also, our rich information on personal characteristics allows us to control for a considerable number of variables that affect productivity (2).

The study is premised on the proposition that job characteristics are , to a large extent, firm-specific. Also, we emphasize the fact that a substantial number of firms in the United States use grading systems in their compensation decisions. The first issue highlights the importance of having firm-specific data . The second underlines the fact that not controlling for grading mechanisms in empirical models yields inefficient results.

Review

THE EQUALIZING WAGE DIFFERENTIAL THEORY

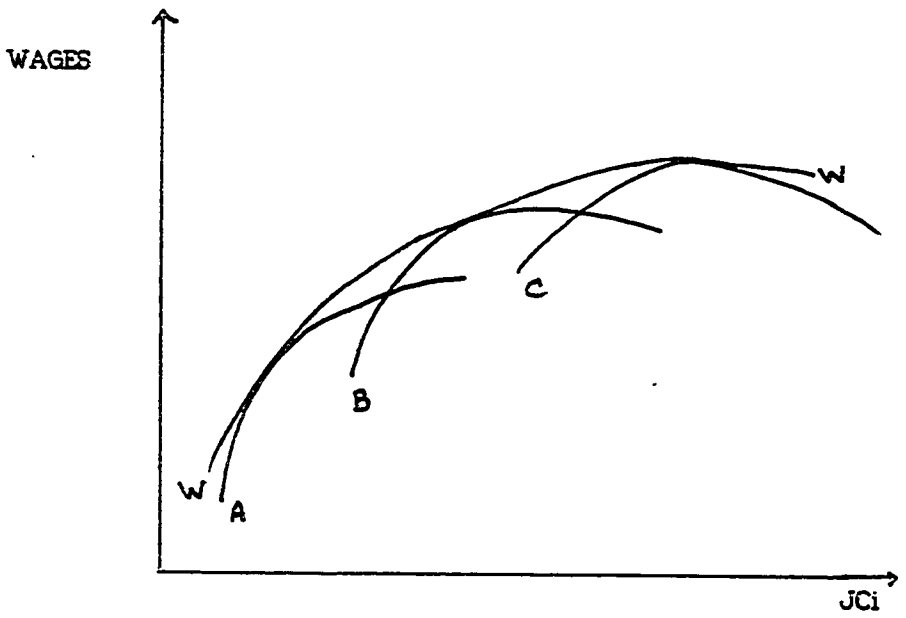
The theoretical model that is traditionally used to explain the existence of compensating wage differentials is based on the assumption that workers maximize their utility and firms maximize profits. Workers, however, can derive satisfaction from some non-pecuniary aspects of their jobs. The non-pecuniary aspects of jobs that contribute to the worker's utility level are the job characteristics that enter the supply of labor function. Firms, on the other hand, have specific technological requirements which , coupled with factor prices, determine the levels of the job characteristics that are demanded for each job.

The wage rate, therefore, includes a series of implicit prices at which each job characteristic is bought and sold. It is these prices that the literature has called compensating wage differentials and represent the shadow prices of the job characteristics. Direct observation of these prices is not possible, and, therefore, the theory of hedonic prices, best outlined by Rosen (1974) and later extended to the labor market model by Lucas (1977), is used for the analysis.

To illustrate, we will follow an example presented by Smith (1979): Consider a group of jobs in which all job characteristics but one are at their market clearing prices (shadow prices) and quantities. Assume that the only job characteristics that remains in disequilibrium is one which yields dissatisfaction to the worker when present i.e. risk of death, presence of disagreeable working conditions, etc. Assuming that firms can control the levels of this job characteristic at some positive and increasing cost, they will only reduce its level if they can also reduce

the wage-maintaining a given level of profits. The assumption that firms can lower the level of the disagreeable job characteristic only at increasing wage reductions, to maintain constant profits, is reflected in the concavity of the iso-profit schedules presented in Figure 3.

FIGURE 3



Not all firms face the same technological constraints nor factor prices. Different firms will most likely have different isoprofit schedules. The only condition necessary to include several firms in the analysis is that they share the labor pool from which they select their workers. In Figure 1 firms B and C find it more costly, at the margin, to reduce each level of the disagreeable job characteristic than does firm A. "If there is a large number of firms operating at the long-run competitive equilibrium, the envelope of the wage-job characteristic offer curves (at zero profits) will trace out what Rosen calls the 'market clearing implict price' curve.

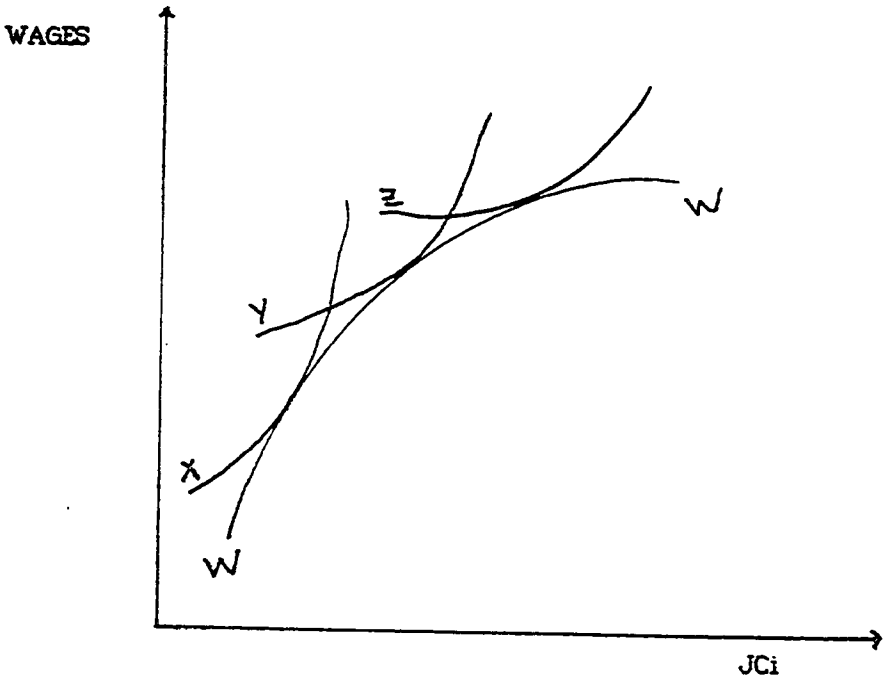
This envelope, *WW* in Figure 1-has a positive slope and will be concave form below. Rosen argues, if there are increasing marginal costs of *reducing the level of the disagreeable job characteristic* across firms or industries and it is impossible to 'untie' any package of job characteristics and sell t*he lower level of the disagreeable job characteristics* separately." (3)

Workers are assumed to maximize their utility based on their consumption of a basket of goods and the level of non-pecuniary job characteristics in their job. If all job characteristic levels have been optimized except one, we can trace the workers utility schedule on Figure 4. The curves represent the trade-off between wages and the level of the disagreeable job characteristic. Convexity follows from the usual second order maximization conditions.

In the example used in Figure 4, we present three workers with differing dislikings for the job characteristic, with worker X needing greater wage compensation for each increase in the level of the job characteristic than workers Y or Z. Workers with greater dislike for a given job characteristic will accept jobs in the firms that can provide the lowest levels of the characteristic in question coupled with lower wages.

Market equilibrium will occur at the points where indifference curves are tangent to iso-profit schedules. Each worker's (firm) equilibrium occurs where his indifference curve (iso-profit schedule) is tangent to the market clearing shadow price curve WW.

FIGURE 4



To our knowledge, all empirical tests of the equalizing wage differential theory have been based on hedonic models of wage determination founded on the analysis presented above. A fundamental aspect that characterizes hedonic-price models is that single stage estimates of the shadow prices-when firms vary in their iso-profit schedules and workers have different tastes- only trace out the market clearing envelope curve, rather than the structural behaviour underlying the model.

Regressing wages on job characteristics is an attempt to locate a series of demand and supply tangencies, not an attempt to estimate the indifference curves or isoquants themselves, therefore, single- equation models can be used.

Unfortunately, the data requirements for the identification of indifference curves and isoquants from the envelope schedule , based on a procedure suggested by Rosen (1974) "are so formidable that attempts to use his suggested procedure have not proven successful" (4)

Robert Smith (1979) mentions two other important issues related to hedonic models : first, the market clearing schedule responds to changes in the relative profitability of production at each level of the job chatacteristic by shifting over time. Second, and most important, more than one wage rate will prevail at every level of the job characteristic if workers vary in productivity at that particular level of the job characteristic. This result implies that we can account for slopes of the offer curves that may differ by interacting job variables with other variables that influence wages , such as personal characteristics.

The second observation by Smith (1979), outlined in the preceding paragraph, stresses the importance of using comprehensive information sets. Omitted variables and errors of measurement have created biases in the estimates of previous research. Brown (1980), in explaining the reasons for the inconsistent support for the equalizing wage differential theory states that " an oft-cited reason for these anomalies is that important characteristics of the worker remain unmeasured, biasing the estimates" (5) .

Brown (1980) motivates the empirical testing of the equalizing wage differential theory by noting that "..previous research provides only inconsistent support for this theory, with wrong signed or insignificant estimates of the wage premiums fairly common " (6). Having stated the problem Brown (1980) proceeded to test the

theory with a more comprehensive data set of worker characteristics. Unfortunately, he was unable to improve the results. Overall, " despite evidence from studies of the internal wage policies of firms that equalizing wage differences are present, recent research on the determinants of individual earnings has provided rather limited support for the theory" (7).

The most common job characteristics utilized in empirical tests are: repetitive work; requires physical strength; bad working conditions (some studies have broken up this agggregate measure into 'noise,' 'dirt,' 'heat,' 'vibrations' and 'bad light'); supervising people; working under stress; risk of death; control of overtime; receiving supervision; and working with tools and/or equipment. A considerable amount of work has centered around the identification of disagreeable job characteristics and the estimation of their shadow prices (8). The most common characteristics utilized in studies that concentrate exclusively on disagreeable job characteristics are : injury rate, risk of death, job insecurity, and stressful work.

Table 1.1 , summarizes the empirical findings to date:

TABLE 1.1

SUMMARY OF PREVIOUS EMPIRICAL RESULTS

AUTHOR	JOB CHARACTERISTIC	RESULT
Abowd-Ashenfelter 1978	Job insecurity	-
Bluestone 1974	Physical Strength Required	-*
	Bad Working Conditions	-
Brown 1980	Physical Work	-
	Repetitive Work	-*
	Stressful Work	+
	Bad Working Conditions	-*
Duncan-Stafford 1977	Working with Tools/Machines	+*
	Not Free to Take Time Off	+
	Index of Work Effort	+*
Hammermesh 1977	Noise	+
	Weather and Heat	+
	Dirt	-
	Hazardous Materials	-
King 1974	Job Insecurity	+*
Lucas 1977	Repetitive Work	+*
	Physical Strength Required	-*
	Bad Working Conditions	+*
	Supervise Workers	+*
Quinn 1975	Working Under Stress	+*
	Other Physical Demands	-
	Bad Working Conditions	+
Thaler-Rosen 1975	Deaths per 1000 manyears	+*

Smith 1973	Deaths per 1000 manyears	+ *
	Lost workyears per 1000 manyears	- *
Viscusi 1978	Fast Paced Job	+ *
	Lack of Freedom (supervision)	-
	Job Insecurity	- *
	Supervise Workers	+ *

* Estimated coefficient is at least twice its standard error
+, - Effect of variable on compensation

Sources: see Bibliography

As noted, the results are quite inconsistent across studies. Specifically, Lucas (1977) found evidence of significant compensation for repetitive work, while Brown (1980) found the coefficent to be negative and significantly different from zero. The same result occurred with compensation for bad working conditions, with Lucas (1977) finding a positive and significant coefficient, as expected, and Brown (1980) obtaining a negative and significant coefficient. Bluestone's (1974) findings with respect to bad working conditions are comparable to Brown's (1980), while Quinn (1975) and Hammermesh (1977) find positive, but insignificant coefficents.

Jobs requiring physical movements and/or strength were found to command lower wages in the papers by Lucas (1977) and Bluestone (1974). Other authors also failed to find compensation for having a job that requires physical strength, but their coefficients were insignificant.

Smith (1973) found that "the probability of [work-related] death may be fully reflected in wage rates, but evidence of compensating differentials related to

nonfatal injuries is scant"(9). The results obtained by Thaler and Rosen (1975) reflect that occupation-specific mortality rates do exert a positive influence on wage levels .

Supervising workers is found to be compensated by higher wages by both Lucas (1977) and Viscusi (1978). This variable reflects an important issue surrounding the equalizing wage differential theory: which job characteristics are disagreeable? and, are they disagreeable for all?, at the margin?. A problem often cited as a major cause for inconclusive results is that " whether jobs that are physical, repetitious, or have little freedom, for example, are unpleasant to the marginal worker (other things equal) is highly uncertain. Therefore, tests of the theory using these characteristics must necessarily be inconclusive " (10). A productive compromise is to determine a-priori which characteristics are agreeable and disagreeable and why, and then try to infer any underlying behavioural pattern from the results of those characteristics whose 'sign' is less obvious.

The results of previous work on the effects of job characteristics on workers' compensation are based on hedonics with little or no control over personal characteristics. Overall, empirical results show some support for the theory of equalizing wage differentials, but a number of studies find unexpected signs and lack of statistical significance. The most common explanation found in papers that have failed to find support for the theory is the omission of key variables that affect productivity. The omission of key variables biases coefficients that have been estimated using a hedonic model that assumes control over all variables that determine workers' supply schedules and firms' labor demand.

Only a small number of previous papers have been able to combine personal and job characteristics. An important constraint in building a comprehensive data base has been lack of access to personnel information from individual firms. Lack of intra-firm data with direct measurements of job characteristics and lack of a complete set of personal characteristics has resulted in the unsatisfactory empirical conclusions found in previous works.

By omitting information on workers' personal characteristics, past studies implicitly assume that the personal characteristics of the workers are not correlated at all with the individual's taste for any given job characteristic. Although some personal characteristics have been accounted for in these studies--eg. sex and age, their inclusion has taken the form of a segmentation of the sample in order to homogenize the trait. That is, estimates were obtained for: only males, only males between the ages of X and Y, etc. Given that tastes for job characteristics need not be homogeneous across all labor groups, a weakness of previous work is their attempt to reach general conclusions based on subsamples that are not necessarily representative of the universe. By controlling for personal characteristics, in contrast, potential biases in the job characteristics estimates will be reduced.

We do not assume that tastes are homogeneous across labor groups. In fact, the latter chapters of this study test for differential compensation practices across sex groups. In the Appendices of this study we present the results of estimating the traditional wage hedonics without controlling for the worker's personal characteristics. These tables clearly show that the omission of personal

characteristics biases the coefficients of the job characteristics. Although the sign and significance of most variables remains the same across models, the magnitude of the coefficients is altered significantly when we omit information on personal characteristics.

Our models control for the personal characteristics of workers by including them as explanatory variables in the wage hedonic. This enhanced information set allows us to identify differential compensation for specific job characteristics across labor groups. Once differential compensations are identified, one can study the nature of the job characteristic in order to determine whether it is reasonable to assume that the like or dislike for the task varies across labor groups. Complementing our personal characteristic data, we utilize a unique and quite comprehensive data set of job characteristics.

Almost all the data on job characteristics used in previous studies fall into one of two types: the first is based on the Dictionary of Occupational Titles (DOT) and was first engineered by Lucas (1974):

> The ideal source of data on individual people would report DOT occupation and personal characteristics for each person. ...In the absence of such an ideal survey, the source chosen here is the *Survey of Economic Opportunity* (SEO) for 1967. The SEO reports the Detailed Census Occupation of each adult, and this fact provides the vital link for this paper, **for a method has to be devised for discovering each adult's job characteristics.**
> Fortunately, there exists a census/DOT occupational conversion matrix, which is derived by cross-classifying the occupations of 35,000 households surveyed by the Bureau of the Census for the Current Population Survey in October 1966 (CPS 66). The

> proximity of the dates of this survey and the SEO is a fortunate coincidence. The result is a matrix giving the number of people in each cross-classification cell. **From this matrix it is possible to calculate the probabilities of having each of the DOT occupations given census occupation, and hence expected job characteristic values can be assigned to each adult.**" (11)

In short, the score for each occupation represents the probability that a randomly selected individual in that 3-digit occupation has the given job characteristic.

An immediate complication arises with the use of these data. The methodology of matching average job characteristics and individuals who may or may not have jobs with those job characteristics introduces an errors-in-variables problem that results in biases of the coefficients estimated from the wage hedonic. These potential biases can be an important cause for the inconclusive results reported by previous studies. Direct observation of job characteristics eliminates the errors-in-variables difficulties that arise with the traditional methodology described above.

The second type of data used is based on **self -reported,** individual-specific job characteristics. Duncan (1976), Hammermesh (1978) and Viscusi (1978) all used the 1969-70 Survey of Working Conditions and the 1972-73 Quality of Employment Survey which contain self-reported qualitative job characteristic measures.

The problems with these data have been very clearly summarized by Smith (1979),

> "While the data on job characteristics in the above samples are individual specific they may suffer from a lack of comparability across individuals because of their subjectivity. Workers dissatisfied with their jobs (perhaps because of relatively low pay) may report the existence of disagreeable characteristics more satisfied workers may not report...Similarly, workers' social background or their degree of aversion to risk may affect their perception of (say) hazards such that subjective and objective measures of job dangers will not correspond across a given sample" (12)

The major faults of both data sets presented above do not represent a constraint in our model , as we use directly observed and homogeneously measured job characteristics. We eliminate potential biases caused by measurement errors and omitted variables by observing every worker in his job and matching actual job characteristics -- not average-- to personal characteristics. Our results, however, can be compared to those of previous research since preceding authors have implicitly assumed that job characteristics are homogeneous across firms, even though their sample is from many different industries and firms. We will demonstrate that aggregation of job characteristics across firms is not a condition that can be assumed before testing for the equalizing wage differential theory. On the contrary, succesful testing of the theory is conditional on homogeneity of job characteristics across firms, a condition that must be imposed, rather than assumed, by directly observing the workers' tasks.

Model and Results

This section presents the results of estimating the traditional wage hedonic model used to test the equalizing wage differential theory . We regress the logarithm of the hourly wage earned by each worker on the measured personal and job characteristics. The coefficients of this semi-log function represent the percentage change in the hourly wage that follows variations in the level of the independent variable. The model is of the form:

(1.1) LHW = f (P, JC)

LHW = log of hourly wage

P = vector of personal characteristics

JC = vector of job characteristics

Specifically,

(1.2) LHW = a0 + a1*P1 + . . . + an*Pn + b1*JC1 + . . . + bm*JCm + e

As explained earlier, the coefficient estimates obtained from this hedonic represent the 'shadow price' of each job charcteristic, and the rate of return for personal characteristics.

Later in this chapter we extend the traditional model by allowing for the influence of point grade information on wages. Estimates of the traditional model are presented as a way to emphasize the advantanges of including the additional information.

Job characteristics can be viewed as activities that affect worker's satisfaction with their jobs (13). Not all job characteristics are obviously a 'good', or a 'bad'. Analyzing the results of estimating a wage hedonic by focusing on the expected

signs of the job characteristic coefficients is meaningful only in cases where the effect of the job charcteristic on worker's utility is known a-priori. Our data include job characteristics for which the impact on utility is unambigous, as well as some whose effect on the workers' satisfaction is uncertain or may vary across labor groups. The presentation of our results carefully describes the nature of the job characteristics and discusses the validity of having an a-priori expected sign for their coefficients.

Tables 1.2, 1.3 and 1.4 present the results of estimating equation 1.2 for organizatons 1, 2 and 3 respectivley (14). The detailed description of the data is found in Tables A. I and A. II below and in the Appendices of the study. The levels of variables 'financial responsibility,' 'data,' and 'things' are inversely related to the complexity and/or degree of the variable. That is, negative coefficients are expected from these variables. The same holds for variable 'supervision received' in organization 2. The interpretation of the sign of all other coefficients is straightforward.

The initial hypothesis to be tested is that job characteristics have important wage effects over and above the effects of human capital. Formally; we cannot accept, with a 1 percent significance level, the null hypothesis stating that job characteristics, **jointly**, do not have important wage effects (15).

TABLE A. I

JOB CHARACTERISTICS

ORGANIZATIONS 1 & 3

VARIABLE	CODE
1. Financial Responsibility (degree)	1 = primary 2 = secondary 3 = tertiary 4 = none
2. Data	0 = synthesizing 1 = coordinating 2 = analyzing 3 = compiling 4 = computing 5 = copying 6 = comparing
3. Things	0 = setting up 1 = precision work 2 = operating-controlling 3 = driving-operating 4 = manipulating 5 = tending 6 = feeding-offbearing 7 = handling
4. Supervision Given	1 = infrequent 2 = frequent 3 = continuous
5. Personal Contact Within the Workplace	1 = infrequent 2 = frequent 3 = continuous
6. Personal Contact Outside the Workplace	1 = infrequent 2 = frequent 3 = continuous
7. Working Conditions (stress, repetitiveness)	0 = no 1 = yes

8. Physical Environment	0 = average 1 = unpleasant
9. Financial Responsibility (amount)	dollars
10. Required Education	years
11. Required Experience	years
12. Vocational Training	years
13. Part Time	0 = no 1 = yes
14. People	0 = mentoring 1 = negotiating 2 = instructing 3 = supervising 4 = diverting 5 = persuading 6 = speaking-signaling 7 = serving 8 = taking instructions-helping

TABLE A. II

JOB CHARACTERISTICS

ORGANIZATION 2

Job characteristics from organization 2 are divided into two groups: the first contains variables that were measured directly by the analysts. They include:

1. Required Education (P46)
   - 0 = none
   - 1 = some high school
   - 2 = high school
   - 3 = some college
   - 4 = college
   - 5 = graduate degree

2. Job Related Experience (P47)
   - 0 = none
   - 1 = less than one month
   - 2 = 1 to 12 months
   - 3 = 1 to 3 years
   - 4 = 3 to 5 years
   - 5 = over 5 years

3. Supervision Given (P130)
   - 0 = none
   - 1 = ten or fewer workers
   - 2 = 11 to 50 workers
   - 3 = 51 to 250 workers
   - 4 = 251 to 750 workers
   - 5 = 751 or more workers

4. Supervision Received (P134)
   - 1 = immediate supervision
   - 2 = general supervision
   - 3 = general direction
   - 4 = nominal direction
   - 5 = no supervision

The second group of job characteristics in organization 2 are job dimension scores based on the results of factor analysis (in particular, principal components). Items which frequently receive similar or correlated ratings are grouped together to form a job dimension. All scores are normalized and range from -2.50 to 2.50 , with 0 being representative of a 'population average' level . The job dimensions used in our analysis are:

5. Stressful/ Unpleasant Environment (D22) Formed from: air contamination, dirty environment, high temperature, noise intensity, vibration, improper illumination, low temperature.

6. Activities Requiring Body Movements (D10) Formed from: kneeling/stooping, standing, walking/running, climbing, balancing, level of physical exertion, long handle tools.

7. Existence of Hazardous Job Situations (D24) Formed from: temporary disability, permanent partial impairment, permanent total disability/death, first aid cases, out-of-door environment

8. Structured/ Repetitive Work (D31) Formed from: repetitive activities, following set procedures, specified work pace, cycled work activities, job structure

TABLE 1.2

WAGE HEDONIC

ORGANIZATION 1

Dependent Variable : Log of Hourly Wages
Model : LHW = f (P, JC)
N = 784

VARIABLE	COEFFICIENT
Intercept	1.693 * (15.04)
Age	.019 * (5.96)
Age-square	-.0002 * (6.08)
Education (years)	.006 * (2.89)
Seniority (months)	.0008 * (8.76)
Marital Status	-.035 * (2.21)
Sex	-.127 * (8.39)
Race	-.032 (1.87)
Financial Responsibility	-.076 * (6.30)
Data	-.029 * (5.07)
Things	-.023 * (4.65)
Supervision Given	.029 * (2.61)
Public Contact Within Organization	.041 * (3.50)
Public Contact Outside of Organizaton	.039 * (2.78)
Working Conditions (stress, repetitiveness)	.016 (0.85)
Physical Environment	-.049 (1.82)
Monetary Sum of Financial Responsibility	.7E-7 * (3.75)
Required Education	.022 * (11.83)
Required Experience	.027 * (5.97)
Part Time	-.056 * (3.26)
Vocational Training	.036 * (4.42)

R2 = . 82
* = significant at 5 percent
() = absolute value of t-statistic
(@)= For a description of the measurements please see the Appendices at the end of the study.

TABLE 1.3

WAGE HEDONIC

ORGANIZATION 2

Dependent Variable : Log of Hourly Wages
Model LHW = f (P, JC)
n = 171

VARIABLE	COEFFICIENT	
Intercept	1.080 *	(9.50)
Age	.020 *	(4.33)
Age-square	-.0002 *	(4.22)
Education (years)	.007 *	(2.42)
Seniority (months)	.001 *	(7.46)
Marital Status	-.028	(1.25)
Sex	-.113 *	(3.43)
Race	-.089 *	(3.26)
Supervision Given	.089 *	(4.60)
Stressful/Unpleasant Environment	-.014	(0.66)
Activities Requiring Body Movements	-.046 *	(2.86)
Existence of Hazardous Job Situations	.049 *	(3.00)
Structured, Repetitive Work	.102 *	(3.68)
Required Education	.076 *	(3.33)
Required Experience	.040 *	(3.58)
Supervision Received	.136 *	(5.36)

R2 = .85
* = significant at 5 percent
() = absolute value of t-statistic

TABLE 1 . 4

WAGE HEDONIC

ORGANIZATION 3

Dependent Variable : Log of Hourly Wages
Model: LHW = f (P, JC)
n = 337

VARIABLE	COEFFICIENT		
Intercept	1.463	*	(11.76)
Sex	.009		(0.96)
Race	-.040	*	(2.98)
Seniority	.0006	*	(4.22)
Financial Responsibility	-.012		(0.90)
Data	-.051	*	(5.57)
Things	-.018	*	(3.28)
Supervision Given	.022	*	(1.50)
Public Contact Within Organization	.100	*	(7.97)
Public Contact Outside of Organization	-.039	*	(2.30)
Working Conditions (stress, repetitiveness)	.050		(1.90)
Physical Environment	.068	*	(2.04)
Required Education	.052	*	(11.03)
Required Experience	.031	*	(5.04)
Vocational Training	.152	*	(5.11)

R2 = .77
* = significant at 5 percent
() = absolute value of t-statistic

Table 1.5 estimates equation 1.2 for a merged sample of organization 1 and organization 3. The model includes a dummy variable to control for industry differences (16).

