

/THE FEMALE/MALE EARNINGS DIFFERENTIAL/

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Introduction

"Women earn less than men. Blacks earn less than whites. These facts are blatantly observable in the economy."

--Kamalich & Polachek (1982, pp. 450)

We all sense that the above statement is true, yet how much can be attributed to discrimination? Simply observing a wage differential between two classes of people does not signify discrimination. There may be productivity differences (differences in education, training, experience, etc.) that can rationally explain the earnings level for each sex. Some researchers (Borjas, 1978, pp. 99) claim that after adjusting for these productivity differences the unexplained portion that remains is "discrimination." However, as Lloyd and Niemi (1979) point out, this is not entirely correct because some factors that affect earnings may not have been considered in the adjustment process. There is also no consensus as to which variables to adjust for in an earnings equation (more will be discussed on this topic later in the paper). In summary, the unexplained portion of the wage gap should be considered only a very "rough" estimate of discrimination.

This report will examine the earnings gap between the sexes. General theories of discrimination will first be reviewed to provide a theoretical foundation for this report. Various techniques that have been used to measure discrimination will then be presented followed by the empirical results of the research concerning wage differentials. The wage differential

will then be dissected by examining productivity and occupational differences between the sexes. In addition, a correlation analysis will be conducted to investigate the degree of correlation between the earnings of an industry and the percentage of female workers within the industry. A central finding of this report is that occupational differences appear to be the major factor for the earnings gap. Women tend to be concentrated into a small number of occupations which tend to be low paying.

I. Theories

This section will examine some of the general theories of discrimination. Two theories, Becker's Theory and the Dual Labor Market Theory, specifically deal with discrimination. The Monopsony Power Theory and the Human Capital Theory will also be examined because they possess implications that could have an impact on the F/M earnings ratio. At the end of this chapter a very brief perusal will be given to some empirical research investigating these theories.

Becker's Theory

Becker's theory can actually be separated into three separate models which attempt to explain discrimination by employers, employees, and consumers. The three models share similar attributes although some modifications exist; therefore each model will be reviewed separately. However some basics, common to all three models will first be addressed.

The foundation to Becker's theory is that some individuals are assumed to have a "taste for discrimination." For example, one individual may strongly despise working for or buying products from a certain group while another individual may have no preference at all for associating with them. Tastes for discrimination not only vary among individuals but they can also vary among regions and different time periods.

If an individual has this taste for discrimination he must act "as if" he were willing to pay something, either directly or in the form of a reduced income, to be associated with a certain group or class of people. When actual discrimination occurs then he must either pay or forfeit income for this privilege.

Becker's theory incorporates discrimination due to both prejudice and ignorance. For instance discrimination due to ignorance would have the employer refuse to hire members of a certain group based on the employer's perception of the group's true productivity. Therefore, knowledge concerning the group's actual economic efficiency could possibly eliminate discrimination. However, Becker's theory does not make this distinction; thus tastes for discrimination can be the result of either prejudice or ignorance.

Employer discrimination

An employer faced with the market wage, W , acts "as if" the net wage is $W(1 + d_1)$. The discrimination coefficient, d_1 , is a measure of the employer's taste for discrimination and represents the non-monetary element of transactions. This

coefficient can be either positive or negative depending on whether the non-pecuniary element is considered "good" or "bad." A preference for not associating with a particular group will have a positive d_i while an employer showing favoritism (nepotism) for a particular group would have a negative d_i . The quantity, Wd_i , indicates the money equivalents of the non-monetary costs.

An employer faced with employing members of two distinct groups (both of which are perfect substitutes), group N and group S, will try to determine the combination of workers that will maximize utility. For example, an employer with a strong dislike of group N will act "as if" the net wage is $W_N(1 + d_N)$. However, the employer does not actually pay the wage, $W_N(1 + d_N)$, to members of group N, but rather the employer pays the wage set by the market, W_N . The employer will hire only members of group S unless $W_S > W_N(1 + d_N)$. When actual discrimination occurs the employer is forfeiting income by not utilizing the labor with the lowest cost. The market wage, W_N , would have to be significantly less than W_S to offset a strong taste for discrimination against group N.