TABLE 1.5

WAGE HEDONIC

ORGANIZATIONS 1 & 3

Dependent Variable : Log of Hourly Wages
Model: LHW = f (P, JC)
n = 1114

VARIABLE	COEFFICIENT	
Intercept	2.245 *	(35.35)
Industry dummy **	-.036 *	(2.57)
Sex	-.074 *	(6.07)
Race	-.033 *	(2.64)
Seniority	.0007 *	(11.22)
Financial Responsibility	-.088 *	(9.52)
Data	-.041 *	(8.20)
Things	-.033 *	(8.58)
Supervision Given	.021 *	(2.27)
Public Contact Within Organization	.060 *	(7.34)
Public Contact Outside of Organization	.013	(1.31)
Working Conditions (stress, repetitiveness)	..027	(1.85)
Physical Environment	-.021	(1.03)
Required Education	.026 *	(16.19)
Required Experience	.033 *	(9.02)
Vocational Training	.113 *	(4.55)

R2 = .79
* = significant at 5 percent
** = dummy equals 1 for organization 3 and 0 for organizaton 1
() = absolute value of t-statistic

Tables 1.2 - 1.4 present results that support the theoretical outcomes of the equalizing wage differential theory. All statistically significant variables, except body movements in organization 2, are of the expected sign. Specifically: having financial responsibilities; manipulating complex data; working with tools; supervising workers and not receiving strict supervision; working under stressful and/or repetitive conditions ; working in unpleasant physical environments; managing higher budgets; working full time; having vocational training, higher education and experience and; being in jobs with potential hazards, all command compensating wage premiums.

This support for the compensating wage differential theory includes several variables that have not been tested previously. Namely, financial responsibility, budget size, contacts within and outside the firm, and vocational training. Also, our inclusion of required education and required experience as explanatory variables enhances the importance of finding statistical significance in many variables that are commonly believed to be highly correlated with education and experience.

Previous work found inconsistent results regarding several job characteristics, among them; unpleasant physical conditions, repetitiveness and stressful tasks, hazardous situations, and, receiving supervision. Our results show that the existence of all the aforementioned job characteristics is compensated with a wage premium. In the case of unpleasant physical conditions we find that the coefficient is negative, but insignificant, for two of the organizations. For the third organization, however, this coefficient is of the

expected sign and significantly different from zero. The explanation for the insignificance and unexpected sign of physical condition's coefficient is that it is highly correlated with variable ' things.' which is of the expected sign and highly significant.

In what follows we present a detailed description of our results. We begin by studying each organization individually, and in the latter part of this section we compare results across organizations.

Organization 1 has 784 workers distributed in over 280 jobs. The range of jobs under study is extremely wide as it includes from top-level executives to service workers. The educational range of the sample is also quite varied as the staff of the institution includes workers without high school education as well as professionals with master and doctoral degrees.

The resuts presented in Table 1.2 indicate that most of the job characteristics , **when taken individually**, are significant determinants of wage levels.

Having financial reponsibilities is rewarded with a 7.6 percent wage differential (the levels of this variable are inversely related to the degree of financial responisibility) . In addition to having a reward for engaging in activities where financial responsibilities are needed, there is also a reward related to the amount of money for which a worker is responsible. This result is reflected by the significant coefficient for variable M--7 percent wage premium for every million dollar increase in the budget. Considering that the model has taken into account the educational level and experience required for the job, this result underlies the importance of having jobs which involve opportunities to handle

money. There is a net wage benefit from having financial responsibilities. An important corrollary to this finding (addressed in depth in Chapter II) is that there might be something inherent in jobs that require financial responsibilites that repels certain labor groups or that increases the potential barriers faced by certain labor groups in their attempt to reach those positions.

Higher wages are for those positions involving more complex levels of data manipulation. A worker whose job requires the comparison of data (i.e. levels of stock, temperatures, etc.) will receive a 11.6% lower wage than a worker whose job requires analyzing data (i.e. studying gathered information to provide alternative solutions and/or explanations to observed phenomena). As with financial responsibility, this result is important for it is obtained after we have controlled for education, experience, etc. There are certain jobs that lead workers to engage themselves in tasks that are better remunerated than others. Again, it is important to understand the nature of these jobs in order to see what it is about them that might make them unattractive to certain workers. Only through these exercises will analysts be able to infer the structure of different job characteristic shadow prices (i. e. supply, demand or institutional).

Working with tools, machinery and equipment is substantially rewarded in organization 1. The wage differential between a worker who handles only 'everyday' objects (i.e. the minimum found in any job) and one who operates and controls machinery is of 11.5 percent. This result supports the findings of Duncan-Stafford (1977) who found a significant reward for working with tools and equipment. While we have found rewards for working with tools and equipment,

we have not been able to do so for work that requires an unpleasant working environment. Our model shows a 5 percent penalty for working in unpleasant environments. This variable reflects the existence of extreme temperatures, dust, noise, etc. Quinn (1975), Lucas (1977) and Hammermesh (1977) all found premiums for jobs requiring unpleasant conditions, while Brown (1980) and Bluestone (1974) found the opposite. Our results indicate that there are no rewards for working in an unpleasant environment, however, as evidenced by the fact that the coefficient is insignificant and by the results of omitting the variable 'things' from the model, we do not consider them conclusive (17). Rather, an improved measure of this variable must be constructed eliminating its possible correlation with other job characteristics.

Supervising workers is rewarded with a 3 percent wage differential. The wage differential between the two extreme cases , no supervision and continuous supervision (i.e. laborer and foreman) is 6 percent, confirming the findings of Viscusi (1978) and Lucas (1977). Jobs that are equal in their educational and experience requirements will command different wages, other things equal, if they have different supervisory requirements. Jobs where contact with others and responsibility for their actions is important will command higher wages than jobs in which independence is a predominant characteristic.

We have measured two different variables that reflect the amount of non-supervisory personal contact that workers have in their job. The measurements are the result of dividing overall personal relationships into contact within the firm and contact outside the firm. These two types of business

relationships are of very different nature: contacts within the firm tend to be informal for jobs in which there is no explicit 'group' participation or jobs in which lines of authority are not clear. Examples of group participation are general projects in which work is divided into several parts all of which are independent of each other for their internal operation but highly interdependent for their timing. A second example is services provided by medical institutions in which contact between members of the 'group' (doctors, nurses, etc) is indispensable. Contacts outside the firm are, on the other hand, mostly formal in nature. A firm will not engage itself in outside contacts for reasons other than business-related issues (18)

.

Larger amounts of public contact within and outside the firm are rewarded with wage premiums in organization 1. Both coefficients are significant and represent an 8.2 percent and 7.8 percent wage differential in favor of workers who do engage in public contacts within and outside the organization, respectively.

Working under stress or in a repetitive job is a characteristic that Quinn (1975) and Lucas (1977) found to be rewarded with higher wages. Brown (1980), on the other hand, found that employees holding jobs with repetitive tasks were penalized with lower wages. All coefficients regarding stress and repetitive tasks were found to be significant in previous work, with the exception of Brown's (1980) result regarding stress -- he finds a reward for stressful environments that is not significantly different from zero. Our results confirm the finding that workers under stress or in repetitive jobs are compensated with higher wages. The 1.6 percent wage differential, however, is not significantly different from zero.

There is a wage premium for being in jobs with high educational requirements. A worker in a job that requires a masters degree will receive a 13.2 percent differential over the wage received by a worker in a job that requires only high school. This result is compounded by the fact that required experience is also , and more strongly, compensated by the organization. Each additional year of job-related required experience represents a 2.7 percent differential for the worker. We must note, additionally, that this is independent of the seniority and the actual education that the individual worker might have. It is the education and experience required by the job that are reflectedby these coefficients, not the actual levels acquired by the workers .

If we add the effects of the actual levels of education and experience that the workers have to those required by the job we obtain the following results for organization 1: Each year of education represents a 2.8 percent wage differential . and each year of experience (for the moment assume that workers stay in the same job within the firm) represents a 3.5 percent wage differential.

The results of our model show that there are costs associated with intermittent labor market participation. Additionally, workers in part-time jobs receive a penalty representing a 5.6 percent wage differential.

In an effort to distinguish between formal academic education and specific vocational training, we created a variable aimed at capturing the relevance of vocational skills in the determination of wages. The results indicate that workers with vocational skills earn a 3.6 percent wage premium over workers without the specialized training. This result is useful in understanding the wage gap between

sexes, as it is a fact that females do not, in general, form part of the skilled-craft labor force.

To summarize, in organization 1 we find that job characteristics are important determinants of wage variations when considered jointly as well as when tested individually. Specifically, only the coefficients of variables 'working conditions' and 'physical environment' were insignificant and only the coefficient for 'physical environment' had an unexpected sign. We argued earlier that this could be due to the correlation between this variable and variable 'things.' Our overall results for organization 1 support the equalizing wage differential theory since we find that extra skills and unpleasant tasks command higher wages. In addition, we have disclosed a set of tasks that command wage premiums which will later be useful in determining the nature of job characteristics for the study of potential heterogeneity in tastes across genders. Our model is capable of explaining 82 percent of the variation in wages observed in organization 1.

Job characteristic data gathered for organization 2 are based on the PAQ. Athough the standardization technique used in PAQ does not allow to test for stability of job characteristcs across organizations, the variables we selected do permit qualitative comparisons of our results with previous work and with the other two organizations under study.

Jobs that require supervising workers are, as with organization 1 and all previous work, compensated with a wage premium--close to 9 percent. Receiving supervision, on the other hand, is severely penalized with a 13.6 percent lower wage. Highly structured and/or repetitive tasks are rewarded with a 10.2 percent

wage differential. This last result contradicts the findings of Brown (1980) (with respect to repetitiveness) , but supports the results of Lucas (1977), Viscusi (1978), Quinn (1975) and the results of this study for organization 1.

Activities requiring body movements are penalized with a 4. 6 percent differential, confirming the findings of Bluestone (1974), Brown (1980) and Lucas (1977). The results coefficient estimated by Brown (1980) , however, was not statistically significantly different from zero. Interpretation of the persistent finding of a perhaps unexpected result leads us to suggest that physically demanding jobs are not, on the margin, less desirable than sedentary jobs.

As in organization 1, unpleasant working conditons are not compensated for with higher wages. In organization 2, workers whose jobs are under unpleasant conditions receive, on average, a 1. 4 percent wage penalty. The coefficient, however, is statistically not significantly different from zero.

Thaler and Rosen (1975) and Smith (1973) have found that risk of death plays a very important role in the determination of compensation packages demanded by workers and unions and offered by firms. Our results for organization 2 confirm this result and show that, on average, the existence of hazardous job situations commands higher wages .

Required education and required experience represent a 7. 6 percent and 4 percent wage differential, respectively. Including actual experience and educational levels shows that each additional year of education commands an 8. 3 percent differential and each additional year of experience calls for a 5. 2 percent premium.

To summarize: supervising workers; being in jobs that could be hazardous; having a structured or repetitive job; being in highly skilled jobs, and/ or jobs that require experience; and, not receiving supervision are all characteristics that command wage premiums. All variables except 'unpleasant environment' are significant and of the expected sign. Our model is capable of explaining 85 percent of the variation in wages in organization 2.

All job characteristic coefficients from the model estimated for organization 3, with the exception of 'public contact outside the organization' were of the expected sign. Having financial responsibilities is rewarded with higher wages. The coefficient is statistically insignificant, however, reflecting the fact that there is little variation in the observed levels of financial responsibilities within our sample of 377 workers . Nevertheless, the coefficient of financial responsibility, is very similar to the one found for organization 1.

Jobs requiring data analysis and/or coordination of events command substantive wage premiums. A worker engaged in comparing data will receive, on average, a 20 percent wage penalty with respect to the worker that analyzes data. This significant differential found in organization 3 can be attributed to the character of the sample. In organization 1 the universe included all levels of data usage, whereas in the case of organization 3 not all jobs in the organization are represented (19). This observation is confirmed below when we test for stability for the individual job characteristics across organizations 1 and 3.

Working with tools, machinery and/or equipment represents a wage premium

of approximately 2 percent per level of 'tool use'. That is, a worker who handles objects in a 'white-collar' fashion will receive a 12 percent lower wage than one who does precision work utilizing tools, equipment, or any kind of machinery. This differential is comparable to the 13.8 percent differential found in organization 1.

A major difference in our results across organizations occurs with the public contact variables. While organization 1 rewards public contact within and outside of the firm in a similar way, organization 3 rewards contact within the firm very strongly--10 percent per level--and penalizes contact outside the organization with a 4 percent wage differential (20). The explanation of these results rests in the different needs of both organizations regarding public contacts outside of the organization. Also, the sample we have from organization 3 is skewed toward jobs where external contacts are mostly of a clerical type. A significant portion of the revenues of organization 1 stem from public contributions which are based, to a great extent, on the persuasive skills of the internal 'negotiators.' On the other hand, organization 3 is a less- exposed, smaller, public organization where revenues stem from a wealthy state source (21).

In summary, the inconsistent results obtained across organizations 1 and 3 for the public contact variables brings out the importance of having firm specific data. The job characteristics used in empirical studies must be homogeneous across firms in order to justify the merging of workers from different industries and firms.

When previous researchers used a sample consisting of several different industries and firms they assumed homogeneity of job characteristics across industries. This assumption allows us to compare our results with theirs, but it is also this assumption that leads to a mispecification of their models. Many job characteristics are firm-specific and consistency of the equalizing wage differential theory must be tested under this assumption.

The results on compensating wage differentials for jobs that entail stressful and/or repetitive tasks support the findings of Lucas (1977) and Quinn (1975), as well as our findings for organizations 1 and 2. In organization 3, jobs that require workers to engage themselves in stressful and/or repetitive tasks receive a 5 percent wage compensation. The consistent results obtained by previous researchers and in the present study for job stress confirm that this job characteristics is disagreeable to the marginal worker across all types of firms.

Results regarding required education, experience and vocational training indicate that all of these job characteristics receive compensating wage differentials . Specifically, each additional year of education required in a job is compensated with a 5 percent premium, almost 3.3 percent per year more than in organization 1. Required education is a variable that also highlights the importance of firm-specific data: although required education is a homogeneous characteristic across firms in terms of its measurement, it is not necessarily homogeneous with respect its firm-specific value. In our sample from organization 3 the mean educational requirement is 13.8 years, whereas in organization 1 it is 9

years. The character of our firms has affected the value of our coefficients. Required experience and vocational training command a 3. 1 percent and 15. 1 percent wage premiums respectively.

The magnitude and significance level of a majority of the job characteristic coefficients included in our model underlies a serious problem usually encountered with empirical studies that concentrate on very few job characteristics: biases due to significant omitted variables that are correlated with the modeled set of explanatory variables.

Previous research, as shown earlier, has concentrated on only a few variables. The reasons for this limited data are lack of reliable information and concern over the ambiguity of the variable with respect to its contribution to utility (i. e. is the job characteristic really a 'bad'). Regardless of the reason, omission of significant explanatory variables will bias the coefficients of variables that are included if there is a correlation between them. The very nature of job characteristics practically ensures that there will be a correlation between the tasks workers do in their jobs (i. e. one cannot expect many instances in which a job that requires indoor tasks with pleasant working conditions has high probability of death).

The job characteristics we have chosen are by no means comprehensive , but they do include a few previously omitted variables that have been shown to be significant and whose omission has biased previous empirical results. The most significant cases are Required Education, Required Experience, Financial Responsibilities , Supervisory tasks, and Verbal Communication (contact within

and outside of the organization). They reflect core tasks or constraints that color the whole nature of the job, thereby, influencing the relative supply of workers and affecting the wage rate . Their omission can severly hinder results unless biases are made explicit and the sign of the correlation is known.

In order to test the equalizing wage differential theory across firms, we merged the data from organization 1 and organization 3. The results of estimating the single wage hedonic model are presented in Table 1.5 .

To verify the stability of job characteristic coefficients across firms we performed two tests: first, all job characteristics were tested jointly ; second, each job characteristic was tested individually. The results of both tests confirm the hypothesis presented above. That is, although the relevance of certain job characteristics in the determination of wages is homogeneous across firms, it is by no means generalizable to all job characteristics (22). Table 1.6 summarizes the results of stability tests across organizations.

TABLE 1.6

STABILITY TESTS ACROSS ORGANIZATIONS

VARIABLE	t-statistic
All Job Characteristics Jointly	7.43
Financial Responsibility	2.07
Data	1.47 *
Things	0.57 *
Supervision Given	3.03
Public Contact Within Organization	4.65
Public Contact Outside of Organization	5.54
Working Conditions (stress,. repetitiveness)	1.77 *
Physical Environment	1.32 *
Required Education	3.87
Required Experience	1.01 *
Vocational Training	2.65

* significant at 5 percent

Our results confirm the fact that several job characteristics that were considered homogeneous (at least in the assignment of job characteristic names) across firms, actually have varying relevance, proxied by their shadow price, depending on the nature of the firm or industry (23).

The marginal significance level of job characteristics that are relatively easier to identify a-priori as agreeable or disagreeable is higher (approximating significance at 5 percent) than that of job characteristics which, in our samples, have presented ambiguity in their interpretation.

Overall, results from the three organizations show consistent support for the theory of equalizing wage differentials relative to previous work. Our results can be

explained by our use of intra-firm data and the availability of a broader set of job characteristics.

Another important weakness found in previous work has been the omission of point-grade information, a tool that has been widely used in organizations throughout the United States in the determination of their compensation policies. Ignoring these systems in the study of compensation practices has created potential statistical biases and inefficiencies that may have contributed to the inconclusive empirical results found to date.

Grading Systems

MODEL

Grading systems have been widely used in private and public sector firms for years. They were originally implemented to introduce a systematized job structure to the organization, standardizing salary administration policies and establishing a basis for placement and promotion.

Earlier we explained how personnel administrators and consulting firms obtain the point-grades that are later used to set the wage structure of the firm (24). In the first stage of job analysis one assigns points to all the elements of a job. This is formally represented by

(1.1) $GRDi = f(JCi)$

(1.2) $GRDi = a0 + a1JCi1 + \ldots + anJCin + e$

where GRD is the point grade , JC is the vector of job characteristics of job i, and

e is the error term of the equation. The second stage of the analysis requires the estimation of a wage-grade line in order to conform to market realities. This is done by estimating

(1.3) $LHWj = f(Pj, GRDij)$

(1.4) $LHW = b0 + b1Pj1 + \ldots + bmPjm + b(m+1)GRDij + \mu$

where P is a vector of personal charcteristics of worker j that affect wages. μ is the error term of the equation.

Using the theoretical and practical roles of point-grades in the determination of wages we construct a model to estimate the shadow prices of job characteristics which incorporates information on the actual way in which firms determine their compensation policies. The model reduces potential biases and inefficiencies generated by the omission of point-grade information, enhancing our ability to test for compensating wage differentials. The model is of the following form:

(1.5) $GRDi = f(JCi)$

$LHWj = g(Pj, GRDij)$

with both equations estimated using joint generalized least squares.

To our knowledge, no previous work on compensating wage differentials has included (in theory or empirically) information on the grading system used by the firms under study (25).

As described earlier, if the role of grading systems is to attract, retain, and motivate workers, it is necessarily the case that point-grades are assigned with certain considerations about the relative value of each job in the market .

We have information on two alternative grading systems for which the data was collected by direct observation. The PAQ method explicitly recognizes the prominence of market wages in the determination of their total points. Points are calculated using a set of job dimension weights that have been estimated for thousands of jobs across the country.

Total points in the second method, however, are calculated without reference to market wages. This has led many observers to believe that it is therefore an unbiased index of 'worth'. In Chapter III, we test whether grading in the second sytem is in fact unbiased, given that analysts can assign points freely following any weight structure. Since wages are influenced by grades and by the market, and grades, in turn, might also be affected by market wages, our model allows us to obtain a seemingly unrelated equation system estimator that is more efficient than the one obtained from the reduced form wage hedonic. Increased efficiency will result if analysts bias the grades toward the market, causing the error terms in both equations to be correlated as they will both contain market wage information.

We have estimated each one of the equations presented above both individually and as a system of equations for organizations 1 and 3 (26). Additionally, for organization 2 we have tested for the effects of using the grading system to make the wage structure more competitive. The following subsection presents our results.

RESULTS

Table 1.7 presents the results of estimating points based on the job characteristics we have selected. The measured job characteristics explain about 80 percent of the variance of the total point variable used by the private consulting firm that designed the wage policy of organizations 1 and 3 (27). The relevance of job characteristics in the determination of points was formally tested for all the characteristcics jointly as well as separately (28): We cannot accept the null hypothesis, for any of the organizations under study, that job characteristics are not significant in the determination of grades. Individual characteristics are also significant. Except for a few cases, such as 'working conditions' and 'physical environment' for organization 1, or 'supervision' and 'public contact outside of organization' for firm 3, all job characteristics are relevant in the determination of grades.

TABLE 1 . 7

GRADE EQUATIONS

ORGANIZATIONS 1 , 3 AND MERGED SAMPLE

DEPENDENT VARIABLE: Grade
MODEL: GRD = f (JC)

ORGANIZATION:	1	3	MERGED
F	277.87	103.57	300.79
VARIABLES			
Intercept	309.79 * (12.90)	-93.85 * (2.39)	336.85 * (21.13)
Industry dummy	n. n.	n. n.	-90.97 * (19.28)
Financial Responsibility	-31.30 * (8.35)	-14.94 * (3.27)	-38.55 * (12.68)
Data	-11.68 * (6.45)	-13.28 * (4.42)	-13.17 * (7.83)
Things	-8.14 * (5.12)	-4.22 * (2.37)	-7.08 * (5.42)
Supervision Given	17.58 * (4.93)	-1.83 (0.38)	10.70 * (3.35)
Contact Within Org.	9.15 * (2.41)	14.58 * (3.60)	-0.74 (0.26)
Contact Outside Org.	9.64 * (2.15)	-7.44 (1.35)	11.50 * (3.27)
Working Conditions	6.99 (1.16)	16.36 (1.90)	0.44 (0.08)
Physical Environment	7.85 (0.92)	59.71 * (5.56)	25.58 * (3.45)
Monetary Resp.(level)	.5E-4 * (7.74)	n. a.	n. a.
Required Education	8.45 * (14.87)	28.99 * (19.49)	10.64 * (20.38)
Required Experience	13.86 * (9.58)	10.39 * (5.23)	14.55 * (11.82)
Part Time	-17.28 * (3.14)	n. a.	n. a.
Vocational Training	5.69 * (2.20)	27.21 * (2.87)	14.55 (1.75)
R-square	.82	.77	.76
Mean Grade	265	240	257

n. n. = not necessary
n. a. = not available
* = significant at 5 percent
() = absolute value of t-statistic

Table 1.8 below presents the results of estimating equation 1.5 : the effect that grades have on wages.

TABLE 1.8

WAGE-GRADE LINES

ORGANIZATIONS 1, 3 AND MERGED SAMPLE

DEPENDENT VARIABLE: Log of Hourly Wages
MODEL: LHW = f (P, GRD) (@)

ORGANIZATION	1	3	MERGE
VARIABLE			
Intercept	1.116 *(20.15)	1.678 * (51.41)	1.319 * (83.79)
Industry dummy	n. n.	n. n.	.252 * (28.05)
Age	.008 * (3.73)	n. a.	n. a.
Age squared	- .0001* (3.87)	n. a.	n. a.
Education	.001 (0.75)	n. a.	n. a.
Seniority	.0005* (8.45)	.001 * (4.88)	.0005* (10.7)
Marital Status	- .012 (1.06)	n. a.	n. a.
Sex	- .030 * (2.95)	- .046 * (3.93)	- .474 * (5.65)
Race	- .002 * (4.11)	- .053 * (2.87)	- .423 * (4.48)
GRD	.0027* (55.13)	.0021* (18.05)	.0026* (83.7)
R-square	.90	.57	.86

* = significant at 5 percent
() = absolute value of t statistic
(@) = Note: Additional regressions with grades as the only explanatory variable, as well as with various alternative sets of independent variables are available upon request.

Results from Table 1.8 strongly support the evidence regarding the influence of grades on wages. Even though we obtained only a small sample of employees in organization 3, we are still able to explain close to 60 percent of the observed wage variation . For organization 1 the result is even stronger, almost 90 percent of the wage variance can be explained using the model we suggested above (29). Grades alone explain 88 percent and 52 percent of the wage variation in organizations 1 and 3, respectively.

Every one hundred points can be translated into a 27 percent and 21 percent wage differential in organization 1 and 3, respectively. The mean point levels for organizations 1 and 3 are 265 and 257, respectively, while the range of points in organization 1 is 716, from a maximum of 804 to a minimum of 88. In firm 3, the maximum is 571 points and the minimum is 98, yielding a range of 416 points.

Careful study of the means and distributions of grades on these two organizations suggests that organization 1 has a substantial portion of its workers in 'low-point' jobs, while the data from organization 3 suggest that the sample lacks representation of top administrators (30).

In short: Tables 1.7 and 1.8 present evidence that grades are a function of job characteristics, and that wages depend on grades. Nevertheless, job characteristics are not explaining all the variation in wages, suggesting that market wages could be influencing grades. Alternatively , perhaps grades could be fully explained with job characteristics and we are omitting some of them . Nevertheless, as argued above, even if grades could be fully explained by job characteristics, the determination of the grades can still be influenced by market

wages, implying that the error term in the model is carrying part of the variance in market wages. The second equation, wages as a function of personal characteristics and grades, is explicitly influenced by market forces in the error term as we know that firms adjust their wage lines to account for local conditions as well as institutional and geographical constraints, in order to attract and retain workers.

Tables 1.9 through 1.11 present the results of obtaining seemingly unrelated equation estimators by modeling the wage deterimination process of the firm as one where grades and job characteristics are explicitly accounted for.

Introducing grades into the traditional wage hedonic model has had several important effects in addition to the gain in efficiency discussed earlier. Specifically, we can observe from Tables 1.9 - 1.11 that the magnitude and significance of various coefficients have been altered considerably with the introduction of grades into the model. Although our analysis of personal characteristic coefficients is presented in the next chapter, it is important to notice that the inclusion of grades has lowered the effects of personal characteristics on wages. The strongest cases of this result are the sex and marital status coefficients in organization 1 and the race coefficient in organization 3. As will be discussed below, if we were studying wage discrimination (i. e. wage differentials based on non-productivity-related personal characteristics) we would overestimate the effects of personal characteristics on wages by not including grades in our model.

TABLE 1.9

WAGE HEDONIC--SEEMINGLY UNRELATED EQUATION SYSTEMS

ORGANIZATION 1

Dependent Variable : Log of Hourly Wages
Model : GRD = f (JC)
LHW = g(P, GRD)

VARIABLE	COEFFICIENT	
Intercept	1.942 *	(20.10)
Age	.011 *	(4.80)
Age-square	-.0001 *	(4.77)
Education	-.0002	(0.12)
Seniority	.0008 *	(9.41)
Marital Status	-.012	(1.07)
Sex	-.043 *	(3.90)
Race	-.010 *	(0.80)
Financial Responsibility	-.092 *	(7.76)
Data	-.031 *	(5.56)
Things	-.030 *	(5.94)
Supervision Given	.041 *	(3.67)
Public Contact Within Organization	.047 *	(4.02)
Public Contact Outside of Organization	.035 *	(2.52)
Working Conditions (stress, repetitiveness)	.020	(1.07)
Physical Environment	-.037	(1.37)
Monetary Sum of Financial Responsibility	.7E-7 *	(3.92)
Required Education	.025 *	(13.78)
Required Experience	..028 *	(6.20)
Vocational Training	.038 *	(4.81)

R2 = .80
* = significant at 5 percent
() = absolute value of t-statistic

TABLE 1 . 10

WAGE HEDONIC--SEEMINGLY UNRELATED EQUATION SYSTEM

ORGANIZATION 3

Dependent Variable : Log of Hourly Wages
Model : GRD = f (JC)
LHW = g (P, GRD)

VARIABLE	COEFFICIENT		
Intercept	1.478	*	(12.00)
Sex	.004		(0.53)
Race	-.029	*	(2.67)
Seniority	.0004	*	(3.49)
Financial Responsibility	-.013		(0.96)
Data	-.052	*	(5.68)
Things	-.019	*	(3.50)
Supervision Given	.022		(1.49)
Public Contact Within Organization	.100	*	(8.04)
Public Contact Outside of Organization	-.043	*	(2.55)
Working Conditions (stress, repetitive)	.054	*	(2.05)
Physical Environment	.065	*	(1.97)
Required Education	.053	*	(11.38)
Required Experience	.031	*	(5.14)
Vocational Training	.146	*	(4.94)

R2 = .77
* = significant at 5 percent
() = absolute value of t-statistic

TABLE 1 . 11

WAGE HEDONIC--SEEMINGLY UNRELATED EQUATION SYSTEM

ORGANIZATIONS 1 & 3

Dependent Variable : Log of Hourly Wages
Model : GRD = f (JC)
LHW = g(P, GRD)

VARIABLE	COEFFICIENT		
Intercept	2.230	*	(35.37)
Industry dummy	-.046	*	(3.25)
Sex	-.024	*	(2.82)
Race	-.013		(1.49)
Seniority	.0005	*	(12.08)
Financial Responsibility	-.097	*	(10.65)
Data	-.041	*	(8.24)
Things	-.034	*	(8.95)
Supervision Given	.030	*	(3.17)
Public Contact Within Organization	.060	*	(7.34)
Public Contact Outside of Organization	.012		(1.22)
Working Conditions (stress, repetitiveness)	.031	*	(2.11)
Physical Environment	-.007		(0.34)
Required Education	.027	*	(17.52)
Required Experience	.033	*	(9.10)
Vocational Training	.130	*	(5.29)

R2 = . 78
* = significant at 5 percent
() = absolute value of t-statistic

Results regarding job characteristics now show even stronger support for the equalizing wage differential theory. All coefficients retained the sign that resulted from the single wage hedonic estimation, but the magnitude and significance of the coefficients varied. In fact, no coefficient lost its significance while some that appeared previously not to be relevant proved to be so.

In organization 1, all coefficients except for 'contacts outside the organization;' 'working conditions;' and 'physical environment' increased in magnitude, showing that part of their 'shadow price' was being accounted for by the grading system which was previously omitted from the model. Holding a job that entails some financial responsibility represents a 9.2 percent wage advantage over a job that does not have such responsibility. Working with tools, machinery, and/or equipment is rewarded with a wage differential of 3 percent per level of dexterity.

Supervisory jobs represent gains in wages of over 8 percent in comparison to jobs which do not entail supervision of other workers. Our findings, then, support the results of previous research with respect to supervisory job characteristics.

Working conditions (stress, repetitiveness, etc) are being rewarded with a 2 percent wage differential in organization 1. Physical environment, which we argued was correlated to 'things' and therefore insignificant and wrong-signed, now has a lower marginal significance level at the same time that the coefficient of 'things' became more relevant.

Results for organization 3 and for the merged sample follow those of organization 1 very closely. Working conditions, when studied without considering the influence of grades, were found to be insignificant, as in many previous works.

When the expanded model was estimated, however, it proved to be relevant in explaining wage differentials and commanded a 5.4 percent wage premium.

Conclusion

The inclusion of grade information and their relationship with job characteristics has yielded results that support the equalizing wage differential theory. Previous empirical estimations of single wage hedonics have found many variables to be insignificant and/or wrong-signed. We have used both intra-firm information and inter-firm data to show how homogeneity of job characteristics across firms is essential for the adequate testing of Smith's hypothesis. Increasing the number of job characteristics in the model has reduced potential biases due to omission of relevant variables. Additionally, we have increased the efficiency of our estimators by modeling the wage determination process of firms in a way that reflects the actual procedures used in most medium to large firms in the United States.

In Chapter II, we investigate the role that job characteristics and grading systems play in the explanation of today's 60 percent male-female earnings gap.

APPENDIX

There are two reasons for omitting organization 2 from the previous analysis. First, they use a grading system (PAQ) which makes explicit use of market wages in the deterimination of their grades. Analysts will determine the point value of the job characteristic but will not choose the weight that this dimension has in the final grade. Secondly, we have omitted organization 2 because equation 1.4 cannot be estimated for them yet, as they have not implemented the new wage structure. The data we have collected from organization 2 include the wage rates paid before the implementation of the system had taken place. This , however, allows us to test whether a proposed new wage structure is significantly different from the original wage structure.

In order to do this we have asked the Chief Analyst of organization 3 to provide us with their 'first choice' (not definite) wage equation. That is, we have the equation that the analyst might propose to the firm as the wage-grade line. This equation has been developed by regressing selected job dimensions (presented in th Data Appendix) on local market wages for comparable jobs (31). The equation is

(1.6) $LHW1 = 2.414 - .051*D9 + .127*D17 + .078*D18 + .134*D19 + + .147*D26$

$- .035*D28 - .133*D29 + .071*D32$

where D9 = using machines/ tools/ equipment
D17 = communication within the firm
D18 = engaging in general personal contacts
D19 = performing supervisory activities
D26 = working in 'businesslike' situations
D28 = salary versus variable basis
D29 = irregular versus regular schedule

D32 = alertness to changing conditions

If we assume that this is the equation that will be used to obtain the final wage structure for the firm, we can test whether it is significantly different from the existing wage structure (32). To do this, we construct a statistic based on the sum of squares of the residuals of the restricted and the unrestricted equations . The sum of squares of the residuals for the restricted equation is the sum of the squared difference between the actual wage and the proposed wage. Formally:

(1.7) ((Úr'Úr - Úu'Úu)/ k)/ (Úu'Úu /(n-k))

Úr'Úr is the sum of squared residuals from the restricted equation.

The results of our tests show that the potential wage structure of organization 2 will be statistically different from the one existing prior to the implementation of the grading system (33). If the company increases its efficiency in hiring and retaining workers it can be due to the additional information they have received from the PAQ and from the new wage structure that will be recommended.

NOTES

(1) Rees , A. & Shultz, G. (1970)

(2) When we do analyze more that one firm we control for establishment differences with the use of a dummy variable. We have no need to use any detailed decomposition of establishment variables for we will deal only with two firms at a time, and we are interested only in the coefficents of the personal and job characteristics.

(3) Smith (1979) p. 340

(4) ibid p. 343

(5) Brown (1980) p 113

(6) ibid p. 113

(7) ibid p 113

(8) See Smith (1979) for an excellent review of the literature on compensating wage differentials for disagreeable job characteristics.

(9) Brown (1980) p. 117

(10) Smith (1979) pp. 343-344

(11) Lucas (1974) p.531 Boldface is mine.

(12) Smith (1979) p. 342

(13) Alternatively, job characteristics can be viewed as inputs in the production process of each worker. With this Becker-type approach, additional levels of the job characteristic can have positive or negative marginal productivity.

(14) The job characteristics chosen for this model were selected in an effort to replicate as closely as possible the data series used in previous empirical work. Although our set does not correspond to all previous work it does include the variables that have been tested most frequently. In addition, we have included several variables that are unique to the literature. Qualitative descriptions of the data and the omitted series are found in the Introduction. Detailed descriptions of all data are found in the Appendices.

(15) We performed an F-test for the three organizations separately and for the

merged sample of organizations 1 and 3. The results were: Organization 1 **F(14, 767) = 73. 88** , Organization 2 **F(8,155) = 36.57**, Organization 3 **F(11, 322) = 42. 33** and, Merged Sample **F(11, 1103) = 69. 25.** All significant at 1 percent.

(16) The reader must be aware that stability inferences based on this table are not generalizable to all job characteristics. Stability tests for all variables, excluding the intercept, are performed in the latter sections of this chapter.

(17) In a separate regression we omitted variable 'things' from the model and found that working in an unpleasant physical environment does command a higher wage. Although the correlation between these two variables seems to obscure the relevance of the latter, we chose not to eliminate either variable from the model because the partial correlation we found was not larger than 50 percent.

(18) The industries to which our organizations belong have the very attractive characteristic of being quite diverse in the type of personal contacts that are required of their jobs. This fact allowed us to infer some interesting notions about the nature of the jobs and the possible errors in measurement that previous researchers might have created by not noting the slight differeces of job characteristics across firms and industries. This point will be treated in detail in the last section of this chapter and in Chapter II.

(19) See Appendices for a detailed description of the data.

(20) The differences in the treatment of these two variables are even wider when we divide the sample between males and females . This issue is dealt with in Chapter III.

(21) We have tested for the stability of the coefficients of these two variables by restricting each pair of coefficients to be equal to each other across firms. Our results indicate that the coefficient for contact outside of school is not stable across organizations.

(22) To test job characteristics jointly we estimated a wage hedonic based only on job characteristics and implemented a Chow test on the results : **F (12, 1100) = 7. 43.**
The individual job characteristics were tested for stability across samples in the following way: a dummy series was created for each variable which took zero values if the observation corresponded to the 'other' organization. That is, we estimated

(f.1) $LHW=a0+a1X1+...+aid1Xi+ajd2Xi+...+anXn+e$

for each i=1...n, where d1 and d2 represent dummy variables of value equal to zero or one.
Next, an explicit restriction was imposed of the form $ai-aj = 0$. The test that determines whether the samples can be merged, with respect to each i, is based on a t-student estimator.

Our results are summarized in Table 1.6

(23) In Chapter III we show how the assignment of points by job analysts can also reflect the different emphasis that is given to each job characteristic across firms.

(24) See Introduction

(25) Malkiel & Malkiel (1973) and Chiplin (1979) have included information on grading systems in their research, but the issue they were addressing was sex discrimination, not compensating wage differentials. Their work is described in the next chapter.

(26) This was not done for organization 2 because there is no error term in the grade equation if all job characteristics are included, given the explicit definition of points based on a market wage index.

(27) The relevance of this result will be highlighted when we study the role that market wages and job analysts play in determining the final wage payed.

(28) The F and t statistics are in Table 1.7 .

(29) A small part of the wage variation , however, remains unexplained . This issue is addressed in detail in the next chapters, where we look at possible sources of wage discrimination.

(30) Standard deviations for grades in organizations 1 and 3 are 130 and 73, respectively.

(31) The method used in obtaining this wage line was stepwise regression.

(32) This equation was intended to be the one used to obtain wages as of April 22, 1964.

(33) $F(7, 163) = 4.32$ from sum of square residuals equal to 2.33 and 1.96 for the restricted and unrestricted equations respectively.

CHAPTER II

MALE-FEMALE EARNINGS GAP

Overview

A significant amount of research has been done to explain the persistent earnings gap between male and female workers. The importance of job charcteristics as explanatory variables in earnings-gap models is underlined in some studies, however, as Hartmann and Treiman (1981) point out after a comprehensive review of the literature:

> " On the whole, however, the studies that use job characteristics as explanatory variables do not constitute a definite body of literature. There are simply not enough of such studies to show what it is about jobs held mainly by men and those held mainly by females that accounts for their differences in earnings. These studies do confirm, however, the importance of job segregation by sex in explaining the difference in earnings between men and women." (1)

Studies that focus on worker characteristics attempt to relate wage inequalities between sexes to differences in personal characteristics that affect productivity. This type of research belongs to the human capital school of thought, which treats wages as any other price and suggests that , in equilibrium, and without discrimination, wages reflect the value of the marginal product of the workers.

This view implies, then, that any difference in wages that cannot be accounted for by discrepancies in the productivity of the workers can be ascribed to

discrimination.

Bergmann and Adelman (1973), however, have documented the fact that sex segregation exists in the labor market and that women are segregated by occupational categories and within occupations by industry and firm. In 1960, 73.3 percent of all female workers were in occupations in which women were overrepresented (i.e. more than 45 percent); in 1970 this proportion was 72.6 percent (2). Although the neoclassical human capital model has generated several plausible explanations for the male-female differential, sex segregation is by no means a necessary outcome of the model, "and the factors which are identified as causes of pay differentials are not persuasive as causes of sex segregation *within* the neoclassical model" (3).

An alternative approach to studying labor markets that has been said to "enhance our understanding of why the same set of factors which produce a male-female pay differential would also produce sex segregation" is based on the internal labor market analysis developed by Doeringer and Piore (1971) (4).

An internal labor market is based on the division of jobs into two basic categories, those filled from sources external to the firm, and jobs filled internally. Market forces such as those underlying the neoclassical model operate mainly at the entry level of most occupations. Job evaluations and administrative tools are used to establish pay rates and to specify wage relationships among occupations.

In short, "the wage relationships among individuals and the promotional possibilities for any given individual are for the most part established as a

consequence of their job assignment " (5).

Within the context of the institutional model the sex segregation outcome is easier to explain: segregation is the way in which employers can legally differentiate men and women. The employer has considerable freedom to differentiate between sexes when selecting new workers for entry level positions. This freedom, on the other hand, is very small when dealing with individuals within the same job category, and with respect to the alteration of wage relationships among occupational categories.

"Indeed, within the internal labor market, wage rates might almost be considered the monetary (or value) dimension of the job structure. Once this conceptual linkage between occupational categories and wage rates has been established, it becomes clear that any factor that would tend to cause male-female pay differences would also tend to cause segregation along sex lines " (6).

In this context one can postulate that grading systems are a bridge between the two schools of thought. The introduction of grading systems enhances the realism of the traditional human capital models by allowing for an important administrative constraint. Economists have long discussed whether the allocative and wage outcomes of the internal labor market model and the neoclassical labor theory model diverge. Unfortunately, the internal labor market model has not been developed with sufficient rigor to permit for definite statements regarding the efficiency of the system. however, when a divergence of outcomes between the institutional and competitive systems appears it does not imply that the

institutional system is inefficient. It is precisely the 'efficiency' of the system, when conditions that lead to segmentation are present, that makes firms willing to abide by institutional arrangements. The use of grade information in a human capital framework adds statistical rigor to models with institutional constraints.

Overall, in situations where workers are not easily replaceable, or when the firm-specific component of the skills necessary to perform the job is significant, an institutional system (including a wage structure) may serve to reduce uncertainties and negotiating costs. However, while the institutional model may ease the burdens of market rigidities, it is not justified (or rational) in its treatment of females.

In this chapter, we study the male-female earnings gap from several perspectives. Our data allow us to concentrate on the personal characteristics of workers in order to see how our results compare to those of human capital researchers. We also include job characteristics into the model in order to account for the fact that male and female jobs are dissimilar in nature and in their specific tasks. Adapting our model to the realities of today's businesses, we incorporate a grading system and verify the role that job evaluations play in job assignment. The final version of our model represents a combination of human capital theory and the institutional model. Personal characteristics are included to account for differences in productivity and to detect discriminatory behaviour on the part of the employers, while job characteristics and grades are present to control for segregation, job assignment, and for the fact that many jobs are

firm-specific (and therefore have no external market).

The next section of this chapter describes the neoclassical and institutional theories with some detail and presents a review of the most significant empirical findings. The latter sections of the chapter focus on the comparison of our results with previous work, and on the presentation of our 'improved' model.

Discrimination Analysis

THEORY

The methodologies adopted by neoclassical economists to explain the male-female earnings gap fall into two broad categories: models based on the assumption of perfect competition and models that assume that the firm has monopsony power (7). Within the first group there are two major approaches: the first approach is founded on the overcrowding hypothesis originally presented by Fawcett (1918) and Edgeworth (1922) and recently formalized by Bergmann (1971, 1974). The second approach argues that women's productivity is low because females have a relatively low stock of accumulated human capital .

The overcrowding approach is best presented by Fawcett (1918), who states: "It is quite true to say that , although the doctrine of demand and supply has fallen of late years into unpopularity, it is nevertheless a fact that if demand for a particular class of labor is either destroyed or very much restricted, 'a downward pull' on wages is called into existence for the whole class" (8).

The formalization of the overcrowding theory elaborated by Bergmann (1971,

1974) relies on the assumption that women are restricted **by demand** factors to a limited set of occupations, therefore, lowering their marginal productivity and consequently reducing their wages. It is employer's tastes that prevent sexual integration of jobs. Employers with a taste for discrimination against women will hire females only when the wage difference between male and female workers is large enough to offset their dissutility of having hired a woman. This type of discriminatory behaviour, introduced by Becker (1957), although helpful in explaining the consequences of discriminatory behaviour, fails to address the causes of employer's distate for female workers and , furthermore, it fails to explain why existing wage differentials are insufficent to compensate employers for hiring females. A satisfactory explanation of the existing job segregation in the labor markets with Bergmann's model depends upon a very skewed distribution of employer's tastes. On the other hand, as shown by Arrow (1971, 1972), if male employees are against sharing their jobs with females the long run equilibrium would be characterized by occupational segregation. An additional difficulty with the analysis of wage discrimination within the competitive model is the treatment of male and female workers as perfect substitutes. When the issue being addressed is the overt lower earnings of females it seems unreasonable to assume that the differences are exclusively demand-driven.

Unfortunately, the alternative competitive model approach, human capital theory, also relies heavily on 'tastes.' The fundamental building block behind the human capital explanation of the male-female earnings gap is that the two labor

groups are not perfect substitutes for one another. Even if they are genetically endowed equally, women accumulate less human capital through work experience since they spend relatively fewer years in the labor force than men. As Lobue (1982) has summarized, the assumption is that labor force participation of wives results from the conditions of household production. Maximization of family utility functions, separable in terms of market goods, home products, and both spouses' leisure time, subject to household budget constraints, consisting of market inputs and time, determines the decision criteria for the allocation of time between market and non-market activities and leisure. For an individual wife, the price of non-market time determines her reservation wage, and the difference between it and her market wage offer explains her labor force participation.

Although the human capital approach concentrates on wage differentials and not on occupational segregation, the latter can be readily predicted by the model. Women will tend to enter occupations which provide few opportunities for increases in productivity through labor market experience. Additionally, the theory suggests that women would shy away from occupations that require a lengthy period of self-financed training, like law or medicine, unless they planned to work throughout the majority of their lives. On the employers side, one would expect firms to tend to exclude women from jobs that entail a prolonged firm-specific training process.

However, as Blau and Jusenius (1976) argue, there is a fault in the preceding logic; " *both* male and female occupations require varying amounts and types of

skills. Some female as well as male occupations require lengthy general training programs - nursing and architecture, for example. Furthermore, some female as well as male occupations require firm-specific training." (9).

The basic issue is that both men and women are in occupations of each skill type and that within each category certain occupations are more suitable for women than others. The human capital approach can only explain a tendency for women to enter low-skill jobs, not the fact that women are concentrated in a small number of occupations within each skill category. To arrive at this conclusion strong assumptions must be made regarding women's tastes.

The human capital model assumes freedom of choice and, therefore, implies that segregation is a consequence of occupational choice. Theorists in this school of thought do not recognize the constraints imposed by society on women's employment choices.

In summary, the perfectly competitive models fail to address the complete picture regarding occupational segregation as each approach concentrates on only the demand function (overcrowding) or the supply function (human capital).

A second major approach toward understanding of the male-female earnings gap within the neoclassical models, the monopsony model, was first introduced by Robinson in 1933 and later developed by Madden (1973).

Workers who face a monopsonist employer are paid less than their marginal revenue product. The divergence between their wage and and their marginal revenue product is determined by the wage elasticity of the supply of labor to the

firm: the less elastic the supply of labor to the firm, the greater the divergence between marginal revenue product and the wage paid to the worker (10). Wage differentials between males and females are thus explained by a varying degree of monopsonistic power across the sexes. Firms, it is implied, have higher monopsonistic power over females than over males. A common explanation for this result is that females are less mobile than males (both geographically across firms and locally across occupations).

The major problem with the monopsonistic model is the lack of evidence that females have lower labor supply elasticities than males. The relative elasticities are undetermined a- priori , as there are equally valid arguments supporting a higher elasticity for females than for males (based on the ease with which females can leave the labor force to housewife occupation).

Neoclassical models have generated a few plausible explanations for the male-female pay differential, " ...however, sex segregation is far from a necessary outcome in these models, and the factors which are identified as causes of pay differentials are not persuasive as causes of sex segregation *within* neoclassical model." (11)

Many economists have opted for an alternative model that takes into account the institutional constraints in the labor market rather than postulate the extreme distribution of tastes or summon the necessary price rigidities that are necessary to obtain segregation from the neoclassical models.

The basis for most institutional models is the internal labor market analysis.

The core of the internal labor market analysis is the division of labor within the firm into two broad occupational groups: jobs filled from sources external to the firm and jobs filled from internal sources. The first category is generally restricted to entry-level jobs in low-level occupations, while the second group is composed of workers that have been promoted and are being upgraded. Access to jobs in the second group is through "advancement" up well-defined promotion ladders. To advance, workers acquire skills which are mostly firm-specific.

The institutional model allows market forces to operate at entry-level jobs, however, the firm-specificity of the rest of the jobs constrains them from being modeled within the neoclassical competitive assumptions. It is an administrative apparatus which allocates labor and determines wage rates within the firm that takes over the market's role. An important part of this apparatus is the grading mechanism that has been described earlier and through which, as will be shown later, there is potential for job assignment discrimination and explicit wage discrimination.

Within the context of the institutional approach, the labor market creates an institutional context in which groups with different interests can enhance their positions by incorporating a set of political, social and economic forces. "In this context discrimination can be understood as one of the important mechanisms that have contributed historically to the creation of segmented labor markets" (12). Discrimination within the internal labor market takes the form of occupational segregation rather than different pay for equal jobs because the institutional

rigidity of rules and regulations within corporations are uniformly enforced and administered.

Given the importance of group oriented policies in internal labor markets, intra-group homogeneity is a desirable trait in the work force. For whatever reasons, sex is a trait that has shown to be relevant in corporation's search for homogeneous characteristics (13). Segregation is, then, the primary way in which employers can differentiate between male and female workers. The employer's freedom to differentiate among workers is greatest in the case of new jobs at the entry level and declines rapidly as the jobs are filled internally.

An important contribution to the internal labor market theory was Phelps' (1972) concept of statistical discrimination which postulates that information costs force firms to make decisions regarding individuals based on group-derived probabilities. For example, if for some reason employers believe that females, as a whole, have higher turnover rates than males, they might exclude individual women from certain jobs based on the group-determined probability. Higher labor costs associated with higher turnover are sufficient reason for firms to segregate workers in efforts to minimize costs.

In short, the institutional approach addresses the evidence of job firm-specificity and administratively determined job wages and hierarchies in a direct fashion that leads to the well documented result of job segregation.

EMPIRICAL LITERATURE

There exists substantial empirical literature on male-female earnings differentials and sexual discrimination. In this study we present an overview of the general findings to date as well as a more detailed review of the most significant works (14).

Most empirical studies on the causes of wage differentials across sexes concentrate on the personal characteristics of the workers. They are based on the estimation of a wage hedonic of the form:

(2.1) $LHW = f(P)$

where LHW represents the log of the hourly wage and P is a vector of personal characteristics that includes age, education, experience, marital status, race, sex, and seniority. (15)

These studies stress differences in endowments of productive personal characteristics as the major determinants of wage differentials. Education and experience are seen as the variables that contribute the most to the workers' stock of human capital.

A majority of the studies based on the human capital approach, however, fail to acknowledge explicitly the existing occupational differences between men and women. Fuchs (1971) argued that virtually all the earnings gap could be accounted for by differences in the occupational distribution if there were data by detailed job categories. Even though the models that include information on the occupation of the workers do in fact have greater explanatory power, there remains an

unexplained portion of the gap.

A significant portion of the unexplained wage gap can be attributed to sex segregation. Focusing on the sources of occupational segregation leads one to stress the relevance of job characteristics in the determination of wages. Although the importance of job characteristics is beginning to be underlined in some studies, "on the whole, however, the studies of earnings differences that use job characteristics as explanatory variables do not constitute a definite body of literature. There are simply not enough of such studies nor are they conclusive enough to show what it is about jobs held primarily by men and those held primarily by women that accounts for differences in their earnings" (16).

Empirical results have shown that worker characteristics account for a very small part of the difference in earnings. Models based on personal characteristics are capable of explaining, at best, 44 percent of the earnings differential (17). In fact, only the studies of Mincer and Polachek (1974) and Corcoran and Duncan (1979) are capable of explaining more than 40 percent of the difference in earnings based only on personal characteristic differentials. When occupation is controlled for, the explained variation of wages rises considerably, as is the case when grades are included in the model. Additionally, virtually all papers rely on national data collected mostly through surveys (18).

In what follows, we present a summary of the most relevant findings to date. Methodological contributions, individual papers, and frequently found results are discussed in a framework that underlies the relevance of intra-firm data, control

for personal **and** job characteristics and , above all, the need to incorporate administrative constraints in the wage structure into the models.

The most popular method used to measure "discrimination" was introduced by Oaxaca (1973) and Blinder (1973). A "discrimination coefficient" is obtained by regressing wages on a set of explanatory variables across sex groups. By obtaining the difference in these equations -- the predicted wage differential -- two separate components can be identified: the difference explained by the regression and the difference not explained by the regression (the intercept differential). The explained portion can be further decomposed into differences in endowments of the explanatory variables, and differences in the coefficients --the rates of return. The former is "the value of the advantage in endowments possessed by the high-wage group *as evaluated by the high-wage group's wage equation* . The second sum is the difference between how the high-wage equation *would value* the characteristics of the low-wage group and how the low-wage group *actually values* them" (19). The discrimination coefficient is the sum of the intercept differential and the coefficient differential (20).

Oaxaca (1973) introduces a formalization of Beckers' concept of a discrimination coefficient and developes a model along the line of the post-schooling investment model of human capital theory. He uses variables that control for the worker's characteristics, their working class (eg. self-employed, union, government, etc), the nature of the firm they work for, their occupation, and the region of the country where they reside.

Oaxaca's thrust is toward analyzing the role of experience in the male-female earnings gap. His measure of experience, however, suffers from a bias: it is constructed as age minus schooling minus 6. This measure overestimates the experience of many female workers that have left the work-force to raise a family. His results show experience-wage profiles that are flatter and peak earlier for females than for males. This implies that, if the rate of return for on-the-job-training (OJT) is the same across sexes, then males invest more initially and for a longer period of time on OJT than females. Alternatively, if the amount of OJT is the same across sexes, then the rate of return for females relative to that of males is less than the females investment horizon relative to that of males.

The most significant variables explaining wage differentials in his model are number of children, marital status and part-time employment. However, if occupational controls are introduced the significance of these variables disappears (21). The final analysis of his results, then, is directed toward the explanation of differentials as consequences of segmentation rather than unequal pay for equal work.

The main contribution of Oaxaca's paper, excluding its methodological innovation, "is to demolish the myth that fewer years of experience is an important factor in the lower pay of women"(22).

Utilizing a very comprehensive set of variables to explain the male-female and white-non-white earnings gap, Blinder (1973) draws a distinction between reduced

form and structural wage equations (23). The author finds that the regressions attribute none of the observed male-female wage differential to differences in the endowments of exogenous variables. He estimates that about 2/3 of the differential is due to outright discrimination in labor markets and about 1/3 to discrimination in attaining occupational status and job security. Additionally, he finds that the age-wage profile does not prove to be significant in explaining the earnings gap.

In a paper based almost exclusively on personal characteristic information, Sawhill (1973) focuses on the role that marriage plays in the determination of the earnings gap. The link between marriage, training, and wages is presented in an innovative way: she classifies jobs according to the training requirements they have and proceeds to hypothesize about the reasons and the ways in which employers will place females in certain jobs (with respect to training) and not in others.

Sawhill's conclusion is that women are concentrated in jobs with little or no training and that experience adjustments have a negligible impact on earnings. Employers are found to give females jobs that require little or no training, although the training effect is negligible.

Sawhill's piece was followed by the very provocative work of Mincer and Pollachek (1974), who explain the lower earnings of females by suggesting they seek jobs in which the penalty for intermittent participation is low. These jobs are crowded with women, marginal productivity is lowered, and, therefore, wages are depressed. This result, however, has not received any additional empirical support.

Furthermore, several authors have been unable to replicate Mincer and Pollacheck's (1974) conclusions. Corcoran (1979) found that , " Surprisingly, women's work skills do not always become less valuable during periods of labor force withdrawal--even for white women" (24). England (1982) , found that " women are not penalized less for time spent out of the labor force if they choose predominantly female occupations than if they choose occupations more typical for males. Thus, there is no evidence that plans for intermittent employment make women's choice of traditionally female occupations economically rational" (25).

In an important paper that used intra-firm data on 272 white collar workers, Malkiel and Malkiel (1973) presented the results of modeling wage differentials across sexes as dependent on the worker's human capital stock. An additional variable , "job level", that measured the degree of responsibility of the job , was included in the model. This variable alone accounted for 80 percent of the observed wage variation. They found that adding a grade eliminated all wage discrimination . In explaining the determination of grade levels they used the workers' personal characteristics. Their model explains 50 and 70 percent of the grade variation for females and males, respectively.

A second important difference between Malkiel and Malkiel's (1973) paper and most others is the detailed breakdown of their experience observations into job related experience (within and outside the firm) and non-related job experience (our data from organization 2 refer to 'job related' experience). This depth, attributable to having intra-firm observations, proved to be extremely important

as they find that experience, education, and productivity variables are able to explain over 3/4 of the variance in salaries for both males and females over several years. They confirm our comment on Oaxaca's paper by noting that using potential experience (age-education-6) is adequate only for the male sample.

Before including 'job level' as an explanatory variable they find that the coefficients of other independent variables (only personal characteristics) are not stable across sexes, implying that there are differential rates of return for the same human capital between males and females.

The inclusion of "job level" into the model decreased the explanatory power of most other independent variables and also lowered the wage differential, leading the authors to conclude that, " ...it is difficult for a discriminatory organization to give male and female employees the same titles and pay them different amounts. It is far easier to assign them to lower job levels and then set up a pay structure by level that is the same for both sexes" (26).

Bridges and Berk (1974) utilize a three-tier classification of job characteristics, in addition to personal characteristics in their effort to analyze the causes of wage differentials across sexes. The job characteristic categories utilized by the authors range from mean measures at the occupation level in the broadest aggregate, to mean work measures for the 'bureaucratic' units within the firm (work groups). Finally, at the most disaggregated level, are the work activities of each individual worker.

Their data are taken from a survey of white collar workers in financial

institutions that examined job content, employees job evaluations, and methods of employee recruitment. Multiple regression is used to explore the relative importance of three clusters of variables: work characteristics, company characteristics and worker characteristics.

In contrast to the findings of other authors that have controlled for occupation, Bridges and Berk (1974) find that, "... for white collar jobs, the type of work performed by an individual is of minor importance in determining earnings, but most of the explained variance can be accounted for by other factors such as sex and marital status. Equal pay for equal work remains unrealized and the implication for ascription achievement and division of labor is noted" (27).

Two other studies use firm-specific data in their analysis of wage differentials and, specifically, the male-female earnings gap. The first of the two is by Ferber and Westmiller (1976) who utilize data from the University of Illinois at Urbana-Champaign . They do not have information on workers' individual characteristics, but rather, they have data on the average education and average experience of workers in 514 different occupations. In addition, the authors have information on the required education and required experience for each job, together with the the specific pay plan of each occupation. That is, they know whether each wage was set by the prevailing market rate, by negotiation, by open range, etc. The authors find that the pattern of wages by occupation is, in fact, influenced by the sex of the worker.

The second study referred to above is by Gordon and Morton (1976). Their paper

" uses data on all full-time staff (non-faculty) employees at a large urban university and controls for age, education, sex, marital status, seniority, and job" (28). In controlling for the worker's job, the authors use different classifications; namely job titles and Dictionary of Occupational Titles lists .

After controlling for all variables, they find that a female staff member earns between 7 and 17 percent less than a man. Using job titles may mean that much of the true differential is disguised by the sex-specific nature of the titles. Additionally, the authors find that the employer has a concern over high female turnover rates and that there are no significant differences in the earnings pattern of single and married females. This last result is not consistent with Sawhill's (1973) findings discussed earlier.

The paper by Corcoran and Duncan (1979) has been classified by Hartman and Treiman (1981) as ' perhaps the most thorough' of this type of study. The article studies " the extent to which differences in work history, on-the-job-training, absenteeism, self imposed restrictions on work hours and locations account for wage differences between the sexes and races" (29).

The main results of the paper are: First, wage advantages enjoyed by men cannot be explained solely , or even primarily, by superior qualifications or more attachment to the labor force. Second, relationships between the various independent variables and wages are remarkably uniform across four sex/race groups. Third, a very large part of the wage differences cannot be explained by their list of productivity variables.

In a great majority of the papers discussed here that focus on the personal characteristics of the workers , the authors have consistently found that a substantial portion of the earnings gap cannot be explained by the factors commonly believed to affect productivity.

In studies that adjust for differences between males and females across broad occupational categories, the variables generally used do not account for a large portion of differences in earnings. A plausible reason for this result is that the differences in earnings within broad occupational groups are on average equal to those for the labor force as a whole, given that within each broad occupational category males and females are segregated by specific jobs. As the detail in the job category classification increases, so does the explanatory power of the model. Occupational segregation, then, accounts for a substantial portion of the observed male-female earnings gap.

The empirical literature to date has emphasized personal characteristics as the primary determinant of wage differentials. The difficulty in obtaining intra-firm data and the lack of formalization of the internal labor market theories have made it extremely difficult to incorporate administrative constraints into the empirical models. Attempts to study segregation , excluding the cases in which very disagregated job categories are used, have made great progress in explaining the earnings gap by controlling for the characteristics of the job.

Unfortunately, there is little left to gain from showing that wage differentials are due to job segregation. In fact, the new trends of thought in the topic are stressing that the problem is not segregation per se, but rather uneven pay across jobs of similar "worth." The study of this issue is based on an understanding how of wages are set within each organization, and on what the nature of different jobs is that might attract or repel certain homogeneous groups. In the next sections of this chapter we present the results of estimating wage differentials for three firms. We include models with only personal characteristics, with personal and job characteristics and, finally, we re-introduce the model presented in Chapter I to show how administrative rules and procedures play a significant role in the wage determination process of firms. As in the case of the firm studied by Malkiel and Malkiel (1973), including a 'grade' variable reduces the unexplained portion of the wage variations to almost zero as well as the earnings gap attributable to wage discrimination. As shown in Chapter I, we do not explain grades as a function of personal characteristics (as Malkiel and Malkiel (1973) do), but rather, we show how they are determined by job characteristics. In Chapter III, we present a series of tests to show how grades and market wages are highly correlated, defeating the purpose of Comparable Worth and perpetuating existing market distortions.

Wage Hedonics Based on Human Capital Theory

MODEL AND RESULTS

To investigate the male-female earnings gap based on the human capital approach we make use of the standard wage hedonic formulation introduced earlier, that is, we estimate

(2.2) LHW = f (P)

where LHW is the logarithm of the hourly wage and P is a vector of personal characteristics.

Table 2.1 presents the results of estimating equation 2.2 for organizations 1 and 2 (30).

TABLE 2.1

WAGE HEDONIC-HUMAN CAPITAL THEORY

ORGANIZATIONS 1 & 2

Dependent Variable : Log of Hourly Wages
Model : LHW = f (P)

Organization	**1**	**2**
VARIABLE		
Intercept	1.143 * (9.31)	1.060 * (9.27)
Age	.033 * (6.34)	.040 * (5.55)
Age-squared	-.0004 * (6.96)	-.0004 * (5.66)
Education (years)	.035 * (10.62)	.021 * (4.41)
Seniority (months)	.001 * (9.45)	.001 * (7.59)
Marital Status	-.117 * (4.72)	-.058 (1.58)
Sex	-.253 * (12.21)	-.078 * (1.98)
Race	-.321 * (14.22)	-.269 * (7.43)
R-square	.52	.58

* = significant at 5 percent
() = absolute value of t-statistic

Results from Table 2. 1 show that personal characteristics are capable of explaining less than 60 percent of the wage variation found in each organization, while controlling for sex and race. All variables are of the expected sign and , except for marital status in organization 2, significantly different from zero.

Each additional year of formal education represents a 3. 5 and 2. 1 percent wage premium in organizations 1 and 2, respectively. These figures show that, in the case of organization 1, the advantage of holding a college degree over holding a high school diploma represents, on average, a 14 percent wage gain. Seniority is compensated equally in both organizations, with each additional year of seniority representing a 1. 2 percent wage premium. While being single is associated with lower wages in both organizations, age is rewarded. Being non-white is severely penalized with a 32. 1 percent wage disadvantage in organization 1, while the penalty is 27 percent in organization 2. Finally, the sex coefficient represents a 25. 3 percent wage differential against females in organization 1 and a lower, while still significantly greater than zero. 7. 8 percent wage disparity in organization 2.

A Chow stability test showed us that the coefficients are not stable across sexes. Additionally, in order to identify the sources of uneven returns to human capital endowments across sexes, we calculated the discrimination coefficients for both organizations.

All results from the discrimination coefficient tables are obtained as follows:

(2.3) $LHWm = B0m + B1m*Xm$
$LHWf = B0f + B1f *Xf$

where m, f = male and female subscripts, respectively
B0, B1 = constant coefficient and vector of variable coefficients
X = vector of explanatory variables

The predicted wage differential (WD) is

(2.4) $LHWm-LHWf = (B0m-B0f) + B1m*Xm - B1f*Xf$

Adding and subtracting $B1m*Xf$ to the left hand side of equation 2.4,

(2.5) $WD = (B0m - B0f) + B1m*(Xm- Xf) +Xf*(B1m - B1f)$

This way,

(2.6) $WD = ID + ED + RRD$

where ID = intercept differential
ED = endowment differential
RRD = rate of return differential
RRD + ID = "discrimination coefficient"

The results presented in Table 2.2 indicate that, in organization 1 the predicted wage gap is 28 percent against females with all of it due to non-endowment related inequities. In fact, females have an endowment advantage with respect to age, education, and marital status. That is , if females where compensated with the male rates of return, their higher age, higher level of education, and lower percentage of single workers would represent a 4.5 percent wage differential in their favor. On the other hand, the fact that there are relatively more non-white female workers than non-white male workers yields a 3.1 percent differential against females.

TABLE 2 . 2

DISCRIMINATION COEFFICIENTS

ORGANIZATIONS 1 & 2

Dependent Variable : Log of Hourly Wage
Model : LHW = f (P)

ORGANIZATION 1

VARIABLE	ENDOWMENT	RATE OF RETURN
Age	-6.43	181.93
Age-squared	4.46	-89.86
Education	-0.09	1.37
Seniority	0.68	0.00
Marital Status	-2.43	-4.28
Race	3.14	-5.67

ENDOWMENT DIFFERENTIAL :	-0. 67
DISCRIMINATION COEFFICIENT :	28.79
WAGE DIFFERENTIAL :	28.12

ORGANIZATION 2

Age	-25.16	21.42
Age-squared	22.84	-12.82
Education	-3.08	15.56
Seniority	1.23	-7.78
Marital Status	-0.55	-2.32
Race	-5.21	-3.21

ENDOWMENT DIFFERENTIAL :	-9 . 93
DISCRIMINATION COEFFICIENT :	1. 85
WAGE DIFFERENTIAL :	- 8 . 08

The significant wage differential against female workers predicted by our personal characteristics model is largely due to an inconsistent treatment of age between sex groups. Females have a much flatter (lower slope) and less sensitive (less concave) age-wage profile than males do. The coefficients for age and age-squared are . 058 and -. 0006 for males and . 015 and -. 0002 for females (31). Male workers' wages peak at the age of 55, while for females the peak age is 42.8.

We estimated equation 2 . 2 for each sex group, as well as for the whole organization, divided into two age groups: older than 35 and younger than 35 (32). Not surprisingly, the wage differential for the 'young' group is considerably lower than that of the 'old' group, 16.11 versus 40. 4 percent, respectively. Additionally, the age-related differentials show that the 'young male' age-wage profile is only slightly steeper (.078 versus .056) than the 'young female' age-wage profile, while the speed at which the profile declines is the same for both sexes, -.0009. On the other hand, the age-wage profile for 'old males' is far steeper than for 'old females', .033 and .009, respectively, and it is also more concave, -.0007 versus -.0001(33).

Organization 2, on the other hand, has a quite different wage structure . Results in Table 2 . 2 show that, using only human capital productive variables to explain wage differentials, the predicted wage differential actually favors female workers, although the discrimination coefficient, while very small, favors male workers. Specifically, males are younger, have less education, and have a larger relative proportion of singles and non-whites than females. Therefore, if females were compensated with the same rates of return than males they would receive a

salary premium almost 10 percent above the male's average wage. Females, however, are not compensated with the same rates of return as males, in fact, they are penalized quite severely with a much lower return to education that represents over a 15 percent wage divergence in favor of males. Additional experience, on the other hand, is compensated more for female workers than for males.

The most important results obtained from organization 2 are that females have considerably higher endowments of human capital which represent a wage differential in their favor of approximately 8 percent. A significant reduction in the wage advantage of females is due to the uneven treatment of education across sexes. That is, females receive considerably lower returns for additional years of education than males do (34). Organization 2, nevertheless, has an unexplained portion of the differential (the discrimination coefficient) that is close to zero, reflecting that even though the rate of return differential clearly favors male workers by around 10 percent, there are unmeasured forces (captured by the intercept differential) affecting wages that compensate for this 'discriminatory' behaviour.

Tables 2.1 and 2.2 summarize the results of testing the relevance of human capital variables in the determination of the male-female earnings gap. Although the model does not explain more than 60 percent of the wage variation in the firm, it has a significantly higher explanatory power than that found in exercises based on national inter-firm data. Education and experience are rewarded in both

organizations and for both labor groups, as human capital theory would predict. yet, the return to education is not homogeneous between the sex groups. Education is rewarded with a premium for male workers. An initial reaction would be to claim that females are possibly in jobs in which education is not necessary. Therefore, even though they have it, there is no compensation for it.

In the next section, we explore this possibility as we study the earnings gap between sexes once job characteristics are included in the model. One of these job characteristics is required education.

Wage Hedonics Including Job Characteristics

MODEL AND RESULTS

Including job characteristics in the wage hedonic incorporates a key element of the market place into our analysis, job segregation. Males and females, as discussed earlier, are not concentrated in the same jobs. Our initial hypothesis is that adding information on job characteristics to the human capital model will, first, enhance our understanding of wage differentials across all workers and second, reduce the unexplained portion of the earnings gap between sexes.

Table 2.3 and Table 2.4 present the results of estimating

(2.7) $LHW = f(P, JC)$

where JC is a vector of job characteristics.

We are considering a different model from those advocated by human capital theorists. The novelty of our approach is the inclusion of job characteristics into the model. Our initial hypothesis, as mentioned above, is that job characteristics increase the explained portion of wage differentials. This can easily be verified by comparing the correlation coefficient between the two sets of models. The inclusion of job characteristics increases the explained variance in our model to .82 and .85 percent for firms 1 and 2, respectively. Formally, we verify the statistical relevance of job characteristics in the model by testing the hypothesis that the job characteristic coefficients are statistically equal to zero. Our results indicate that job characteristics are significant in explaining wage differentials in both

organizations and for each sex group (35).

TABLE 2. 3

WAGE HEDONIC

ORGANIZATION 1

Dependent Variable : Log of Hourly Wages
Model : LHW = f (P, JC)
n = 784

VARIABLE	COEFFICIENT
Intercept	1.693 * (15.04)
Age	.019 * (5.96)
Age-square	-.0002 * (6.08)
Education (years)	.006 * (2.89)
Seniority (months)	.0008 * (8.76)
Marital Status	-.035 * (2.21)
Sex	-.127 * (8.39)
Race	-.032 (1.87)
Financial Responsibility	-.076 * (6.30)
Data	-.029 * (5.07)
Things	-.023 * (4.65)
Supervision Given	.029 * (2.61)
Public Contact Within Organization	.041 * (3.50)
Public Contact Outside Organizaton	.039 * (2.76)
Working Conditions (stress, repetitiveness)	.016 (0.85)
Physical Environement	-.049 (1.82)
Monetary Sum of Financial Responsibility	.7E-7 * (3.75)
Required Education	.022 * (11.83)
Required Experience	.027 * (5.97)
Part Time	-.056 * (3.26)
Vocational Training	.036 * (4.42)

R2 = .82
* = significant at 5 percent
() = absolute value of t-statistic
(@) = For a description of the measurements please see the Appendices.

TABLE 2. 4

WAGE HEDONIC

ORGANIZATION 2

Dependent Variable : Log of Hourly Wages
Model LHW = f (P, JC)
n = 171

VARIABLE	COEFFICIENT	
Intercept	1.080 *	(9.50)
Age	.020 *	(4.33)
Age-square	-.0002 *	(4.22)
Education (years)	.007 *	(2.42)
Seniority (months)	.001 *	(7.46)
Marital Status	-.028	(1.25)
Sex	-.113 *	(3.43)
Race	-.089 *	(3.26)
Supervision Given	.089 *	(4.60)
Stressful/Unpleasant Environment	-.014	(0.68)
Activities Requiring Body Movements	-.046 *	(2.88)
Existence of Hazardous Job Situations	.049 *	(3.00)
Structured, Repetitive Work	.102 *	(3.68)
Required Education	.076 *	(3.33)
Required Experience	.040 *	(3.58)
Supervision Received	.138 *	(5.36)

R2 = .85
* = significant at 5 percent
() = absolute value of t-statistic

The fact that job characteristics are significant in explaining wages, coupled with the observed job segregation across sexes, leads us to hypothesize that the sex coefficient in 'partial' human capital models is biased.

In exploring the consequences of adding job characteristics into our model we see that the sex coefficient in organization 1 falls from -.253 to -.127. That is, not accounting for the differences in the types of jobs held by men and women (which in itself could be the result of discrimination, or, alternatively, of the workers own choices) leads to an overestimation of the sex coefficient by about 13 percent.

In organization 2, on the other hand, adding job characteristic information increases the negative effect that being female has on wages (36). That is , omitting job characteristics leads to an underestimation of the sex coefficient in organization 2.

Clearly, then, omission of job characteristics can bias the sex coefficient, leading to a possible overestimation of the effect of sex on wages (which is the most common case) and even a possible underestimation of the effect of sex on wages (which is the case in organization 2).

The result for organizaton 1 is less surprising than that of organization 2 given the existence of job segregation. In organization 2, an interesting phenomenon is taking place: females are concentrated in jobs in which certain job characteristics are rewarded significantly less for females than for males. Thus, when these job characteristics are included in the model, the effect of sex on wages becomes larger.

Before exploring this hypothesis in further detail, we will study what the addition of job characteristics does to the distribution of the earnings differential between endowment differences and rate of return disparities.

Tables 2.5 and 2.6 present the results of calculating the discrimination coefficients for organizations 1 and 2, respectively.

Including job characteristics in our model reduces the predicted wage differential from 28.12 percent to 27.57 percent in organization 1. In organization 2, however, the predicted wage differential, which favors female workers in the human capital model with an 8 percent differential, now represents a 4.7 percent differential in favor of male workers.

The discrimination coefficient in organization 1 is significantly reduced from 28 percent to 17 percent with the inclusion of job characteristics. In organization 2, on the other hand, the discrimination coefficient increases from 2 percent to 13 percent when we add information on the workers' job characteristics.

Almost one half of the wage differential predicted for organization 1 is due to endowment disparities. Female workers have less financial responsibility, work less with tools and equipment, are in jobs requiring lower levels of education and experience, and are not found in jobs where vocational training is a requirement. All the job characteristics outlined above are compensated with wage premiums and men, on average, have more of these characteristics in their jobs than females.

TABLE 2 . 5

DISCRIMINATION COEFFICIENTS

ORGANIZATION 1

Dependent Variable : Log of Hourly Wage
Model : LHW = f (P, JC)

VARIABLE	ENDOWMENT	RATE OF RETURN
Age	-2.99	59.23
Age-squared	2.23	-33.15
Education	-0.01	-5.49
Seniority	0.40	-1.53
Marital Status	-1.01	-2.23
Race	0.49	-1.37
Financial Responsibility	1.50	9.72
Data	-0.12	-11.61
Things	2.39	3.22
Supervision Given	0.88	-2.48
Public Contact Within Organization	-0.13	-3.96
Public Contact Outside Organization	0.06	7.80
Working Conditions (stress, rep.)	-0.02	-0.29
Physical Environment	-0.57	0.89
Monetary Sum of Financial Respons.	0.59	-0.09
Required Education	2.94	-1.88
Required Experience	2.00	2.49
Part-time	0.96	-1.83
Vocational Training	1.84	0.00

ENDOWMENT DIFFERENTIAL :	11.43
DISCRIMINATION COEFFICIENT :	16.14
WAGE DIFFERENTIAL :	27.57

TABLE 2 .6

DISCRIMINATION COEFFICIENTS

ORGANIZATION 2

Dependent Variable : Log of Hourly Wages
Model : LHW = f (P, JC)

VARIABLE	ENDOWMENT	RATE OF RETURN
Age	-13.15	13.63
Age-squared	9.13	-6.37
Education	-0.80	-3.89
Seniority	1.23	0.00
Marital Status	-0.22	-0.02
Race	-1.26	0.90
Supervision Given	0.86	1.13
Sressful/Unpleasant Environment	6.13	3.50
Activities Requiring Body Movements	-2.98	-3.45
Existence of Hazardous Job Situations	-0.04	6.38
Structured Repetitive Work	1.86	-3.12
Required Education	-6.25	32.76
Required Experience	-1.32	0.15
Supervision Received	-1.53	-19.52

ENDOWMENT DIFFERENTIAL :	-8.31
DISCRIMINATION COEFFICIENT :	13.08
WAGE DIFFERENTIAL :	4.77

Endowment differences in human capital account for less than 1 percent in favor of female workers, with a significant portion due to a relatively lower number of single females (37). On the other hand, the five most important job characteristics, financial responsibility, things, required education, required experience, and vocational training represent a 10. 64 percent differential in favor of male workers.

Inconsistent payment for the same factors of production across sexes produces a 17.44 percent wage penalty against female workers. Although females earn a higher rate of return than males for analyzing data, supervising workers, dealing with others within the organization, being in jobs with high educational requirements, and are penalized less than men for working part-time, men earn a sufficiently higher rate of return in other job characteristics to more than offset the female advantages. Specifically, males earn higher rates of return for having financial responsibilities (representing a 9.72 percent premium), for working with things (3.22 percent), having public contacts outside the firm (7.80 percent) and having jobs that require experience (2.49 percent).

One of the most interesting results from Table 2.5 is the rate of return divergence across sexes that exists for jobs requiring public contact outside the organization. This job characteristic is compensated with a 3.9 percent premium for each level (no contact, frequent contact, and continuous contact) for all workers taken jointly, slightly lower than the 4.1 percent premium given to 'contact within the organization'. This result, however, is considerably different when we estimate the model for each sex group separately (38). Specifically, males are rewarded for having contacts outside the organizaton, while females are compensated for their contacts within the organization. Males earn 8.6 times the amount females do for their public outside contacts (6.9 percent v.s. 0.8 percent). The reason for this result is, as described in Chapter I, that organization 1 relies heavily on maintaining contacts with outside individuals and corporations. Even

though the endowment difference is not largely favorable to males, the gains from having a job in which contact outside the organization is important are partial toward male workers. The outcome is, then, that we are faced with some form of unexplained bias, or, alternatively, that there is need for additional detail on the characteristics of jobs involving outside contacts.

Overall, the rate of return differential attributable to job characteristics is around 2 percent, with the rest, over 15 percent, due to disparities in the rates of return of human capital factors. The endowment differential, on the other hand, is concentrated on job characteristics, rather than on human capital variables. Human capital factor levels are similar across sexes, but they are not compensated equally. Job characteristics, on the other hand, although quite dissimilar across male and female jobs, are, for the most part, compensated evenly across sex groups.

Table 2.6 presents the results of calculating endowment differentials, rate of return differentials, and discrimination coefficients for organization 2. The inclusion of job characteristics into the model has significantly increased the discrimination coefficient, from 1.65 percent to 13.08 percent in favor of males. The largest sources of change between the models are rate of return disparities, which jump from 10.65 percent to 22.08 percent. The endowment differential, on the other hand, is not affected significantly when job characteristics are added to the human capital model.

A close look at the endowment and rate of return differentials allows us to

understand the source of the underestimation of the sex coeffiecient shown to exist when the 'partial' human capital model is estimated.

Female workers in organization 2 are found, on average, in jobs in which there are minimal physical movement requirements, higher required education and experience, and where less supervision is received. At the same time, females are concentrated in jobs with low supervisory assignments, unstressful and pleasant working environment, and less repetitive and structured work relative to that of the average male worker.

The aforementioned job characteristic distinctions between male and female workers imply that, if females were compensated for their personal and job characteristics with the male rates of return, they would have an 8.31 percent wage premium over men. Out of the 8.31 percent differential, however, 5.42 percent is due to differences in the human capital endowments between sex groups. Specifically, females have a net age advantage due to their higher age, and additional endowment advantages due to higher educational levels and a relatively lower number of single and non-white workers.

The predicted wage differential against females spurs exclusively from rate of return differentials. Of the 22 percent premium received by male workers, only 4.25 percent is attributable to favorable endowments. The rest, almost 18 percent, is due to unexplained advantages in the rates of return of job characteristics paid to male workers. Male workers are paid a 10.2 percent wage premium for each additional year of formal education, while female employees receive, on average, a

2.7 percent wage cut for every year of formal education. Required education alone represents a 32 percent wage penalty for female workers. This differential stems entirely from the rate of return disparity which favors men so drastically (39).

Females in organization 2 are in jobs with high educational requirements, as signaled by the endowment differential, but are rewarded far less than males for the same job characteristic. In fact, males receive a 12.1 percent differential for each additional year of formal education found in their job, whereas females, on the other hand, receive not only a lower wage differential than men as a premium to required education, but they are penalized with a 4.2 percent wage decrease. When required education is incorporated into the human capital model, then, the sex coefficient increases in absolute terms to reflect this fact.

This section demonstrates that introducing job characteristics into the traditional human capital model enhances our understanding of the causes underlying the observed earnings gap between male and female workers. Specifically, the discrimination coefficient for both organizations decreases significantly, and, in addition, the explained variance of wages in both cases is incremented substantially.

The fact that the discrimination coefficient decreases when job characteristics are included implies that the model is explaining the wage differential based on endowment differences. Nevertheless, female workers are earning less than male workers. This fact can be traced to the type of jobs females hold.

An interesting phenomenon is occurring in the estimation of the expanded

model: in organization 1, human capital variables represent a negligible portion of the total endowment differential, while their role in the rate of return differential is substantially higher than that of job characteristics. In organization 2, on the other hand, the situation is reversed. That is, human capital variables have an important impact on the endowment differential, whereas their role on the rate of return disparities is relatively insignificant.

As opposed to organization 1, male and female workers in organizaton 2 have low endowment-related wage advantages regarding job dimensions amongst them, while the rates of return paid to job characteristics are extremely skewed in favor of male workers. A substantial portion of this differential is due to an uneven treatment of required education between males and females.

In the next section we explore the influence that point-grades play in the determination of the male-female earnings gap. We demonstrate how gains in information accrued from using point-grades in our model are directly translated into lower discrimination coefficients and into a very high explanatory power of the model.

Wage Hedonics Including Point-Grade Information

MODELS AND RESULTS

In this section, we present the results of modeling the wage determination process of the firms under study utilizing point-grade information. We present results for two models: the first exposes the influence of grades on job assignments; the second demonstrates how the inclusion of point-grade information lowers the discrimination coefficients and affects the influence of certain personal characteristics on wages.

Including grade information in the model enhances its flexibility by complementing human capital theory with the administrative procedures that generate an internal labor market.

Table 2.7 summarizes the results of estimating the human capital version of the wage hedonic with the inclusion of point-grades as an explanatory variable. That is, we estimate

(2.8) LHW = f(P,GRD)

where GRD represent the point- grades (an important issue to keep in mind is that grade information for organization 2 is market-based, whereas the grade for organization 1 is not explicitly based on market wages).

The introduction of grades into the model for organization 1 increases its explanatory power, to 80 percent (40). The sex coefficient falls to -.03, representing an almost negligible 3 percent wage differential against females. The coefficients of most personal characteristics fall by a considerable magnitude with

TABLE 2 . 7

WAGE HEDONIC

ORGANIZATIONS 1 & 2

Dependent Variable : Log of Hourly Wage
Model : LHW = f(P, GRD)

ORGANIZATION 1

VARIABLE	COEFFICIENT	
Intercept	1.116 *	(20.15)
Age	.008 *	(3.73)
Age-square	-.0001 *	(3.87)
Education	.001	(0.75)
Seniority	.0005 *	(8.45)
Marital Status	-.012	(1.06)
Sex	-.030 *	(2.95)
Race	-.002 *	(4.11)
GRADE	.0027 *	(55.13)

R2 = .90
* = significant at 5 percent
() = absolute value of t-statistic

ORGANIZATION 2

Intercept	1.030 *	(9.27)
Age	.017 *	(3.50)
Age-square	-.0001 *	(3.28)
Educaton	.007 *	(2.47)
Seniority	.001 *	(7.62)
Marital Status	-.038	(1.67)
Sex	-.058 *	(2.27)
Race	-.084 *	(3.25)
GRADE	.0011 *	(9.27)

R2 = .85
* = significant at 5 percent
() = absolute value of t-statistics

the inclusion of grades into the model. Education, in fact, ceases to be significantly different from zero.

In organization 2, the addition of grades to the human capital version of the wage hedonic reduces the influence of sex on wages. The wage penalty for being female is now 5.8 percent, lower than the 7.8 percent and 11.3 percent resulting from the human capital model and the job characteristic model, respectively. The sex coefficient increases when job characteristics are added to the human capital model and falls when the market wage proxy is included (grades). This indicates that it is incorrect to make inferences about the influence of human capital endowments on wages (without controlling for grades) when the market treats the same endowment unevenly across jobs at the same time that males and females are concentrated in different jobs.

In organization 2, the market wage is absorbing the effects of sex on wages. The roots of the claim made by many comparable worth advocates who argue that the market is inherently discriminatory can be observed in our results for organization 2. The concentration of males and females in different jobs is reflected in the market wages. If discrimination in organization 2 occurs, it is partly because they follow the market evaluation of jobs and job characteristics (i.e. required education) in the determination of their wages. Additionally, not all job characteristics are valued equally across jobs, implying that, again, it is the market value of the job coupled with the male-female segregation that accounts for wage disparities.

TABLE 2 . 8

DISCRIMINATION COEFFICIENTS

ORGANIZATIONS 1 & 2

Dependent Variable : Log of Hourly Wages
Model : LHW = f(P , GRD)

ORGANIZATION 1

VARIABLE	ENDOWMENT	RATE OF RETURN
Age	-1.22	21.15
Age-square	0.74	-12.90
Education	0.00	-9.61
Seniority	0.34	0.00
Marital Status	-0.38	-0.88
Race	0.39	-0.21
GRADE	23.18	4.64

ENDOWMENT DIFFERENTIAL	23.05
DISCRIMINATION COEFFICIENT	5.69
WAGE DIFFERENTIAL	28.78

ORGANIZATION 2

Age	-13.72	38.56
Age-square	9.13	-23.06
Education	-0.93	3.89
Seniority	1.23	0.00
Marital Status	-0.28	-0.87
Race	-1.38	0.04
GRADE	2.42	11.32

ENDOWMENT DIFFERENTIAL	- 3.53
DISCRIMINATION COEFFICIENT	9.08
WAGE DIFFERENTIAL	5.55

The fact that the sex coefficient is significantly reduced when grades are added to organization 1's model does not imply, however, that grades are assigned irrespective of sex. In fact, it does not even imply, as we will see in Chapter III, that grades are assigned without the influence of market wages.

Table 2.8 presents the results of calculating the discrimination coefficient for both organizations when grades are included in the model.

The model predicts a 28.74 percent wage differential against female workers in organization 1 and 10.25 percent against female workers in organization 2. The discrimination coefficient, however, is reduced to 5.96 percent from 28.79 percent in the human capital model for organization 1.

Of the 29 percent wage differential predicted for the first firm, 23 percent stems from differences in the workers' endowments -- not even 3 percent is due to disparities in rates of return. The bulk of the endowment differential is found in the grade variable: if female workers had the male average grade they would earn a 23.18 percent higher wage. The average female worker has 85 points less than the average male worker, roughly a 21 percent wage differential when evaluated with the females' rate.

In organization 2, on the other hand, the largest part of the predicted wage differential cannot be attributed to endowment differences, but rather to differences in the rates of return. The average female worker in organization 2 would earn 11.32 percent more than she does now if she were compensated with the male rate of return to grades. That is, each point is worth more to male

workers than it is to female workers. The point differential, 22 points, represents a 2 percent gap against female workers evaluated with the females' rate of return.

Tables 2.7 and 2.8 show that females are concentrated in low grade jobs in organization 1. Of the 28 percent wage gap in favor of male workers, 23 percent is due exclusively to lower grades for female variables. The grading system in organization 1 is not explicitly (or even implicitly, according to some of its representatives) based on market wages. We saw how the market absorbs the effect of sex on wages in organization 2, where low market-valued jobs were compensated with low wages regardless of the endowment differentials in favor of the jobs. In organizaton 1, however, the lower female wages can be attributed to job assignment discrimination (in the form of direct employee discrimination), or to grade discrimination in the form of analysts' biases against females or toward the market.

As argued earlier, if anlaysts are hired to attract, retain, and motivate workers they will have to include some information on market wages into their model, implicitly or explicitly. If, as we contend and will show later, analysts can bias grades toward the market while assigning points to different job characteristics, then efficient estimators of the effects of personal and job characteristics on wages are obtained from a generalized least squares system of equations of the form

(2.9) $GRD = f(JC)$

$LHW = g(P, GRD)$

Tables 2.9 and 2.10 summarize the results of estimating system 2.9 for organization 1 (41).

TABLE 2.9

WAGE HEDONICS--SEEMINGLY UNRELATED EQUATION SYSTEMS

ORGANIZATION 1

Dependent Variable : Log of Hourly Wage
Model : GRD = f (JC)
LHW = g(P, GRD)

VARIABLE	COEFFICIENT	
Intercept	1.942 *	(20.10)
Age	.011 *	(4.80)
Age-square	-.0001 *	(4.77)
Education	-.0002	(0.12)
Seniority	.0008 *	(9.41)
Marital Status	-.012	(1.07)
Sex	-.043 *	(3.90)
Race	-.010 *	(0.80)
Financial Responsibility	-.092 *	(7.76)
Data	-.031 *	(5.58)
Things	-.030 *	(5.94)
Supervision Given	.041 *	(3.67)
Public Contact Within Organization	.047 *	(4.02)
Public Contact Outside Organization	.035 *	(2.52)
Working Conditions (stress, repetitiveness)	.020	(1.07)
Physical Environment	-.037	(1.37)
Monetary Sum of Financial Responsibility	.7E-7 *	(3.92)
Required Education	.025 *	(13.78)
Required Experience	..028 *	(6.20)
Vocational Training	.038 *	(4.81)

R2 = .80
* = significant at 5 percent
() = absolute value of t-statistic

TABLE 2 . 10

DISCRIMINATION COEFFICIENTS

SEEMINGLY UNRELATED EQUATION SYSTEM

ORGANIZATION 1

Dependent Variable : Log of Hourly Wages
Model : GRD = f (JC)
LHW = g(P, GRD)

VARIABLE	ENDOWMENT	RATE OF RETURN
Age	-1.11	0.00
Age-square	0.74	-3.12
Education	0.00	-6.86
Seniority	0.34	-0.76
Marital Status	-0.41	-1.11
Race	0.07	-0.21
Financial Responsibility	1.64	9.33
Data	-0.15	-13.15
Things	2.62	1.93
Supervision Given	0.85	-3.66
Public Contact Within Organization	-0.15	-3.46
Public Contact Outside Organization	0.06	7.50
Working Conditions (stress, rep.)	-0.32	-0.42
Physical Environment	-0.58	1.09
Monetary Sum of Financial Resp.	0.59	-0.09
Required Education	3.30	0.00
Required Experience	2.20	2.79
Part Time	1.00	-1.67
Vocational Training	2.01	0.01

ENDOWMENT DIFFERENTIAL	12. 70
DISCRIMINATION COEFFICIENT	13. 10
WAGE DIFFERENTIAL	25. 80

Results from Table 2. 9 indicate that estimating system 2. 9 yields a sex coefficient of -. 043, a 4. 3 wage differential against female workers. This coefficient is considerably lower than the one obtained from estimating the job characteristics wage hedonic (12. 7 percent) and much smaller than the result of estimating the human capital model (25. 3 percent). As we can see, then, modeling the wage-setting process of the firm as it is in fact practiced leads to a lower wage variance attributable to sex than if the model does not include grade information. Previous empirical studies, with the exception of Malkiel and Malkiel (1973), do not include grade information and are based mostly on national samples which do not contain homogeneous job characteristic measures.

In Table 2. 10, we see the discrimination coefficient calculations for system 2. 9. The discrimination coefficient falls to 13. 10 (from 16. 14 in the job characteristic model), again reflecting the gain in information about worker segregation within the firm accessed through grades. The endowment differential represents a 12. 7 percent wage disadvantage for female workers. This endowment disadvantage stems almost exclusively from job characteristics, as was the case in the job characteristics model. The discrimination coefficient, however, has completely changed its composition with the introduction of the system. Differentials due to disparities in the rates of return earned by human capital variables now represent a 12 percent differential against males, whereas this group accounted for a 15 percent differential against females in the job characteristics model.

The key difference is the result regarding age. The age functions of males and

females are now almost identical, with the only difference representing a 3 percent differential against males. This variable, in the job characteristics model, represented a 20 percent differential against females, as the age profiles were quite different across sexes. Use of the grading systems has eliminated the differential effect of age on wages across sexes. The elimination of the differential effect is due to the fact that the analysts know what the experience and age requirements are for different jobs and can include this information in the grade. If men and women vary in the time they spend in the labor force or in the type of jobs they choose (or are relegated to), this information is absorbed by the grade which will give lower grades to jobs where intermittent job participation is high. The additional effect of age on wages is negligible.

Conclusion

This chapter supports the human capital notion that workers' endowments are responsible for dissimilarities in their wages. Specifically, education and experience are compensated with higher wages, though the rate of return to the education endowment is not homogeneous across sexes. Additionally, we find that the male age-wage profile is steeper and peaks earlier than the female age-wage profile, supporting the evidence that males advance faster than women on the job ladder.

The human capital model, however, is uncapable of incorporating the forces behind job segregation. By including job characteristics into our model we confirm

the importance of job segregation in explaining the male-female earnings gap. Our measures of job characteristics include detailed information on the type of education needed for a job , in order to allow for differential treatment of vocational training. Results confirm that the inclusion of job characteristics reduces unexplained portion of the male-female earnings gap.

Including grade information in the model enhances its flexibility by complementing human capital theory with important administrative proceedures that generate an internal labor market. Our enhanced model, a combination of human capital theory and the internal labor market approach to job segregation, allows us to understand a significant portion of wage variation and reduces the biases and inefficiencies associated with interfirm data from national samples. Specifically, as seen in Table 2.11, the discrimination coefficient is reduced when grades are included in the model.

Having grade information from the Position Analysis Questionnaire allows us to substantiate the claim of many feminists (male and female) and Comparable Worth advocates regarding the inherently biased nature of the market: the sex coefficient falls when grades (a proxy for market wages) substitute our measures of job segregation -- job characteristics.

In order to verify whether administrative procedures characteristic of internal labor markets (such as grading systems) are subject to implicit biases, and whether the Comparable Worth doctrine is viable, in Chapter III we study the basic premises behind non-market grading systems.

TABLE 2.11

EXPLANATORY POWER AND

DISCRIMINATION COEFFICIENTS ACROSS MODELS

ORGANIZATIONS 1 & 2

DC = WAGE DIFFERENTIAL - ENDOWMENT DIFFERENTIAL

MODEL	ORGANIZATION 1		ORGANIZATION 2	
	R2	DC	R2	DC
LHW = f (P)	.52	28.79	.58	1.85
LHW = f (P, JC)	.82	16.14	.85	13.08
SYSTEM: GRD = f (JC) LHW = g (P, GRD)	.80	13.10	n.a.	n.a.
LHW = f (P, GRD)	.90	5.69	.83	9.08

n.a. not applicable

APPENDIX

In an effort to enhance our control over productivity characteristics that may distort the estimated influence of sex on wages, we constructed a measure of vocational training. The vocational training variable was obtained for organization 1, where we have a full set of jobs represented in the sample and where the personnel administrators have differentiated job titles based on levels of on-the-job training.

In the models using the vocational training variable presented in the previous sections of this chapter, we utilized both job and personal characteristics as explanatory variables in the determination of wages. Traditional human capital models, however, focus exclusively on the workers' personal characteristics.

In the human capital model estimated earlier we did not include information on the vocational training of the workers. Rather, we concentrated on replicating the traditional model used in previous papers. In this section we introduce information on the vocational training required by the job (which, by construction, is equal to the actual levels obtained by the workers), and we estimate the personal characteristics model presented above.

Table 2.12 presents the results of estimating the human capital model with and without information on the workers vocational training. The

inclusion of the vocational training variable affected the explanatory power

TABLE 2 . 12

WAGE HEDONIC-HUMAN CAPITAL THEORY & VOCATIONAL TRAINING

ORGANIZATION 1

Dependent Variable : Log of Hourly Wages
Model ; LHW = f (P)

	WITHOUT V@	WITH V
VARIABLE		
Intercept	1.143 * (9.31)	1.133 * (9.28)
Age	.033 * (6.34)	.031 * (6.07)
Age-squared	-.0004 * (6.96)	-.0003 * (6.64)
Education (years)	.035 * (10.82)	.037 * (11.17)
Seniority (months)	.001 * (9.45)	.001 * (9.44)
Marital Status	-.117 * (4.72)	-.116 * (4.71)
Sex	-.253 * (12.21)	-.234 * (10.94)
Race	-.321 * (14.22)	-.316 * (14.07)
Vocational Training	n. a	.053 * (3.35)
R-square	.52	.53

* = significant at 5 percent
() = absolute value of t-statistic
@ = V: vocational training

of the model and reduced the wage differential attributable to sex and race.

Specifically, the explanatory power of the model was increased by approximately 2 percent, while the coefficients of most variables remained very close to their original values. Nevertheless, despite its marginal influence on the explanatory power of the model, the vocational training variable is significantly different from zero and represents a 5. 3 percent wage

premium per year of additional training. Considering that the average male worker in organization 1 has four and one half months of vocational training and the average female worker has practically none, the wage differential in favor of males is about 2 percent. This result is reflected in the coefficient of the sex variable, which fell from 25.3 to 23.4 when we controlled for vocational training.

While including vocational training reduced the coefficient of most variables, it increased the effect of education on wages. This result implies that ommiting vocational training tends to underestimate the influence of education, a variable that is inversely correlated with vocational training.

Previous studies that have failed to distinguish between vocational training and formal education may have underestimated the effects of the latter and overestimated the influence of sex on the wage differential.

NOTES

(1) Hartmann and Treiman (1981). A very detailed and comprehensive review of the literature can be found in the study conducted by the aforementioned authors , sponsored by the National Academy of Sciences.

(2) Bergmann and Adelman (1973)

(3) Blau and Jusenius (1976) p. 189

(4) ibid p. 190

(5) ibid p. 193

(6) ibid p. 193

(7) The format of this section is based on the review articles of Lobue (1982) and Blau and Jusenius (1976).

(8) Blau and Jusenius (1976) p. 184 quoting Fawcett (1918) p. 2

(9) ibid p. 187

(10) Assuming a profit maximizing firm and an upward sloping supply of labor curve to the firm.

(11) Blau and Jusenius (1976) p. 189

(12) Hartmann and Treiman (1981) p. 62

(13) The reasons can be employers' distaste for hiring females for male dominated occupations, or perceived quality differences between genders.

(14) Clearly, evaluating the 'significance' of past papers is a very subjective process. Nevertheless, faced without having a non-arbitrary method to select the articles, we have chosen to do so based on the overall value of the methodological contributions of the works (e. g. Oaxaca , Blinder), on the identification of key explanatory variables (e. g. Malkiel and Malkiel) and on the informally-measured

number of times the article is quoted in the literature (we hope that the bias against recent articles implicit in this last selection criteria is minimal). For a very comprehensive bibliography we suggest Hartmann and Treiman (1981).

(15) A detailed description of the data can be found in the Appendices.

(16) Treiman and Hartman (1981) pp. 38-39

(17) Treiman and Hartman (1981) present a comprehensive review of studies that have looked at the earnings gap from a human capital perspective. When additional variables are added to control for occupational categories, or for specific jobs, the unexplained variance is reduced, as expected.

(18) The significance of this trait is discussed at length in Chapter I.

(19) Blinder (1973) p. 438

(20) Jones (1983) points out that the choice of omitted dummy group in the estimation and/or the actual measure of the independent variables affects the relative size of the intercept and coefficient differentials. Although this important finding rejects anlyses that focuses on the coefficient differential alone, it is not important for the bulk of the literature which bases it's analysis on the 'explained' and the 'unexplained' as the only two categories.

(21) Most of our firm-specific data, on the other hand, when coupled with grades to control for occupational differences, maintains its relevance. This will be expanded later in this chapter.

(22) Bergmann (1973) p. 152

(23) Blinder's structural model is underidentified, so, by assuming that the error terms in all his equations are uncorrelated with the error term in the wage equation (a block recursive system), he uses ordinary least squares to estimate the structural and reduced form wage equations. The structural model results are interpreted as the conditional expectation of the wage given the worker's past socio-economic condition, while the results from the reduced form regression are dependent only on the worker's circumstances at birth (family background , etc) . The comprehensive set of variables that allow Blinder to estimate both equations (although it is precisely a lack of sufficient data that forces him to assume uncorrelated errors — a strong and non-trivial assumption) is made up of personal characteristics, job characteristics, family background, regional location

information, local labor market data and worker category.

(24) Corcoran (1979) p. 218

(25) England (1982) abstract

(26) Malkiel and Malkiel (1973) p. 704

(27) Bridges and Berk (1974) p. 211

(28) Gordon and Morton (1976) p. 374

(29) Corocoran and Duncan (1979) p. 3

(30) Results for organization 3 are not presented in this and the following chapter due to the lack of personal characteristic information available for the sample.

(31) Regression results for separate male- female equations are found in Appendix B. The reported coefficients are rounded-off, however, all calculations using coefficients, however, are done using the complete number.

(32) Although our choice of cut-age is somewhat arbitrary, it was based on observation constraints, we feel that the age of 35 is a good breaking point between workers who take their job as permanent and those who are still willing, and eager, to change jobs if the opportunity arises.

(33) This support of Sawhill's hypothesis is complemented by our findings that non-single females earn lower wages than single females and that the age-wage profile for non-single females is flatter than that of single females. We did not find, however, that the age-wage profile for single females resembled that of males.

(34) This last result will be very significant in the continuing sections.

(35) The null hypothesis $\beta jc = 0$ is rejected with $F(14,767) = 75.68$, $F(14,285) = 43.50$ and $F(14,467) = 29.92$ for all workers, male workers and female workers, respectively, in organization 1. Results for organization 2 are $F(8,155) = 38.57$, $F(8,122) = 20.91$ and $F(8,32) = 20.07$ for all workers, male workers and female workers, respectively.

(36) Asuming males = 0 and females = 1.

(37) It is interesting to note that the endowment 'benefit' of being single for females only occurs because we are taking the male's rate of return as the base rate. When studying the effects of marital status on wages for females and males separately we find that females are compensated for being single while males are compensated for being non-single. This result is particularly important for it supports the human capital notion that females leave the labor force when they marry. This behaviour can be related to lower wages in two ways; lower labor force experience implies lower wages and/or, females choose jobs where intermittent participation is not penalized and these jobs are low-waged.

(38) Tables for male and female separate regressions are found in Appendix B.

(39) In Chapter III we will study the reasons behind this interesting phenomenon , as we show how the analysts can infer that the "female-type" job with high educational requirements is probably a librarian and, therefore, is priced with low wages (given the market wage structure of their grade).

(40) Malkiel and Malkiel (1973) also found that including a grade variable in their model raised the explained wage variance to levels above 90 percent. What Malkiel and Malkiel failed to do, however, was to study the nature of the grade determination process. They modeled grades as being determined by personal characteristics and concluded that discrimination in the firm they studied was in job assignment, not wage discrimination. The problem with their approach is that grades are not determined by personal characteristics, they may be correlated, but the causal link does not, and should not, exist. Rather, grades are a function of job characteristics and it is through segmentation that the aforementioned correlation stems. In Chapter III we show how discrimination in the presence of grades can exist through job assignment and through grade (wage) discrimination.

(41) As explained in detail in the last section of Chapter I, we do not include organization 2 in this analysis because their grade variable is explicitly a function of market wages, therefore, the efficiency of the estimators would not be improved at all if we estimated system 2.4 for organization 2.

CHAPTER III

THE COMPARABLE WORTH CONTROVERSY

Overview

This decade has witnessed an emerging struggle between public and private firms and female workers (1). " Women who are nurses, librarians, government employees, and clerical workers have assessed their skills and the requirements of their jobs and have argued that their jobs are underpaid relative to jobs of comparable worth -- that is, jobs requiring similar levels of skill, effort, and responsibility and similar working conditions -- that are held mainly by men. For many women, the slogan 'equal pay for equal value' has replaced the slogan 'equal pay for equal work', which is embodied in the Equal Pay Act of 1963" (2).

The main issue being dealt with by official and private organizations that seek to eliminate all forms of discrimination is no longer the identification of a discriminatory practice, but a solution to the problem. "Will employment discrimination be eliminated primarily through voluntary action or through government defined and enforced equality? Will it be done through affirmative action that creates opportunities and provides needed training or through meeting goals that are indistinguishable from quotas? Will society accept true mobility in employment as the essence of equal opportunity or must parity in employment be achieved? and if parity is to be the answer, *how and by whom will it be defined* and how quickly must it be reached" (3).

If men and women held the same jobs, unequal pay for equal work would be easy to identify and to correct. The fact is, however, that males and females do not hold the same jobs and that male-dominated jobs command higher wages than female-dominated jobs.

These issues point towards the study of compensation systems in search of elements that might provide clues as to where and how improvements can be made to allow for more equity in compensation. Comparable worth advocates are pursuing the generalized use of 'unbiased' point-grading systems to make work comparable across jobs. These systems, as described above, attempt to measure the relative contribution of each job to the overall product of the firm. This rough estimate of marginal productivity relies almost exclusively on two things: on the analyst's perception of the difficulties and complexities of the jobs, and on the dollar value that can be estimated for the tasks in the job. The main issue proponents of comparable worth have succesfully taken to court is that grading systems are often arbitrarily adjusted in a discriminatory manner. We propose to test whether or not the analysts can bias the grades toward market wages.

When an analyst is hired to implement a wage structure that attracts, motivates, and retains workers he/she will rely, in principle, on the market wages in the determination of the internal wages. Setting wages outside a reasonable range from the market wage will only alter the turnover rates and productivity will be affected as the quality of the workers begins to vary. Our contention is that analysts will have a market bias in their evaluation of the jobs,

if their objective is to maximize the profits of the firm. by creating a compensation system that is efficient in the relevant labor market where it competes for workers.

Reliance on the market assures efficiency , but Comparable Worth advocates contend that it also guarantees discrimination. Proponents of the doctrine argue that market-based wage structures are inherently discriminatory against females. Women have traditionally been relegated to few jobs, they argue, crowding their market and depressing their wages.

In brief

> " proponents contend that the marketplace has historically discriminated by establishing lower rates of compensation for jobs held predominantly by women and, in some instances, by minorities. They argue that any job has a certain inherent 'worth' to the employer, or perhaps to society at large, and that it is therefore possible to compare these 'worths' even though they do not require the same skill, effort, and responsibility and are not performed under similar working conditions (the Equal Pay Act standards). If this comparison indicates that a position held predominantely by women is paid less than a 'male' job of comparable worth, the difference in pay rates is presumed to be exclusively the result of past societal discrimination. Consequently, proponents argue that it is necessary to devise a common measuring system which is capable of assigning a numerical worth to each job, so that jobs which are dissimilar can be compared and their pays rates analyzed for possible discrimination" (4).

The ideological undertone of the Comparable Worth doctrine has stirred political controversy , and polititians have taken sides with respect to the

need of its implementation.

"When [Helen] Castrelli and eight other workers sued [the State of Washington], claiming sex discrimination, a federal-court judge in Tacoma decided in their favor. That ruling is now being appealed by state officials, with the Reagan Administration considering joining in the case against Castrelli and her co-workers" (5).

"The drive to raise women's pay is gathering strength again, this time under a new flag that could be a Democratic standard in the 1984 campaign" (6).

" Gary Hart and Walter Mondale have rushed to embrace the comparable pay principle. And the American Federation of State, County and Municipal Employees -- plaintiffs to the successful Washington State suit -- has filed similar discrimination charges against Philadelphia" (7).

Events following the controversial ruling of Judge Tanner in Washington State have focused on the serious economic, social, and political implications of the adoption of a compensation system based on the suggestions of Comparable Worth advocates.

The problem, however, is even broader. There remains considerable controversy regarding the basic premises underlying the Comparable Worth doctrine, and, in addition, there is no agreement on the type of 'mechanism' that should be used to homogenize wages across sexes and across firms.

Commenting on the 'mechanisms' used to assert the relative 'worth' of

jobs. C. Krauthammer (1984), an avid critic of the doctrine, stated: " ...the 'Willis' scale gives marks for 'knowledge and skills,' mental demands,' 'accountability,' and 'working conditions.' The committee then awards points in each category to every job, tallies them up, and declares those with equal totals to have — *voila!* — comparable worth.....Everything is arbitrary: the categories, the rankings, even the choice of judges" (8).

Following Gold (1983), we present a summary of the most controversial points that have led advocates and critics of Comparable Worth to a dangerous deadlock in thier 'negotiations':

1. **The male-female earnings gap**: Critics argue that there is no hard evidence that the earnings gap is caused by discrimination in the labor market. Furthermore, they maintain that much of the gap results from causes outside the market, many of them legitimate, like womens' free choice to become mothers and housekeepers. In those cases when forces outside the market are not legitimate, the critics of comparable worth consider that it is unfair to make an innocent employer pay for discrimination over which the firm has no control. Advocates of the doctrine, on the other hand, maintain that there is ample proof that a substantial part of the gap is caused by employers' discrimination. They argue that the dual labor market excludes females from good jobs and crowds them into jobs that are undervalued and

under paid.

2. **Job evaluations** : Critics argue that a job has no inherent worth, only a market value. They claim that job evaluations do not pretend to measure the real worth of jobs, instead, as practiced today, they rely on the market to establish the pay of key jobs. Job evaluations, in the eyes of Comparable Worth critics, are only a useful device for approximating the market value of jobs for which market rates do not exist.

For Comparable Worth sympathizers, however, job evaluations can measure the relative worth of jobs, even if they may not reveal the inherent value of jobs. Job evaluations that are market based are perpetuating market discrimination. The prejudice is built into the system.

3. **Solution** : Opponents of the doctrine argue that if the labor market is functioning improperly with respect to certain jobs, the right answer is to correct the imperfection, not subvert the market. Under no circumstances, they claim, should the market be abandoned as the institution that prices and allocates labor.

Advocates contend that comparable worth will not cause the government to price and allocate labor. Once the value of womens work is fairly determined, the market can be utilized for these purposes again. Until then, they claim, given the existing bias against women, the market cannot be used as a reference point.

4. **Title VII of the Civil Rights Act of 1964** (9) : Critics of Comparable Worth believe that Title VII was meant to guarantee equality of opportunities, not equality of outcomes. They feel Comparable Worth is not part of this guarantee. Advocates of the doctrine, on the other hand , feel that Title VII was enacted to overcome employment discrimination, including sex discrimination.

It appears that human capital differences are not enough to explain the earnings gap. Although the market reflects past discriminatory practices of employers and society in general, we do not think that existing job evaluation systems can be used to restructure the wage policy of firms across the country. This issue is the focus of the remainder of this chapter.

Without addressing the normative issue of whether past imperfections should be corrected once-and-for-all with the imposition of 'unbiased' grading systems, as opposed to opening more opportunities to females, we will show how two inherently different grading systems are equally highly correlated with the market. This result substantiates the claim that if any step is to be taken to compensate today's females for past discrimination against women , it should not be based on job evaluations as we presently know them.

"You can design a point- factor system to capture any set of values, any structure. When comparable worth advocates argue the point-factor system can be used for comparable worth, they are right — but what is the acceptable structure?

Society's got to decide the relative importance of jobs -- through the courts, through collective bargaining, through the marketplace.." (10)

As described earlier, there are several types of job evaluation techniques currently being used in businesses and government agencies throughout the United States. The most popular method, and one which seems to be the most applicable to the proposed Comparable Worth methodology, is the point-factor system that we introduced in detail in the Introduction.

The point factor system " begins by identifying a set of compensable factors, which are elements considered to be legitimate bases for pay differentials among jobs. Then scales are devised for measuring the extent to which the various factors are associated with jobs. Next, to take account that some factors are more important than others, the factors are weighted. Finally, each job is scored on the various scales; the weightings are applied; and each job receives a total score." (11)

A key issue regarding the controversy over Comparable Worth is the manner in which weights are determined in the point-setting mechanism. Our data has the powerful characteristic of containing two conceptually and methodologically different grading systems. First, we use the Position Analysis Questionnaire (PAQ), a method that explicitly selects compensable factors and weights so as to maximize the correlation between points and market wages. As explained in the Data Appendix, this method is based on a policy-capturing approach which judges success by the closeness of the grading hierarchy to the market wage rankings.

The second grading system we have access to claims to set the weights before

the jobs are scored. therefore no a-priori wage structure is in mind. The way these weights are set is a result of the firm's belief regarding legitimate bases of compensation. A high-paying job might receive a low grade, signaling the employer that the job is overpaid.

The issue that has been successfully taken to court by advocates of the Comparable Worth doctrine is that grading systems are arbitrarily adjusted in a discriminatory manner. In the case of grading systems such as the PAQ, this claim is not an issue: if the market is discriminatory the grades will also be discriminatory. Chapter II already presented evidence confirming this fact. The case for the grading system used in the other two organizations, however, is not as straightforward.

As the construction of the second grading index is outside our control, we use a set of job characteristics, formulated jointly with personnel experts from organizations 1 and 3, that allows us to estimate the implicit weights to various job characteristics given by the grading system and fit a relationship between our job characteristics and the index. The most important results of this exercise are presented in Chapter I, where one sees that our job characteristics are capable of explaining over 80 percent of the grade variation in organization 1. For organization 3 we can explain almost 80 percent of their variation.

Our job characteristics are not weighted a-priori, nor do they reflect a ranking of 'desireability'. We simply observe that a job requires the performance of job characteristics X and Y. An issue taken to court by Comparable Worth advocates is

that analysts assign characteristic X more points than to characteristic Y because they know that characteristic X is more common in male jobs and characteristic Y is more common in female jobs. The reason that analysts can 'afford' to do this while performing the job they were hired to do — attract and retain workers — is that female jobs command a lower market wage, on average, than male jobs.

In this chapter we focus on the relationship between the grade index and the market, given the 'common denominator' provided by our job characteristics. The next section presents a summary of the most important court cases that have led to the flurry of publicity recently received by the Comparable Worth doctrine. The review will permit us to identify the major sources of legal contention that will dictate the future of the controversy. We also present a detailed analysis of the effects of 'our' job characteristics on grades. This exercise paves the road to a final test of the grades' correlation with market wages. The following section presents a formal test to detect discrimination in the presence of a grading system. The value of this test lies in its reliance on actual wages and grades, and on the fact that, to date, it is not illegal to use the market as a guideline to set wages. The heart of the chapter is a model that allows analysts to estimate the sex of the worker by observing the characteristics of their job. We show how as the probability of being female rises, the points awarded to the job fall. Finally, we present a two equation model to show that job characteristics enter grades in the same way that they determine wages. The implications of this latter result are that even grading systems that do not explicitly acknowledge their dependence on market wages,

actually are correlated with the market.

Comparable Worth and the Law

Comparable Worth is not a law. There are two major federal laws that cover employment discrimination, the Equal Pay Act of 1963 and the Civil Rights Act of 1964. The latter states that:

> "No employer having employees subject to any provision of this section shall discriminate within any establishment in which such employees are employed, between employees on the basis of sex by paying wages to employees on such establishments for equal work on jobs, the performance of which requires equal skill, effort, and responsibility, and which are performed under similar working conditions, except where such payment is made pursuant to (i) a seniority system (ii) a merit sustem (iii) a system which measures earnings by quantity or quality of production, or (iv) a differential based on any other factor other than sex: Provided, that an employer who is paying a wage rate differential in violation of this subsection shall not in order to comply with the provisions of this subsection, reduce the wage of any other employee" (12).

The Equal Pay Act, then, requires employers to pay men and women the same wages if they work in the same firm under equivalent working conditions, doing the same work on jobs that require equal skill, effort, and responsibility. Title VII, on the other hand, bans employment practices that discriminate on the basis of race, color, religion, sex or national origin. There has been, however, considerable controversy regarding the scope of Title VII. Its broadness raises the question of "...whether Title VII goes beyond the Equal Pay Act to require parity in compensation between men and women performing jobs that are not 'equal under the standards of the latter Act, but are viewed as being of 'comparable worth' to the employer or perhaps, in a broader sense, to society at large" (13).

Even though the theory that Title VII requires comparison of dissimilar jobs on the basis of their relative 'worth' has been rejected by the courts on many occasions, it has been increasingly advocated by several socio-political organizations.

The recent case in Washington State where federal Judge Tanner ordered an increase in female wages exemplifies the renewed vitality of sex discrimination suits that began with the *County of Washington v. Gunther* (U.S. Sup.Ct., June 8, 1981) ruling early in the decade.

The controversy surrounding the Gunther case arose because the female matrons who guarded female prisoners in a county prison in Oregon were not being paid as much as the male guards in charge of the male section.

Arguing that they did the same work as men guards, female matrons complained to the prison administrators. Their pleas were unsuccesful as the response was that they were getting market wages and, additionally, that the prisoner-per guard ratio was not the same across sex-groups.

Having other slight differences in the context of their work, the results of a job evaluation that had been performed earlier showed that female matrons should be paid 95 percent of the wage paid to male guards. The county prison, however, was only paying them 70 percent of what males earned. The county argued that the difference in pay was exclusively due to market wages.

Female matrons took their case to court, arguing that they were doing 'comparable' work. The court, based on the Equal Pay Act ruled that since they were not doing the same work (in all respects), it was not required to consider the

mens' pay when it set the womens' wages. The judge of the trial ruled against the matrons and refused to see evidence that the jobs were comparable.

The decision was appealed, and the case was reinstated by a ruling of the State Supreme Court. Part of the ruling allowed the matrons to present the results of the job evaluation. The justices ruled in favor of the women.

The relevance of the ruling is the way in which it treats job evaluations. The only real evidence the women had that they were being underpaid relative to the 'worth' of the job were the job evaluations conducted by the county. By allowing the case to proceed, and by changing the ruling after new evidence was presented, the importance of job evaluations was greatly increased. **"The decision implied that if job evaluations are undertaken but are not then used for pricing, they can be used as evidence of discrimination"** (14).

However, the court "concluded that'a comparable work standard cannot be substituted for and equal work standard' in wage discrimination cases brought under Title VII (22FEP Cases at 1655). Rather, the court stated that a Title VII plaintiff claiming wage discrimination based solely on a comparison between men's and women's jobs 'would have to show that her job requirements are substantially *equal, not comparable,* to that [sic] of a similarly situated male' " (15). Clearly, the court stopped short from endorsing the Comparable Worth doctrine.

Westinghouse v. IUE is a case that was brought to court in 1980 where female workers and male workers had dissimilar jobs (quality control inspectors and materials handlers, respectively). But, women workers were not being compensated in accordance to the job evaluation points. They proved in court that

the jobs were initially rated as equal and that when the company's separate male/female job categories were merged into a single ranking system, the female jobs were assigned a lower grade.

In the Gunther case the male and female jobs were similar but had different evaluation points. In the Westinghouse case the jobs were dissimilar but had been assigned, initially, equal grades. "To date, no significant case has successfully combined those elements to present a situation in which dissimilar, unequally valued jobs are involved" (16).

Comparable Worth advocates argue that there is no legal basis for permitting a claim by quality control inspectors or prison matrons, but not allowing suits by librarians or nurses because there is no male-dominated position that is equally valued or similar in content to these occupations. The reason such a case (dissimilar and unequally valued jobs) has not yet presented itself in courts is that there is a requirement that there be some element of intentional discrimination. Even though judges allow evidence through job evaluations, it is easier to make a case when equally valued jobs or similar jobs are compared.

Comparable Worth advocates have not been successful in arguing that use of the market in the determination of wages is in itself discriminatory . In the *Christensen v. State of Iowa* 1977 case, female clerical workers claimed that they were being paid less than male physical plant workers for jobs that were of equal value to the organization. The organization claimed that it determined its wage scales for nonprofessional jobs by reference to wages paid for similar work in the local labor market. They added, however, that they had actually tried to

implement the wage rates suggested by a private consulting firm (the same firm we use for organizations 1 and 3), but that the local labor market paid higher wages for physical plant jobs than the levels recomended by the grading system. The court held that the plaintiff's argument against using the market misconstrued the purpose of Title VII. The court stated that:

> " Appelant's theory ignores economic realities. The value of the job to the employer represents but one factor affecting wages. Other factors may include the supply of workers willing to do the job and the ability of workers to band together to bargain collectively for higher wages. We find nothing in the text or history of Title VII suggesting that Congress intended to abrogate the laws of supply and demand or other economic principles that determine wage rates for various kinds of work. We do not interpret Title VII as requiring an employer to ignore the market in setting wage rates for genuinely different work classifications" (17).

Nurses in the city and county of Denver (*Lemons v. City & County of Denver)* claimed that the city's practice of paying jobs at Denver's market wages violated Title VII because society had placed an improperly low market value on nursing work given that the jobs where held by women. The case's Judge noted that he was aware of society's history of sex discrimination, but argued that Congress had not intended federal courts to be the determinants of the country's wage structure. The court stated that:

> " ...the relationship of pay for nurses to pay for other positions is obviously a product of past attitudes, practices, and perhaps of supply and demand...it became a part of the economic balance and relationships prevailing in the community among the myriad of positions prevailing in the

> job market...this type of disparity [wage disparities] was not sought to be adjusted the Civil Rights Act, and is not within the equal protection clause. The courts under existing authority cannot require the City within its employment to reassess the worth of services in each position in relation to all others, and to strike a new balance and relationship" (18).

Present law does not provide any support for the idea that courts should become involved in the process of evaluating jobs. Nevertheless, recent cases are being settled based on the use of evaluation mechanisms which, as we have argued earlier, have no reliable form or structure that could make them generalizable to all jobs.

Many firms use grading systems as a defense mechanism against potential suits. In the cases of institutions receiving federal aid, the use of grading systems is a common shield against governmental action. On many occasions, however, firms may behave as the organization in the Christensen case did: the sytem is used, but it is adapted to the local economic realities of the organization.

Job evaluations are gaining importance in court cases. They have been used to protect and defend existing compensation structures. They have also been used to prove discriminatory practices. This double-edged characteristic of job evaluations stems from the two-sided objective of their use. Proponents of Comparable Worth want to use evaluations to grade jobs before market considerations are introduced into the wage structure. Employers, on the other hand, are eager to use the grading systems in order to maintain their competitiveness in the local labor market.

Models and Tests

DETERMINANTS OF TOTAL POINTS

In determining the total points assigned to a job, the grading system in organizations 1 and 3 makes no explicit reference to market wages. This grading system, like the one used in the State of Washington court case, is based on four general compensable factors: accountability, know-how, problem solving, and working conditions. Only the last of these factors can be directly observed. That is, one can define working condition X (i.e. temperature level range, noise intensity, etc.), and proceed to verify whether or not the job has the requirements for condition X. Alternatively, one can observe each one of the components of X separately and either dichotomize the levels or assign a continuum of points. But, even after the levels (or verification of the presence of the characteristic) have been determined, there is no a-priori reason to assign more points to one level than to another (19).

The rest of the compensable factors used by the consulting firm hired by organizations 1 and 3 (accountability, know-how, and problem solving), are not directly observable. Point assignment for these factors must be based on observable tasks that are then transformed into the total grade. It is in this process that market induced biases can occur.

Without having information on the different "lower level" compensable factor that were used by the graders, we estimated their total points based on the job characteristics that we constructed. We estimate

(3.1) GRD = f (JC)

where GRD is the grade point total from the consulting firm and JC are the set of job characteristics described in Appendix A.

Next we present a formal statistical test for the correlation of grades and wages on job characteristics. In Tables 3.1 - 3.2 we present the results of estimating equation 3.1 for each organization. The second set of results included in these tables is the outcome of estimating the wage hedonic for each firm. The information gained from comparing the results across equations enhances our understanding of the way grades are determined.

It is immediately apparent that, in the assignment of points, characteristic X receives, relative to characteristic Y, the same weight as it does in the market.

Results in Tables 3.1 and 3.2 show that analysts have valued job characteristics in a very similar way to shadow prices determined with actual wages. If we assume that both organizations are paying wages that are close enough to the market to ensure them a 'normal' turnover rate, these results emphasize the implicit importance of market wages for the assignment of grades. As we will see later in this chapter, the specific firm requirements for each job, best exemplified by the public contact variables, are reflected in the assignment of points.

We have explained total points based on a set of job characteristics not necessarily observed or used by the graders. The models are capable of explaining a substantial portion of the grade variance, 82 and 75 percent for organizations 1 and 3, respectively. The variables we have chosen are based on a combination of data gathered from the Dictionary of Occupational Titles and from the most

TABLE 3 . 1

GRADE AND WAGE HEDONIC

ORGANIZATION 1

MODEL	GRD = f (JC)	LHW = g (JC)
VARIABLE		
Financial Responsibility	-31.30 * (12.90)	-. 097 * (7.34)
Data	-11.66 * (6. 45)	-. 036 * (5.70)
Things	-8. 14 * (5. 12)	-. 034 * (6.27)
Supervision Given	17. 58 * (4.93)	. 062 * (4.96)
Public Contact Within Org.	9. 15 * (2.41)	. 053 * (3.97)
Public Contact Outside Org.	9. 64 * (2.15)	. 032 * (2.04)
Working Conditions	6. 99 (1.16)	. 024 (1.14)
Physical Environment	7. 85 (0.92)	. 000 (0.02)
Monetary Sum of Fin. Resp per million dollars	50. 00 * (7.74)	. 089 * (3.90)
Required Education	8. 45 * (14.87)	. 025 * (12.57)
Required Experience	13. 88 * (9.58)	. 031 * (6.01)
Part-Time	-17. 28 * (3.14)	-. 061 * (3.18)
Vocational Training	5. 69 * (2.10)	. 052 * (3.83)

* = significant at 5 percent
() = absolute value of t-statistic

TABLE 3.2

GRADE AND WAGE HEDONIC

ORGANIZATION 3

VARIABLE	GRD = f (JC)			LHW = g (JC)		
Financial Responsibility	-14.94	*	(2.39)	-.015		(1.07)
Data	-13.28	*	(4.42)	-.054	*	(5.64)
Things	-4.22	*	(2.37)	-.021	*	(3.81)
Supervision Given	-1.83		(0.38)	.022		(1.48)
Public Contact Within Org.	14.58	*	(3.60)	.101	*	(7.84)
Public Contact Outside Org.	-7.44		(1.35)	-.050	*	(2.86)
Working Conditions	16.36	*	(1.98)	.061	*	(2.22)
Physical Environment	59.71	*	(5.56)	.064		(1.87)
Required Education	28.99	*	(19.49)	.055	*	(11.61)
Required Experience	10.39	*	(5.23)	.032	*	(5.08)
Vocational Training	-27.21	*	(2.87)	.137	*	(4.51)

* = significant at 5 percent
() = absolute value of t-statistic

common variables used to estimate compensating wage differentials. The variables are all easy to collect and weights are not assigned to them.

An additional, necessary step toward understanding the economic rationale behind the determination of total points is to analyze the determination of grades across sex groups. In Tables 3.3 and 3.4 we present the results of estimating equation 3.1 for males and females separately in organizations 1 and 3.

Tables 3.3 and 3.4 display the difference that exists in the way grades are being assigned for the same tasks across jobs. In organization 1, male workers receive significant rewards for complex data analysis requirements and for indispensable experience. Additionally, male workers are highly rewarded for being in jobs that require public contacts outside the organization. Female workers, on the other hand, are penalized for this same task. Also, having financial responsibilities, supervising workers, and having additional money in their budgets are job characteristics that are highly rewarded for female workers.

Overall, female workers in jobs with 'male' job characteristics (determined by using the mean endowments presented in the appendices) are compensated with higher grades and higher wages. It appears, therefore, that if females move into 'male' high-paid jobs they will receive the same salaries offered to men.

TABLE 3.3

GRADE HEDONIC FOR MALES AND FEMALES SEPARATELY

ORGANIZATION 1

Dependent Variable : GRD
Model : GRD = f (JC)

VARIABLE	Males			Females		
Financial Responsibility	-9.31		(1.62)	-29.37	*	(5.08)
Data	-17.00	*	(6.03)	-9.53	*	(4.44)
Things	-5.01	*	(2.05)	-7.83	*	(3.65)
Supervision Given	7.71		(1.34)	24.66	*	(5.68)
Public Contact Within Org.	9.86		(1.43)	10.98	*	(2.78)
Public Contact Outside Org.	27.89	*	(3.51)	-5.68		(1.15)
Working Conditions	-1.78		(0.17)	-7.02		(0.98)
Physical Environment	0.36		(0.24)	-4.63		(0.53)
Monetary Sum of Fin. Resp. per million dollars	30.00	*	(4.30)	70.00	*	(6.88)
Required Education	7.89	*	(7.55)	7.50	*	(12.67)
Required Experience	19.33	*	(7.89)	9.32	*	(5.29)
Part-time	-57.74	*	(3.36)	-15.13	*	(2.82)
Vocational Training	4.70		(1.35)	3.05		(0.20)

* = significant at 5 percent
() = absolute value of t-statistic

TABLE 3.4

GRADE HEDONIC FOR MALES AND FEMALES SEPARATELY

ORGANIZATION 3

Dependent Variable : GRD
Model : GRD = f (JC)

VARIABLE	Males		Females	
Financial Responsibility	-17.18 *	(2.34)	-6.66	(1.30)
Data	8.77	(1.74)	-40.04 *	(10.74)
Things	-3.99	(1.34)	7.45 *	(3.59)
Supervision Given	20.23 *	(2.61)	13.76 *	(2.33)
Public Contact Within Org.	11.39	(1.53)	0.10	(0.02)
Public Contact Outside Org.	23.89	(1.59)	-44.42 *	(7.21)
Working Conditions	-19.40	(1.62)	71.52 *	(5.41)
Physical Environment	67.97 *	(5.19)	169.27 *	(6.50)
Required Education	27.20 *	(9.68)	33.32 *	(23.90)
Required Experience	10.07 *	(2.73)	16.37 *	(8.30)
Vocational Training	-15.14	(1.00)	-45.93	(1.42)

* = significant at 5 percent
() = absolute value of t-statistic

The same results hold for organization 3, in which females in the sample earn higher wages than males and are in an overall better professional position. Physical environment is one variable that illustrates our general observation that there is a high correlation between grades and wages : less than 2 percent of the female workers in the sample work in unpleasant environments, while 57 percent of the male workers are in jobs with undesirable working conditions. The presence of this 'negative' job characteristic is rewarded (as indicated in Chapter I and in Table 3.2) both with higher points and with higher wages for both sexes. Females, however, have a 100 point advantage over males for being in a job with unpleasant working conditions.

The collection of job characteristics used in the previous exercises explain a significant portion of the grade assignment developed for organizations 1 and 3. Most job characteristics appear to be compensated or penalized in the same way the market compensates and penalizes them, as reflected by the shadow prices estimated in Chapter I.

Two important issues remain unresolved. First, if firms have grading systems, how can discrimination in the form of unequal pay for equal grades be detected? Second, is there a formal methodology to test for correlation between grades and market wages in the point assignment process. That is, can one determine whether a correlation between grades and market wages exists before analysts explicitly refer to the market to assign their wages.

The fact that males and females would be treated equally were they holding the

same job, does not imply that the grading system eliminates all non-market sex biases. As we saw in the previous section, many court cases have been based on tests of whether equally valued jobs (in terms of grades) are being compensated equally. The grading system used in organizations 1 and 3 does not make any explicit reference to the market until all points have been assigned. Court decisions have repeatedly ruled that following the market is not an illegal action, therefore, if a firm compensates workers in a way that is not reflective of the market and of the grading sytem, there is reason to suspect discriminatory pricing of labor.

In the next section we present a formal test for sex discrimination in the presence of a grading system in the wage-setting mechanism of firms. The second unresolved issue mentioned above will be dealt with in the last section of this chapter.

A Test for Equal Pay for Comparable Work

In this section, we develop a model to test the existence of unequal pay for comparable work for firms that have implemented a point-grading system in their compensation structure. The model allows for restrictions to be imposed across equations to test if the firm penalizes workers for being female in any way that is not fully reflected by the grades.

For many firms the use of grading systems has the side benefit of showing their workers that efforts are being taken to compensate their efforts more fairly. The likelihood that a firm will lose a discrimination suit when a grading system has been imposed is reduced if the system prices jobs according to the market (20).

It is important to separate the influence of sex on wages from the influence of sex on grades. The sex of the worker can be correlated to the grade assigned to a job in two ways: via biases in grade assignment, and from the fact that males and females are concentrated in different jobs.

The test presented in this section is designed to detect biases against females (or males) that are not related to the grading system. In the following section we present a model to analyze the market dependence of grades.

The test does not detect any occupational discrimination. It does not distinguish whether females are found in certain jobs, identified by the grades, because of their own choice or due to discrimination in job assignment.

Grades are determined by analyzing and evaluating jobs and their tasks. If analysts identify the job as being typically female (or typically male) and assign points based on their knowledge of the average earnings gap that exists in the

market between male and female jobs, their grades will then be a function of the job characteristics and the personal characteristics of the workers. That is,

(3.2) $GRD = f(P1, JC)$

(3.2a) $GRD = a0 + a1*sex + a2*race + \ldots + an*V + e$

where P1 represents those personal characteristics that could be highly correlated with a specific job (e.g. sex, race, etc).

Wages, with the use of grading systems, are determined by estimating a wage-line based on the grades and wages of key-jobs (21), and on the merit and seniority premiums of each worker (22):

(3.3) $LHW = g(P2, GRD)$

(3.3a) $LHW = b0 + b1*sen + b2*GRD + w$

(3.3b) $LHW = b0 + b1*sen + b2*(a0 + a1*sex + a2*race + \ldots + an*V + e) + w$

where P2 is the seniority and merit vector.

If wages were determined without the aid of grading systems the proper equation to estimate the weights of all relevant variables would be, as we saw in Chapter I,

(3.4) $LHW = c0 + c1*sen + c2*sex + \ldots + cn*V + \mu$

If the firm prizes and penalizes only personal characteristics inasmuch as they reflect the grading criterion, be it segregation and earning gaps due to occupational choice or job assignment discrimination, then the following restrictions must hold across equations 3.4 and 3.3b:

(3.5) $c1 = b1$

$c2 = b2*a1$

$c3 = b2*a2$

.

.

.

$ck = b2*a(k-1)$

where ck is the coefficient of the last personal characteristic in equation 3.4, and a(k-1) corresponds to the same coefficient in equation 3.2a.

To test if any sex group is being penalized with lower wages than those called for by the grade assignment, we impose a cross-equation nonlinear restriction on the sex coefficient. The restriction is imposed by substituting [ck / a(k-1)] * a2 for c2 in equation 3.4 (for any k greater than 1) (23).

The results of the test show that sex is not an important determinant of wages once job assignment has been controlled for (24). This finding implies that the hypothesis that the organizations under study do not compensate sex in any way that is not reflected by the grades is not rejected at a 5 percent significance level.

If women are earning less than men (in organizations 1 and 2), it is exclusively because they are in jobs evaluated as having lower worth to the firm. None of the firms under study could be found guilty of paying unequally for comparable work, given grades as the comparability criterion.

We have introduced a test that will statistically detect uneven pay for jobs with the same total points. The test relies on the existence of grading systems in the wage-determination process of firms. Unfortunately, biases can occur in the grade

assignment process, raising strong doubts about the soundness of using grades to compare jobs under the assumption that they are free of market biases. In the next section we present a model that can be used to determine whether analysts are biasing their assignment of points, and whether this bias is representative of sexual discrimination per se, or rather, a reflection of an implicit bias toward the market.

Analysts' Bias

IS THERE A BIAS?

The influence of the analysts a priori estimate of the incumbent's sex can bias the job evaluation. Studies have shown that analysts can accurately estimate the sex of the incumbent by simply knowing the job titles. Cascio and O' Reilly (1982) show that subtle biases might exist which undermine the effectiveness of job evaluation as a vehicle for assessing comparable worth . They find that judgments about the worth of identical jobs are shaped by contextual cues, with male cues resulting in higher evaluation points than female cues. The source of the bias stems from the fact that, historically, women have tended to concentrate on very few jobs, most of which command low wages. Analysts, in their attempt to construct a grading system that attracts and retains workers, will lower the grade of female jobs to obtain consistency with the lower wages that prevail in the market for those jobs.

We present a model to detect analysts' bias. We will show that the bias is not against females per se, but rather, reflects a correlation with the market that

underlies the objective of constructing a competitive wage structure for the firm.

Analysts grade jobs by evaluating the different requirements needed for a satisfactory performance of the job's tasks. In studying each task in a job the analyst can formulate an estimate of the sex of the incumbent. The more information the analyst has about the job, the more accurate his prediction will be. In short, analysts can estimate the probability that the worker is female based on the information they have on the characteristics of the job. That is,

(3.6) $P(f) = h(JC)$

where P(f) is the probability of being female.

Equation 3.6 can be estimated using Probit. To test if analysts are biased against female workers, we estimate

(3.7) $GRD = g(JC, P(f))$ (25)

using ordinary least squares.

Tables 3.5 and 3.6 present the results of estimating equation 3.7 for organizations 1, 2, and 3. One must keep in mind that organization 2 uses a proxy for market wages as their grade variable.

Tables 3.5 and 3.6 lead us to reject the hypothesis that analysts do not bias the assignment of points. The coefficient of the variable measuring the estimated probability that the worker is female is significantly different from zero and has a negative sign for all organizations under study. This implies that analysts use the information they have on job characteristics to determine the probability that the worker is female and then assign fewer points to that position as the probability increases.

Specifically, in organization 1 there is a 78 point differential against female workers exclusively due to the analysts' adjustments based on their estimate that the workers are female. This point difference represents a 20 percent wage differential in favor of male workers. In organizations 2 and 3, the wage differential against female workers attributable to analysts' biases stemming from the estimated probability that the incumbent is female are 16 percent and 23 percent, respectively.

TABLE 3.5

ANALYST BIAS

ORGANIZATIONS 1 & 3

Model : GRD = g (GRD, P(f))

Organizaton	1		3	
Variable				
Intercept	316.63	*	-73.01	
Financial Responsibility	-17.79		-1.40	
Data	-14.10	*	-18.35	*
Things	-3.00		-6.73	*
Supervision Given	11.74	*	-11.91	*
Public Contact Within Org.	5.48		20.37	*
Public Contact Outside Org.	13.08	*	-15.86	*
Working Conditions	-3.35		17.67	*
Physical Environment	6.81		22.93	
Monetary Sum of Fin. Resp. (per million $)	40.00	*		
Required Education	7.05	*	31.46	*
Required Experience	14.98	*	14.18	*
Vocational Training	3.90	*	-74.25	*
Probability of Being Female	-78.23	*	-100.29	*

* = significant at 5 percent

TABLE 3.6

ANALYST BIAS

ORGANIZATION 2

Model : GRD = g (GRD, P(f))

Variable		
Intercept	298.00	*
Supervision Given	45.73	*
Hazardous Job Conditions	0.85	
Body Movements	-14.04	
Stressful / Unpleasant Environment	-26.96	*
Structured / Repetitive Work	-19.28	*
Required Education	77.20	*
Required Experience	43.19	*
Supervision Received	44.05	*
Probability of Being Female	-175.76	*

* = significant at 5 percent

The wage differentials calculated above were obtained by multiplying the point differential by the grade coefficient estimated from the female grade hedonic with personal characteristics and grades. If we estimate the differential using the males' coefficient (the difference between the two also reflecting the analysts' bias), the wage differential attributable to analysts' bias jumps to 22 percent, and 19 percent in organizations 1 and 2.

The analysts' 'guess' of the incumbent's sex affects the grade given to the job. We have shown that analysts lower the points awarded to jobs as the probability increases that the incumbent is female. The question of whether this bias is against female workers is resolved: it is. The most relevant question, however, remains : is the bias against females reflective of sexual discrimination per se, or

is it a result of the 'hidden' market influence?

The nature of the first possibility precludes any attempt to solve the issue from being free of value judgments. Resolving the second question, on the other hand, can be done by observing the point assignment process and comparing it to the market mechanism of setting wages. Our data from organizaton 2 data founded on market observations. In what follows we present a series of examples, based on data from organization 2 , to show that the point-assignment process in organization 1 is correlated with market wages, and hence, represents a bias against female workers.

CORRELATION WITH THE MARKET

When analysts evaluate a job, they have two major tasks: first, they must assign points in a consistent manner across jobs in order to enhance the screening efficiency of the personnel department of the organization. Second, they must use grades to structure the compensation policy such that the organization can attract and retain workers.

In the last section we saw how analysts can estimate the probability that a worker is female by studying the job characteristics of the position. The more information the analyst has about the position, the more accurate his estimate will be. Additionally, the more accurate his estimate is, the lower the risk of assigning fewer points to a job that commands higher wages in the market. The following tables show the effect that omitting information would have on the coefficient of the probability of being female variable. We will then use these results to show how grades are highly correlated with market wages.

TABLE 3. 7

ANALYST BIAS-MARKET BIAS

ORGANIZATIONS 1 & 2

Model : GRD = h(JC, P(f)))

Organization 2

Variable	All JC @		No Required Education	
Intercept	298.00	*	243.60	*
Supervision Given	45.73	*	77.93	*
Hazardous Job Conditions	0.85		26.45	*
Body Movements	-14.04		-2.85	
Stressful / Unpleasant Environment	-26.96	*	-39.78	*
Structured / Repetitive Work	-19.28	*	-35. 29	*
Required Education	77.20	*		
Required Experience	43.19	*	47.50	*
Supervision Received	44.05	*	97.42	*
Probability of Being Female	-175.76	*	-32.21	

Organization 1

Variable	All JC		No FR		No PT	
Intercept	316.63	*	414.19	*	319.40	*
Financial Responsibility	-17.79				-16.66	
Data	-14.10	*	-20.18	*	-14.62	*
Things	-3.00		10.32	*	-2.89	
Supervision Given	11.74	*	-6.26		10.60	
Public Contact Within Org.	5.46		5.87		4.82	
Public Contact Ouside Org.	13.08	*	20.66	*	13.79	*
Physical Environment	6.81		-46.67	*	-13.46	
Monetary Sum of Fin. Resp. per million dollars	40.00	*	20.00	*	40.00	*
Required Education	7.05	*	3.22	*	6.86	*
Required Experience	14.98	*	15.56	*	15.47	*
Part-Time Work	-15.35	*	-9.68	*		
Vocational Training	3.90		0.14		4.08	
Probability of Being Female	-78.23	*	-284.80	*	-86.20	

* = significant at 5 percent

@ = JC : job characteristics, FR : financial resp. , PT : part-time

Although the static analysis of wage determination processes results in the hypothesis that grades are influenced by market wages, our exercises will not disclose this causal relationship. Through time, grades have been used to set wages for firm-specific jobs and, in turn, market considerations have influenced the choice of both the weights and the compensable factors used by personnel administrators. This dynamic simultaneous process where firms and workers negotiate wages and set grades across thousands of local labor markets does not permit us to determine the causal relationship between grades and market wages. At any one point in time, however, an individual firm will set grades that will not be instantaneously reflected in the market. Rather, the firm will use existing market wages to determine their grades. Our analysis is in a static framework. Therefore, even though we cannot formally test for causality, we will refer to the correlation findings as a 'bias toward the market'.

The first exercise presented in Table 3.7 is based on the omission of information regarding required education in organization 2. If analysts (in this case the market) had information on all job characteristics except required education, they would lower the grade by 32 points to account for the probability that the worker is female. Given the available information, the probability variable weights little in the determination of the grade. There is not enough evidence to be sure that the job is a 'female-type' job. When analysts have information on all characteristics, on the other hand, the coefficient of variable P(f) becomes highly significant and very negative.

The process at work in this exercise is easy to detect: analysts, once they have information on the required education of the job, can 'safely' penalize females while rewarding education. By doing this, they can maintain parity with the market by grading in a way that reflects the lower value of education for female jobs.

The grading system in organization 2 is in fact based on market wages. The exercise presented above in reality represents the way the market is working. Education is a job characteristic that is rewarded by the market, however, for jobs like librarians and nurses, where education is important but market wages are low, there is no need to compensate for education in the same way that is needed in the case of other professions. The way in which the grading system reflects this market reality, and maintains a consistency across jobs, is by allowing the probability of being female to absorb the market conditions faced by each job while permitting all other variables to reflect their unbiased market weights.

In organizations 1 and 3, grades have been assigned without explicit reference to the market. In fact, only when the wage-grade line is estimated do market wages enter into the compensation structure. Nevertheless, if we study the point assignment process for these firms we can find that the exact same mechanism that was described for organization 2 is occurring in organizations 1 and 3. This indicates that analysts for organization 1 and 3 are taking the market into account when they assign points to the different job tasks.

To substantiate our last assertion, we present two examples from organization 1 in Table 3.7. If analysts have all the available information on job characteristics there remains a 78 point differential against female workers based on the probability of being female variable. If analysts have no information on, say, the financial responsibility required by the job, the grade differential attributable to the probability of being female variable is 284 points. Financial responsibility is a job characteristic that is rewarded more favorably for women than for men. Females, however, have lower levels of financial responsibility. When the variable is included in the information set faced by the analyst it commands higher points, given that it is rewarded in the market. The probability of being female, however, is negatively correlated with increasing levels of financial responsibility and positively correlated with the returns to higher required financial responsibility. This implies that when analysts have full information they can reward higher levels of financial responsibility (recall that the negative sign is consistent with the ordering of the financial responsibility levels) while lowering the penalty for being female without sacrificing any consistency with the market.

This last result is consistent with the one presented for organization 2, in which analysts rewarded higher education, but increased the penalty for being in a female job because required education commanded lower wages for males than for females in the market. In the case of financial responsibility in organization 1, the market values financial responsibility more for females than for males, hence, as the reward to this variable is increased, the penalty for being female is lowered.

The second example for organization 2 focuses on Part-Time, a variable for which females are penalized less in the market than males, on the other hand, females have a higher relative number of part-time workers than males.

If analysts have no information on the time-structure of the job (full-time v.s. part time), they penalize the probability of being female with 88 points, a 20 percent wage differential. If the analysts knew that the job was part-time, and therefore, accompanied with a higher probability that the worker is female, they would penalize the probability of being female less, but would punish the part-time variable with a 15 point penalty. This behavior is consistent with the fact that having a part-time job is a 'bad' job characteristic and that females are penalized less relative to males, in the market, for having jobs with this characteristic.

All three examples presented above outline how the weight of the probability of being female variable in the grade determination process is closely related to the relative value that the market places on each job characteristic across sexes and across the rest of the job characteristics. Our results do show manipulation at the disposal of analysts, at the same time, however, there is a feature which complicates the interpretation of the results: omission of key variables is shown to affect P(f) significantly. A skeptic, therefore, can claim that the significance and sign of the P(f) coefficient variable we have estimated is due to omitted variables.

Information on the job charcteristic mix of jobs allows the analyst to estimate the sex of the incumbent. This information is then merged with the job description to assign grades. Grades assigned to different jobs depend on whether the job is

likely to be a 'female-type' job and on the market value of the job characteristics for females relative to their value for males.

The common mechanism underlying the point-setting process for both firms confirms our hypothesis that grades in the non-market-based point system are in fact correlated with market wages.

Having information on all relevant personal characteristics of workers in organization 1 allows us to perform one additional test to verify the grader's implicit reliance on the market (26): assuming analysts have no information on the personal characteristics of the workers, grades are determined by evaluating the job characteristics of the position. That is,

(3.8) $GRD = f(JC)$

The market determined wage hedonic with no information on grades is a function explaining wage variations by differences in the personal characterisitics of workers and in the job characteristics of each position, then,

(3.9) $LHW = g(P, JC)$

Following the same process described in the last section to detect sex biases, we can impose nonlinear restrictions across equations 3.8 and 3.9 to test for the influence of market wages on the relative weight of job characteristics in the determination of grades. This test focuses on the grade bias toward the market without distinguishing between sexes.

Table 3.8 presents the results of testing each of the job characteristics for organization 1. Ten out of 13 job characteristics are assigned grades in a way that

is fully consistent with the market. The influence of job characteristics on points is determined by their influence on market wages. These results, then, confirm the fact that grades are correlated to the market valuation of most job characteristics. When combined with the results presented in the last exercises, we have a set of tests that empirically show that grades are biased and, furthermore, that the observed biases against female workers is a reflection of the different shadow prices commanded by their job characteristic mix (the job's wage) in the market.

TABLE 3. 8

MARKET BIAS

ORGANIZATION 1

Model : GRD = JC
LHW= P, JC

	Loglikelihood	-2*(Lr-Lu)	Chi-square restr. = 1
Unrestricted Model	-3793. 88		
Restricted Model			
Variables Restricted:			
Financial Responsibility	-3794. 56	1. 36	*
Data	-3794. 53	1. 30	*
Things	-3798. 03	8. 30	
Supervision Given	-3794. 68	1. 60	*
Public Contact Within Org.	-3797. 11	6. 46	
Public Contact Outside Org.	-3794. 29	0. 82	*
Working Conditions	-3793. 91	0. 06	*
Physical Environment	-3795. 33	2. 90	*
Monetary Sum of Fin. Resp.	-3798. 79	9. 82	
Required Education	-3794. 77	1. 76	*
Required Experience	-3794. 18	0. 60	*
Part-time	-3794. 30	0. 84	*
Vocational Training	-3795. 28	2. 80	*

* = significant at 5 percent significance level
Chi-squared with one restriction at 5 percent significance level = 3. 84

Conclusion

With a set of job characteristics designed to be compatible with previous work on compensating wage differential theory and on the male-female earnings gap controversy, we successfully explain approximately 80 percent of the point assignment process of a grading system that does not make explicit a-priori use of market wages to set its points. Utilizing a second grading system that does base its points on a market-determined wage index we trace the effects of market wages on points and identify a mechanism of adjustment that is also present in the non-market based grading system. The common mechanism underlying the dynamics of the point-setting process for both firms confirms our hypothesis that analysts for the non-market based system are in fact assigning points that are highly correlated with market wages. An additional effort to further substantiate our contention, based on cross-equation tests for job characteristics, shows that a majority of the tasks are rewarded with grades that are compatible with the shadow prices of the job characteristics.

Job evaluations, even when created without explicit reference to the market, do not measure "worth" any way that is not contained in the market. Schwab (1980) described the mechanism which connects the market with the point assignment process based on a model that assumes that analysts attempt to maximize the hiring efficiency of firms. His theoretical results lead him to conclude that "Job variables are only used to generate a market wage estimate for jobs where such estimates are difficult to obtain from the market itself. The choice

and weighting of job content variables are based, therefore, on a criterion of wages, and not on a criterion of worth" (27).

Our models and data support the notion that existing grading systems are correlated with the market valuation of jobs, as a result of the primary objectives of the grading systems themselves: enhanced competitiveness for the firm in the labor market. This result calls into question the success of using the systems in their present form to correct market distortions, even if they are used before any explicit reference is made to the market.

NOTES

(1) The rapid increase in legal suits that has taken place regarding sex discrimination during this decade has become an issue of such political importance that Presidential Candidate Walter Mondale explicitly mentioned his favor toward the Comparable Worth principle in the first debate with President Ronald Reagan on October 7th, 1984.

(2) Treiman and Hartman (1981) pp.1-2

(3) Livernash R. E. (1980) p. iii-iv. Italics are mine.

(4) Kenneth C. McGuiness President: Equal Employment Advisory Council in Livernash (1980) p. v

(5) Jake Lamar Time Februray 6, 1984. We present a summary of the most relevant court rulings regarding comparable worth in the next section.

(6) Robert Hershey The New York Times October 31, 1983

(7) Neal Peirce The Philadelphia Inquirer April 30, 1984

(8) C. Krauthammer (1984) p. 17

(9) The legal aspects of Comparable Worth are discussed in the next section.

(10) G. Milkovich in John Bales, The American Psychological Association Monitor March 1984

(11) M. E. Gold (1983) p.41

(12) 29 U.S.C. § 206 (d)(1)(1970)

(13) Livernash (1980) p. 199 (article by McDowell and Williams)

(14) Bureau of Law & Business, Inc. (1982) p. II-5

(15) Livernash (1980) p. 240

(16) Bureau of Law & Business, Inc. (1982) p. II-9 This handbook has a very complete analysis of the court cases dealing with sex discrimination and, specifically, comparable worth.

(17) Livernash (1980) p. 241 from 563 F.2d 353,356 (8th Cir. 1977)

(18) Livernash (1980) p. 243 from 620 F.2d 228, FEP Cases 959 (10th Cir. 1980) and 620 F.2d at 229, 22 FEP Cases at 959-60.

(19) Chapter I deals extensively with this issue.

(20) This issue, as seen below, is a major source of contention between advocates and critics of the comparable worth doctrine.

(21) Key jobs are jobs whose wages are determined exogenously for the firm. In terms of the internal labor market model, it refers to entry level positions for non-firm specific jobs.

(22) We only have information on seniority .

(23) A generalized restriction for any personal characteristics in this model is to substitute [ck / a(k-1)] * aj for cj in equation 3. 4 for any k greater than 1 and any j greater than one. The actual test is done by comparing the log-likelihood of the restricted and the unrestricted nonlinear system of equations. We estimate equations 3. 2a and 3. 4 with generalized least squares. The two systems, restriced and unrestricted, yield log-likelihood estimates from which we calculate the chi-square with one effective restriction.

(24) The Chi-squares for all three firms are below 3. 84, which represents a 5 percent significance level.

(25) The degree of multicollinearity between the two sets of independent variables will depend on the correlation between the actual sex of the incumbent and the predicted value of the probit regression. In no case was it necessary to omit job characteristics from equation 3. 6

(26) The sample from organization 3 does not include important personal characteristics that are correlated with wages and with job characteristics. This fact prevents the results from this organization, regarding the tests in this section to have any validity given the omitted variable biases found in the job charcteristics of the wage hedonic.

The market-dependence of points in the grading system of organization 2 make the following test unecessary for that organization.

(27) Schwab, D. (1980) p. 76 in Livernash (1980)

CONCLUSIONS

This study has been concerned with the role that job characteristics and point-grading systems play in economic analysis. The study of Adam Smith's equalizing wage differential theory and the male-female earnings gap, both rely on the understanding of job characteristics and point-grading systems.

Previous empirical studies of the equalizing wage differential theory have focused on single equation wage equations that include only a small number of job and personal characteristics. Most previous research has utilized inter-firm data based on national surveys, in addition, these studies do not utilize information on the grading systems used by firms to determine their wage structure. Previous results have found many variables to be insignificant and/or wrong-signed.

Our model utilizes both intra-firm and inter-firm data to show how homogeneity of job characteristics across firms is an important requirement that must be satisfied for the testing of Adam Smith's hypothesis. Increasing the number of job and personal characteristics and measuring them by direct observation, rather than by surveys, has reduced potential biases in the estimators.

An important requirement for attaining homogeneity of job characteristics across firms and accurately measuring the shadow price of job characteristics is the inclusion of grade information into the model. We have increased the efficiency of our estimators by modeling the wage determination process of firms in a way that reflects the actual procedures used in most medium and large firms in the

United States.

Our results have shown sytematic support for the theory of equalizing wage differentials. That is, after controlling for the specific needs of each organization, through the utilization of point-grade information, workers receive higher wages as compensation for having jobs with stressful and repetitive tasks; for working with tools, machinery, and equipment; for supervising other workers; for having hazardous job situations; for having vocational training; and for being in jobs with high educational requirements and high required experience.

The result that tasks associated with higher supervisory jobs, educational requirements, and vocational training are compensated with high wages confirm that there are rewards to omitted skills not fully reflected in traditional models that use only education and age variables.

Job characteristics and grading systems not only aid in the estimation of compensating wage differentials, but are also useful in enhancing our understanding of the male-female earnings gap. While our data supported the human capital notion that worker's endowments are responsible for dissimilarities in their wages, we have demonstrated that the human capital model is uncapable of incorporating the forces that generate job segregation. By including job characteristics into our model we confirm the importance of job segregation in explaining the male-female earnings gap.

The inclusion of grade information into our model enhanced its flexibility by complementing human capital theory with important administrative procedures

that are part of an internal labor market. The enhanced model allows us to understand a significant portion of the earnings gap and reduces the biases and inefficiencies associated with inter-firm data from national samples. Discrimination coefficients were calculated with alternative models and our results show that this statistic falls considerably when point-grade information is included in the model.

Using a grading system that is explicitly market-dependent we were able to substantiate the claim of many Comparable Worth advocates regarding the inherently biased nature of market wages.

With a set of job characteristics designed to be compatible with previous work on compensating wage differential theory and on the male-female earnings gap controversy, we explain approximately 80 percent of the point assignment process of a grading system that does not make explicit a-priori use of market wages to set its points. Utilizing a second grading system that does base its points on a market-determined wage index we trace the effects of market wages on points and identify a mechanism of adjustment that is also present in the non-market based grading system. The common mechanism underlying the dynamics of the point-setting process for both firms confirms our hypothesis that analysts for the non-market based system are in fact influenced in their point assignments by market factors. An additional effort to further substantiate our contention, based on cross-equation tests for job characteristics, shows that a majority of the tasks are rewarded with grades compatible with the shadow prices of the job

characteristics.

Job evaluations, even when created without explicit reference to the market, do not measure 'worth' any way that is not contained in the market. Our models and data support the notion that existing grading systems are highly correlated with the market valuation of jobs as a result of the primary objectives of the grading systems themselves; enhanced competitiveness for the firm in the labor market.

Whether or not females' lower average wages are a result of discrimination, directly in the grading process, or indirectly through references toward an 'inherently discriminatory' market, the solution to the problem does not lie on the use of grading systems, stripping them from their 'market-connections', as a means to reduce the earnings inequalities. The Comparable Worth proposal leads to administrative wage control for the entire economy. Opting for this type of economic system, however, would not eliminate the market biases inherent in the existing grading systems. Committees with representatives of all labor groups involved (and nobody can claim that the doctrine should or could not be generalizable to all labor groups) will have to gather and assign new points to new characteristics in a way that everyones' peculiar talents weigh as much as everybody else's in the determination of wages.

Court cases have seen job evaluations used as a means to show how equal points have not been rewarded equally. They have also witnessed cases in which the main argument is that the grading system is unfair because it is biased toward the

market. Grading systems, although they have been used for many years and have served their original purpose quite well, are not designed to assign wages in a non-market based fashion. If the final solution to the Comparable Worth controversy will be an arbitrary selection of compensable factors and weights to ensure a 'fair' compensation (reduce the earnings gap), this can be easier and done more cheaply by arbitrarily enforcing a wage increase for female workers.

The market distortions created by such a policy, the dynamics of which would be similar to those of imposing a tax on only one input, should be weighed against the social benefits that would arise from its implementation. The decision of whether to implement the policy or not will not be based on any statistical exercise. However, what can be tested formally is the methodology by which the policy would be implemented. Existing point-grading systems are designed to be market-dependent. Forcing different parameters or weights into the system will not transform an inherently arbitrary procedure into a valid, unbiased, scientific exercise.

DATA APPENDIX

DATA

The empirical study of wage differentials, as an attempt to verify the theory of compensating wage differentials, or, with an emphasis on the understanding of earning gaps across groups of workers, is based on differences in personal and job characteristics across individuals.

The data for this study were collected from three different organizations. As will be explained shortly, the data are not entirely homogeneous across organizations, also, the different analyses are not done for all three organizations. Each test, however, is shared by at least two of the organizations.

We collected information on three sets of variables: first, on the personal characteristics of workers. Second, on the characteristics of their jobs and third, on the points assigned to their jobs by job analysts.

All the data were gathered by the author. The personal characteristics of workers in organizations 1 and 3 were obtained through computer listings and tapes, whereas for organizaton 2 they were taken directly from their personnel files. Organizations 2 and 3 agreed to share information on the personal characteristics of their workers with the author in exchange for assistance with the implementation of an evaluation system . The data on job characteristics for organization 1 were gathered jointly by the author and one of their personnel administrators . Information on the job characteristics for the second organization was collected by the author, the personnel administrator of the

organization , an 'expert' analyst, and a personnel executive. For the third organization, the information was collected by the author, a second analyst and four psychology graduate students that had been trained to do job anlaysis. The data-collection process for the point-grades will be explained below.

Table D. I summarizes the data bases:

Table D. I

Data Bases

ORGANIZATION	PERSONAL	JOB	GRADES
1	FULL	TYPE A *	TYPE A
2	FULL	TYPE B**	TYPE B
3	INCOMPLETE	TYPE A	TYPE A

* Name of consultants is confidential
** Position Analysis Questionnaire

Organizations 1 and 2 have in common a very complete set of personal characteristics data, however, they have different grading systems and job characteristics. Organization 3, on the other hand, shares the grading system and job characteristic measures with organization 1. It does not have, unfortunately, a complete data set on personal characteristics .

In order to introduce the different data, to explain their relative advantages and disadvantages, and to describe the tests for which they are each best suited, we begin by reviewing each set individually (personal characteristics, job

characteristics and grades), and later comment on the specific organizational constraints.

PERSONAL CHARACTERISTICS

The information available on the workers personal characteristics is quite comprehensive and contains a majority of the variables used in previous empirical work. Table D. II presents the variables that were common to organizations 1 and 2 and that were used as control variables while testing the equalizing wage differential theory.

All the data were obtained from the personnel files of the organizations. The information is a cross section of all part-time and full-time workers officially on the payroll on December 15, 1983.

Previous empirical research has tested the effects of each of these variables on wages. In Chapter II we test for the relevance of these variables in our models. There are two ways in which students of the compensating wage differential theory control for the effects of personal characteristics on wages while observing the behaviour of job characteristics: first, one can include the personal characteristics in the model as independent variables, or second, one can estimate a hedonic with only job characteristics across groups that are entirely homogeneous with respect to the personal characteristics.

Most previous work that has been done using the second alternative has concentrated on three biographical variables: sex (only males), education, and age. Our access to a very complete set of personal characteristics with a limited

number of observations forced us to choose between using all the relevant data with the first estimation method and using only a few of the personal characteristics with the second approach. We opted for the former as there is no clear advantage in using homogeneous groups if we can control for the personal characteristics by using them as independent variables. We estimate our hedonics using a larger number of observations and controlling for a greater number of significant personal variables.

Either because there is a causal relationship being reflected in the estimation results (i.e. seniority commands wage increases), or because a given characteristic is 'for some reason' correlated with wages (i.e. females are found in lower-wage jobs), we expect to find that :

a) Wages will increase with age at a decreasing rate, reaching a peak at a higher age for men than for women--i.e. The age-wage profile is a quadratic function with a higher slope for males .

b) Education is positively related to wages

c) Seniority is positively related to wages

d) Non-single males earn higher wages than single males , while the reverse is true for females.

e) Being female is negatively correlated with wages

f) Being non-white is negatively correlated with wages

The theories behind these hypotheses, as well as the results of our tests are explored in Chapter II .

Table D. II

Biodata

VARIABLE	CODE *
Age	AGE
Education	YRED
Seniority	SEN
Experience	EX
Marital Status	MS
Sex	SEX
Race	RACE

* Appendix A contains the full description of the data including the complete list of available series as well as the specific units of measurement.

JOB CHARACTERISTICS

The data we have collected on job characteristics and the point-grades are the most unique contribution of the study.

Job elements (characteristics) are divided into two main classes: 'job-oriented' and 'worker- oriented' elements. Job oriented characteristics are represented by tasks such as repairing equipment or final goods, operating tools and machinery, etc. They characterize job activities by what is accomplished in the job, reflected in terms of the actual production processes. Worker oriented job elements characterize the human patterns that are usually found when the activity takes place. For instance, the use of smell, taste, and touch; the depth of the mental

requirements: even the physical activities involved in the completion of the job.

The data for both types of elements are collected through job analysis. In the job-oriented approach a task inventory is prepared by the analysts and the incumbent. The worker will indicate whether each task is part of the job and, if so, to what extent (measured in proportion of time or in degree of frequency). Worker-oriented approaches include tasks that are common to all jobs, as well as job-specific tasks. An interview is held in which a set of about 190 questions is administered to the worker. The questions are the same for all jobs, therefore, a substantial number of them will not be applicable to most workers. For instance, Item 74 asks the worker to rate the importance of operating AIR/SPACE vehicles in his/her job. On the other hand, Item 15 asks the incumbent to rate the extent with which he/she receives verbal instructions.

To summarize, the worker-oriented analyses yield a large number of different job characteristics with the possibiltiy of having many workers sharing only a few of the characteristics. As is explained in Chapter I, we used the results of a factor analysis report presented to the organization that used the worker-oriented analysis in order to reduce the number of different observed characteristics. The principal components technique established two types of Dimension Scores that were utilized in our study:

As explained in the Position Analysis Questionnaire Manual (PAQ, page 73), in the factor analysis process with PAQ data, the items (or job elements) *(characteristics)* which frequently receive similar or correlated ratings are

grouped together to form a job dimension. The divisional dimensions are derived from ratings on items found in the six different divisions of PAQ and tend to be uncorrelated with other dimensions from within the same division, but they may be correlated with with dimensions from other divisions. The overall dimensions were derived from ratings on all items (sic) and tend to be uncorrelated between themselves, but they may have some correlations with divisional dimensions .

The full set of elements, the two division scores and their codes, are detailed in Appendix A. We used two sets of characteristics from the PAQ results: one set (SET A) was chosen by the author to ease the comparison of results across firms and to replicate the variables of previous empirical research. The second set (SET B) was obtained from the Chief Analyst of the project who used the chosen elements to obtain the 'wage-line' for the company.

Table D. III presents the sets of job characteristics that were obtained using the 'worker-oriented' job analysis approach (PAQ) in organization 2.

The second type of job characteristics that we were able to collect are a combination of classifications made by the Department of Labor's Dictionary of Occupational Titles (DOT) and the author's own elements, chosen to maximize the similarity with previous empirical work. These job characteristics are both traditional and innovative. We have information on basic variables such as working conditions, risks of injury, supervision given, required education and experience, part-time versus full-time and physical environment. Additionally, we gathered data on previously unmeasured variables such as financial

responsibility, supervision received, a distinction between public contact within and outside the firm, and a special dummy designed to capture the effects of vocational schooling and on-the-job training. The variables we used from the DOT were "data" and "things", which represent the level at which workers deal with "data", i.e. from counting to synthesizing or analyzing and with "things", i.e. from 'feeding-offbearing' to precision work. There are several additional variables that are not included in the final analysis because of their high correlation with another variable, for example, "people" from the DOT, is significantly correlated with our 'personal contact' variables.

Table D. IV presents the job characteristics used in the models estimated for organizations 1 and 3.

In addition to our observations of job characteristics we have gathered data on the point-grades that each of the jobs under study has. The next subsection describes the most important aspects of the two systems and explores the practical and theoretical differences between them.

Table D. III

Job Characteristics from PAQ

VARIABLE	CODE
SET A	
Supervision Given	P130
Stressful/Unpleasant Environment	D22
Activities Requiring Body Movements	D10
Existence of Hazardous Job Situations	D24
Structured, Repetitive Work	D31
Required Education	P46
Required Experience	P47
Supervision Received	P134
SET B *	
Using Machines/Tools /Equipment	D9
Communicating Within Firm	D17
Engaging in General Personal Contacts	D18
Performing Supervisory Activities	D19
Working in 'Businesslike' Situations	D26
Salary versus Variable Basis	D28
Irregular versus Regular Schedule	D29
Being Alert to Constantly Changing Conditions	D32

* The methodology used by the Analyst to select these dimensions is described in the Appendix of Chapter I

TABLE D. IV

Job Characteristics for Organizations 1 and 3

VARIABLE	CODE
Financial Responsibility (degree)	FR
Data	D
Things	T
Supervision Given	SG
Personal Contact Within the Workplace	WS
Personal Contact Outside the Workplace	OS
Working Conditions (Repetitiveness, etc)	WC
Physical Environment	PE
Financial Responsibility (amount)	M
Required Education	RE
Required Experience	REX
Part-time versus Full-time	PT
Vocational Training	V

POINT-GRADES

We have collected information from two point-grading systems. The identity of one of the systems is confidential, as is the way in which the consultans obtained their total points. The other system is the Position Analysis Questionnaire (PAQ). The two systems vary in several ways, but the most important difference between them is their reliance on market wages for the determination of their points: PAQ relies explicitly on the market to derive its grades.

In brief, PAQ grades are determined as follows: the analysts have information on several thousand jobs across the country and for all occupations. They have correlated the job dimensions with the wages paid for these jobs and have obtained the job dimension weights. The grade, then, is the predicted wage given the newly analyzed jobs' dimensions and their known weights.

The other system, in contrast, has never claimed reliance on the market. It has even gone a bit further and claimed to be able to determine the actual worth of a job for any given firm based exclusively on its contribution to the firm's revenues. These non-market-based marginal revenue product estimates may or may not be correlated to market wages to determine the job's wage .

We do not have access to the mechanisms with which the firm obtained their total points. All we know is that it is based on four general factors: Accountability, Know-How, Problem Solving, and Working Conditions. Only the last of these factors can be directly observed and measured, the rest rely on measures of other tasks that are then transformed into a subtotal point level.

The basic difference between the two systems is that the points for PAQ are

direct correlations between the job dimension scores and market wages, while the points with the other system are determined before any information is taken from the market. The job dimension scores in PAQ are obtained through a ranking of worker-oriented tasks that are directly observable and exist for all jobs. The actual wage-setting process after the points have been obtained is an adaptation of the points to the local conditions faced by the firm . The points for the alternative system are assigned by the analyst and can later be correlated to the market wages.

The issue that has been succesfully taken to court by comparable worth advocates is that grading systems are often arbitrarily adjusted in a discriminatory manner. Analysts assign characteristic X more points than characteristic Y because they know that X is more common in male jobs and Y in female jobs. Analysts can "get away with this' because their role is to attract and retain workers which is done by referring to the market where, on average, male jobs command a higher wage than female jobs.

What determines that characteristic X (using a wrench) commands more points than characteristic Y (finger dexterity) ? The conservative answer is the market. The comparable worth answer is not only the market, which is already discriminatory, but also the analysts who perpetuate the existing distortions.

We are able to explain 80 percent of the variance in the "confidential" grades with our own job characteristics, allowing us to perform tests across models and determine whether the a-priori points are biased toward the market.

The most important aspect of having grade information is the gain in efficiency

from our hedonic models. That is , grade information will allow us to estimate a model where the true relationship between grades, wages, and job characteristics is explored. The fact that firm wages and grades are both dependent on an unobserved market-wage index will increase the efficiency of our estimates when a seemingly unrelated equation model is used.

APPENDIX A

TABLE A. I

JOB CHARACTERISTICS

ORGANIZATIONS 1 & 3

VARIABLE	CODE
1. Financial Responsibility (degree)	1 = primary 2 = secondary 3 = tertiary 4 = none
2. Data	0 = synthesizing 1 = coordinating 2 = analyzing 3 = compiling 4 = computing 5 = copying 6 = comparing
3. Things	0 = setting up 1 = precision work 2 = operating-controlling 3 = driving-operating 4 = manipulating 5 = tending 6 = feeding-offbearing 7 = handling
4. Supervision Given	1 = infrequent 2 = frequent 3 = continuous
5. Personal Contact Within the Workplace	1 = infrequent 2 = frequent 3 = continuous
6. Personal Contact Outside the Workplace	1 = infrequent 2 = frequent 3 = continuous

7. Working Conditions (stress, repetitivenes)	0 = no 1 = yes
8. Physical Environment	0 = average 1 = unpleasant
9. Financial Responsibility (amount)	dollars
10. Required Education	years
11. Required Experience	years
12. Vocational Training	years
13. Part Time	0 = no 1 = yes
14. People	0 = mentoring 1 = negotiating 2 = instructing 3 = supervising 4 = diverting 5 = persuading 6 = speaking-signaling 7 = serving 8 = taking instructions-helping

TABLE A. II

JOB CHARACTERISTICS

ORGANIZATION 2

Job characteristics from organization 2 are divided into two groups: the first contains variables that were measured directly by the analysts. They include

1. Required Education (P46)
   - 0 = none
   - 1 = some high school
   - 2 = high school
   - 3 = some college
   - 4 = college
   - 5 = graduate degree

2. Job Related Experience (P47)
   - 0 = none
   - 1 = less than one month
   - 2 = 1 to 12 months
   - 3 = 1 to 3 years
   - 4 = 3 to 5 years
   - 5 = over 5 years

3. Supervision Given (P130)
   - 0 = none
   - 1 = ten or fewer workers
   - 2 = 11 to 50 workers
   - 3 = 51 to 250 workers
   - 4 = 251 to 750 workers
   - 5 = 751 or more workers

4. Supervision Received (P134)
   - 1 = immediate supervision
   - 2 = general supervision
   - 3 = general direction
   - 4 = nominal direction
   - 5 = no supervision

The second group of job characteristics in organization 2 are job dimension scores based on the results of factor analysis (in particular, principal components). Items which frequently receive similar or correlated ratings are grouped together to form a job dimension. All scores are normalized and range from -2.50 to 2.50 , with 0 being representative of a 'population average' level . The job dimensions used in our analysis are:

5. Stressful/ Unpleasant Environment (D22) Formed from: air contamination, dirty environment, high temperature, noise intensity, vibration, improper illumination, low temperature.

6. Activities Requiring Body Movements (D10) Formed from: kneeling/stooping, standing, walking/running, climbing, balancing, level of physical exertion, long handle tools.

7. Existence of Hazardous Job Situations (D24) Formed from: temporary disability, permanent partial impairment, permanent total disability/death, first aid cases, out-of-door environment

8. Structured/ Repetitive Work (D31) Formed from: repetitive activities, following set procedures, specified work pace, cycled work activities, job structure

TABLE A. III

WORKER AND JOB COMPOSITION

ORGANIZATION 1

VARIABLE	AVERAGE ENDOWMENTS	
	MALES	FEMALES
Age	41.20	42.31
Years of Education	13.70	13.73
Months of Seniority	83.30	76.50
Percent of Single Workers	33.80	22.80
Percent of Non-White Workers	35.20	43.00
Financial Responsibility	3.54	3.89
Data	3.90	3.87
Things	5.30	6.44
Supervision Given	1.68	1.31
Public Contacts Within Workplace	1.61	1.65
Public Contacts Outside Workplace	1.29	1.28
Percent of Workers with Stressful and/or Repetitive Tasks	46.30	21.30
Percent of Workers with Unpleasant Working Conditions	44.20	25.50
Monetary Sum of Financial Responsibility (thousands)	150.43	31.56
Required Education	10.83	9.43
Required Experience	2.02	1.47
Percent of Workers with Part-Time Jobs	14.40	22.60
Vocational Training/ Experience months	4.50	< 1
Grade	318.06	232.19
Hourly Wage	10.03	7.21

TABLE A. IV

WORKER AND JOB COMPOSITION

ORGANIZATION 2

VARIABLE	AVERAGE ENDOWMENTS	
	MALES	FEMALES
Age	37.13	42.85
Years of Education	11.63	12.97
Months of Seniority	91.23	78.90
Percent of Single Workers	30.70	25.00
Percent of Non-White Workers	40.00	22.50
Supervision Given	.41	.32
Stressful/ Unpleasant Environment	-.19	-.68
Body Movements	.40	-.66
Hazardous Job Situations	.78	-.61
Stressful/ Repetitive Tasks	-.08	-.24
Required Education	1.66	2.27
Required Experience	1.18	1.56
Supervision Received	2.30	2.41
Grade	588.10	566.08
Hourly Wage	9.67	9.44

TABLE A. V

WORKER AND JOB COMPOSITION

ORGANIZATION 3

VARIABLE	AVERAGE ENDOWMENTS	
	MALES	FEMALES
Months of Seniority	41.66	51.44
Percent of Non-White Workers	41.21	31.91
Financial Responsibility	3.77	3.90
Data	3.69	2.57
Things	3.87	4.43
Supervision Given	1.37	1.18
Public Contacts Within Workplace	1.73	1.78
Public Contacts Outside Workplace	1.29	1.64
Percent of Workers with Stressful and/or Repetitive Tasks	46.62	9.50
Percent of Workers with Unpleasant Working Conditions	57.43	1.60
Required Education	12.55	14.78
Required Experience	2.29	2.16
Percent of Workers with Vocational Training/ Experience	41.89	0.53
Grade	215.08	260.18
Hourly Wage	9.08	9.40

APPENDIX B

TABLE B. I

ALTERNATIVE WAGE HEDONIC

(no personal characteristics)

ORGANIZATION 1

MODEL: LHW = h (JC)

VARIABLE			
Intercept	2.210	*	(25.93)
Financial Responsibility	-.097	*	(7.34)
Data	-.036	*	(5.70)
Things	-.034	*	(6.27)
Supervision Given	.062	*	(4.96)
Public Contact Within Workplace	.053	*	(3.97)
Public Contact Outside Workplace	.032	*	(2.04)
Working Conditions	.024		(1.14)
Physical Environment	-.000		(0.00)
Monetary Sum of Fin. Resp.	.89E+7	*	(3.90)
Required Education	.025	*	(12.57)
Required Experience	.031	*	(6.01)
Part-Time	-.061	*	(3.18)
Vocational Training	.052	*	(3.83)
R2	.77		

* = significant at 5 percent
() = absolute value of t-statistic

TABLE B. II

ALTERNATIVE WAGE HEDONIC

ORGANIZATION 2

MODEL: LHW = f (JC)

VARIABLE			
Intercept	1.469	*	(22.23)
Supervision Given	.147	*	(5.73)
Stressful/ Unpleasant Env.	-.017		(0.63)
Body Movements	-.033		(1.51)
Hazardous Job Situations	.082	*	(3.98)
Structured/Repetitive Tasks	.114	*	(3.04)
Required Education	.047		(1.72)
Required Experience	.053	*	(3.53)
Supervision Received	.212	*	(6.54)
R2	.70		

* = significant at 5 percent
() = absolute value of t-statistic

TABLE B. III

ALTERNATIVE WAGE HEDONIC

ORGANIZATION 3

MODEL: LHW = f (JC)

VARIABLE			
Intercept	1.489	*	(11.81)
Financial Responsibility	-.015		(1.07)
Data	-.054	*	(5.64)
Things	-.021	*	(3.81)
Supervision Given	.022		(1.48)
Public Contact Within Workplace	.102	*	(7.84)
Public Contact Outside Workplace	-.050	*	(2.86)
Working Conditions	.061	*	(2.22)
Physical Environment	.064		(1.87)
Required Education	.055	*	(11.61)
Required Experience	.032	*	(5.08)
Vocational Training	.137	*	(4.51)
R2	.76		

* = significant at 5 percent
() = absolute value of t-statistic

TABLE B. IV

MALE-FEMALE WAGE HEDONICS

ORGANIZATION 1

MODELS: LHW = f (P)
LHW = g (P, GRD)
LHW = h (P, JC)
SYSTEM: GRD = f (JC)
LHW = g (P, GRD)

	MALES	FEMALES
LHW = f (P)		
VARIABLE		
Intercept	.708 * (3.28)	1.255 * (9.21)
Age	.058 * (6.07)	.015 * (2.78)
Age-squared	-.0006 * (6.41)	-.0002 * (3.37)
Education	.033 * (5.84)	.032 * (8.86)
Seniority	.001 * (4.60)	.001 * (8.42)
Marital Status	-.221 * (4.93)	-.033 (1.23)
Race	-.403 * (9.21)	-.271 * (11.48)
R2	.53	.46
LHW = g (P, GRD)		
VARIABLE		
Intercept	1.120 * (12.73)	1.085 * (15.03)
Age	.011 * (2.85)	.008 * (2.34)
Age-squared	-.0001 * (3.16)	-.7E-4 * (2.25)
Education	-.002 * (1.06)	.005 * (2.41)
Seniority	.0005 * (5.10)	.0005 * (6.42)
Marital Status	-.035 (1.90)	.004 (0.29)
Race	-.050 * (2.52)	-.045 * (3.20)
GRADE	.0027 * (38.49)	.0025 * (35.18)
R2	.92	.85

LHW = f (P, JC)	MALES		FEMALES	
VARIABLE				
Intercept	1.558 *	(8.21)	1.571 *	(10.47)
Age	.027 *	(4.35)	.013 *	(3.50)
Age-squared	-.0003 *	(4.61)	-.0001 *	(3.44)
Education	.004 *	(0.99)	.008 *	(3.04)
Seniority	.0006 *	(3.85)	.0008 *	(7.97)
Marital Status	-.092 *	(3.25)	.006	(0.34)
Race	-.064 *	(1.97)	-.032 *	(1.67)
Financial Responsibility	-.043 *	(2.35)	-.068 *	(3.38)
Data	-.042 *	(4.57)	-.012	(1.64)
Things	-.021 *	(2.68)	-.026 *	(3.51)
Supervision Given	.024	(1.31)	.043 *	(2.81)
Public Contact Within Workplace	.034	(1.56)	.058 *	(4.29)
Public Contact Outside Workplace	.069 *	(2.60)	.008	(0.52)
Working Conditions	-.001	(0.05)	.013	(0.52)
Physical Environment	-.031	(0.63)	-.066 *	(2.15)
Monetary Sum of Fin. Resp.	.5E-7 *	(2.14)	.1E-6 *	(3.04)
Required Education	.021 *	(5.96)	.023 *	(10.69)
Required Experience	.037 *	(4.86)	.020 *	(3.26)
Part-Time	-.118 *	(3.21)	-.037 *	(1.99)
Vocational Training	.031 *	(2.77)	.017	(0.33)
R2	.83		.78	

	MALES	FEMALES
SYSTEM:		
GRD = f (JC)		
LHW = g (P, GRD)		
VARIABLE		
Intercept	1.955 * (12.78)	1.704 * (12.59)
Age	.010 * (2.62)	.010 * (3.69)
Age-squared	-.0001 * (2.62)	-.0001 * (3.47)
Education	-.003 * (1.17)	.002 (1.39)
Seniority	.0005 * (4.98)	.0006 * (8.31)
Marital Status	-.038 * (2.02)	.011 (0.81)
Race	-.010 * (0.48)	-.005 (0.34)
Financial Responsibility	-.047 * (2.60)	-.071 * (3.55)
Data	-.050 * (5.60)	-.016 * (2.24)
Things	-.023 * (3.04)	-.026 * (3.57)
Supervision Given	.023 (1.30)	.051 * (3.53)
Public Contact Within Workplace	.038 (1.78)	.059 * (4.39)
Public Contact Outside Workplace	.067 * (2.66)	.008 (0.30)
Working Conditions	-.013 (0.41)	.007 (0.30)
Physical Environment	-.031 (0.65)	-.074 * (2.43)
Monetary Sum of Fin. Resp.	.5E-7 * (2.08)	.1E-6 * (3.08)
Required Education	.024 * (7.28)	.024 * (11.43)
Required Experience	.040 * (5.32)	.021 * (3.45)
Part-Time	-.122 * (3.41)	-.038 * (2.05)
Vocational Training	.034 * (3.10)	.010 (0.20)
R2	.82	.77

TABLE B. V

MALE-FEMALE WAGE HEDONICS

ORGANIZATION 2

MODELS: LHW = f (P)
LHW = g (P, GRD)
LHW = h (P, JC)

	MALES	FEMALES
LHW = f (P)		
VARIABLE		
Intercept	1.028 * (4.45)	1.116 * (4.22)
Age	.044 * (4.18)	.039 * (3.61)
Age-squared	-.0005 * (4.10)	-.0004 * (3.81)
Education	.023 * (3.80)	.011 (1.36)
Seniority	.001 * (6.95)	.002 * (3.08)
Marital Status	-.098 * (2.27)	-.005 (0.06)
Race	-.298 * (7.07)	-.155 (1.85)
R2	.60	.56
LHW = g (P, GRD)		
VARIABLE		
Intercept	.898 * (5.96)	1.104 * (7.58)
Age	.024 * (3.49)	.015 * (2.38)
Age-squared	-.0002 * (3.41)	-.0001 * (2.23)
Education	.007 (1.83)	.004 (0.96)
Seniority	.001 * (6.34)	.001 * (3.60)
Marital Status	-.050 (1.77)	-.015 (0.36)
Race	-.079 * (2.42)	-.081 (1.74)
GRADE	.0011 * (12.87)	.0009 * (8.76)
R2	.83	.87

LHW = f (P, JC)

VARIABLE	MALES	FEMALES
Intercept	.993 * (6.68)	1.083 * (3.29)
Age	.023 * (3.43)	.020 * (2.25)
Age-squared	-.0002 * (3.29)	-.0002 * (2.32)
Education	.006 (1.62)	.009 (1.51)
Seniority	.001 * (6.23)	.001 * (2.52)
Marital Status	-.040 (1.41)	-.039 (0.60)
Race	-.072 * (2.13)	-.112 * (1.80)
Supervision Given	.095 * (4.18)	.060 (1.02)
Stressful/ Unpleasant Env.	-.001 (0.08)	.093 (0.21)
Body Movements	-.028 (1.5-)	-.080 (1.72)
Hazardous Job Situations	.044 * (2.42)	.101 (1.16)
Structured/Repetitive Tasks	.121 * (3.82)	-.009 (0.13)
Required Education	.102 * (3.72)	-.042 (0.60)
Required Experience	.035 * (2.57)	.034 (1.31)
Supervision Received	.146 * (4.95)	.227 * (2.80)
R2	.86	.85

TABLE B. VI

MALE-FEMALE WAGE HEDONICS

ORGANIZATION 3

MODELS: LHW = f (P)
LHW = g (P, GRD)
LHW = h (P, JC)
SYSTEM: GRD = f (JC)
LHW = g (P, GRD)

	MALES	FEMALES
LHW = g (P, GRD)		
VARIABLE		
Intercept	1.644 * (31.72)	1.591 * (35.85)
Seniority	.001 * (3.73)	.0006 * (3.14)
Race	-.075 * (2.50)	-.021 (0.95)
GRADE	.0022 * (11.60)	.0023 * (14.80)
R2	.53	.62
LHW = f (P, JC)		
VARIABLE		
Intercept	1.138 * (5.32)	1.424 * (10.12)
Seniority	.001 * (3.56)	.0005 * (3.38)
Race	-.031 (1.57)	-.035 * (2.15)
Financial Responsibility	-.002 (0.10)	-.032 (1.68)
Data	-.001 (0.10)	-.082 * (5.75)
Things	-.021 * (2.38)	.000 (0.00)
Supervision Given	.101 * (4.30)	-.023 (1.04)
Public Contact Within Workplace	.083 * (3.70)	.081 * (5.34)
Public Contact Outside Workplace	.030 (0.67)	-.135 * (5.76)
Working Conditions	-.051 (1.40)	.234 * (4.67)
Physical Environment	.084 * (2.12)	.193 (1.95)
Required Education	.049 * (5.71)	.071 * (12.03)
Required Experience	.024 * (2.10)	.061 * (8.22)
Vocational Training	.181 * (3.93)	.162 (1.32)
R2	.62	.81

	MALES	FEMALES
SYSTEM:		
GRD = f (JC)		
LHW = g (P, GRD)		
VARIABLE		
Intercept	1.205 * (5.72)	1.432 * (10.26)
Seniority	.0008 * (2.89)	.0003 * (2.34)
Race	-.025 (1.52)	-.031 * (2.28)
Financial Responsibility	-.005 (0.24)	-.031 (1.71)
Data	-.003 (0.23)	-.080 * (5.65)
Things	-.020 * (2.27)	-.002 (0.30)
Supervision Given	.102 * (4.35)	-.024 (1.10)
Public Contact Within Workplace	.081 * (3.60)	.083 * (5.50)
Public Contact Outside Workplace	.022 (0.22)	-.135 * (5.79)
Working Conditions	-.053 (1.47)	.237 * (4.75)
Physical Environment	.084 * (2.14)	.182 (1.85)
Required Education	.046 * (5.52)	.072 * (13.20)
Required Experience	.026 * (2.32)	.061 * (8.14)
Vocational Training	.178 * (3.89)	.167 (1.37)
R2	.82	.81

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