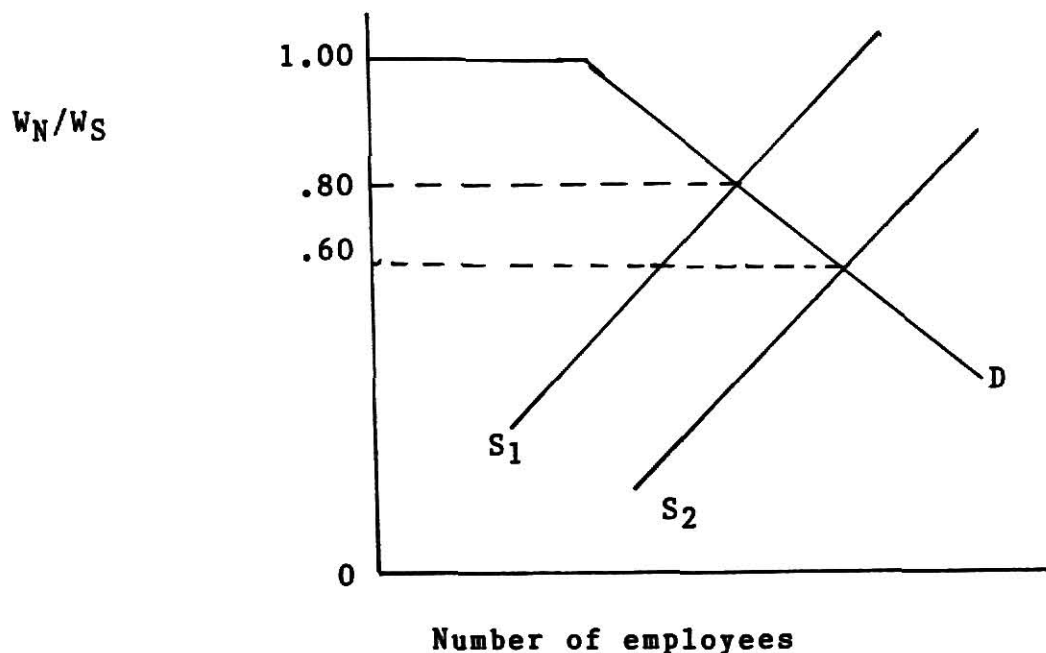
A logical result of Becker's model would be that in a competitive environment one non-discriminating employer could force the discriminating employers out of business (assuming constant returns to scale). However, Becker's model assumes that discrimination is more likely in a monopoly market since the discriminating employer can forego some monopoly profits to sustain his taste for discrimination. Marshall (1974, pp. 852)

stated that Becker's model is mainly a reflection of market imperfections and monopoly power.

Assuming that workers are perfect substitutes, the "long run" implication of Becker's model is that if there are no costs for adjustment then total segregation and no wage dispersion will result. At equilibrium the discriminating employers will only hire their preferred group and the non-discriminating employers will hire the non-preferred group. Wages will then be equal between the two groups, thus offering neither type of employer a competitive advantage (Marshall, 1974, pp. 852). Employers would never hire a mixed labor force because to do so would sacrifice profits. However, Arrow (1973, pp. 92) points out that the non-discriminating employer may not force the wage gap to close in the long run if the discriminated group composes only a small portion of the total labor force.

Arrow extends Becker's model and conforms it more closely to reality because he recognizes that adjustment costs make it possible to see mixed work forces in the short run. It is unrealistic to imagine non-discriminating firms hiring and firing their entire labor force in response to small changes in wages. In this respect, as the wage gap becomes smaller and the discriminated workers' wages increased (and even surpasses the preferred group's wages) non-discriminating employers will not automatically and solely hire the lower wage worker. Hiring and firing costs need to be considered. If these costs are extensive, then a mixed labor force is possible in the short run; however in the long run, segregation should still occur.

As mentioned earlier, Becker's model predicts segregation and no wage dispersion in the long run; however in the short run wage differentials can be present. The size of this wage differential will depend on two factors: the distribution of employers by the extent to which they discriminate and the size of the discriminated group (see Rees, 1973, pp. 182). Figure 1 demonstrates that the wage differential will theoretically be larger for discriminated groups when the group comprises a larger fraction of the labor force.



The vertical axis is the ratio of wages between group N and group S. Line D represents the demand schedule regarding the total number of jobs that will be offered to the discriminated group at each wage ratio. This curve is formed by arranging the employers in the order that they discriminate, with the employers discriminating the least placed furthest

left. Therefore the horizontal portion of D represents the non-discriminating employers. As can be seen from the diagram, as the supply of the discriminated group increases (i.e. S_1 to S_2) the size of the wage differential correspondingly increases.

Employee discrimination

Employees with a taste for discrimination act as if the net wage rate is $W(1-d_j)$. "W" is the actual money wage that is being offered and d_j is positive if an employee has a prejudice against working with a particular group (favoritism for working with a particular group would have a negative d_j). As in the case of employer discrimination, the extent of an employee's taste for discrimination is established by the magnitude of d_j .

The employee acts as if the net wage rate is the actual money wage that is being offered. The prejudiced employee feels that this offered wage is too low for working in a mixed work force but would be willing to work at the offered wage in a segregated work force with preferred workers. In this manner the employee is willing to sacrifice income to work with the preferred group.

In reality, all workers are not substitutes--workers can also be complements. Jobs can differ in their required skill levels and a firm may need to employ both types of skilled workers. For example, if females are unskilled and males skilled, then integration has two effects (Welch, 1967): Increasing the female/male employment ratio will raise the

marginal productivity of male labor; however this increased integration will also require higher male wages. Male employees with a taste for discrimination will demand higher wages for working with female employees. Employers must then determine the ultimate balance between integration's marginal costs and benefits.

A theoretical analysis of the effects of complementary workers has been examined by Arrow. Foremen and floor workers are deemed as complementary because a firm may require both types of workers to remain in operation. Discriminatory male foremen would require a higher wage to work with female floor workers. Conversely, in another situation, discriminatory male floor workers would require a higher wage to work under a female foreman. Foreman's wages would depend upon the F/M employment ratio of the floor workers, while floor workers' wages would depend on the sex of their foreman. Thus, Arrow's more advanced version of Becker's model predicts wage dispersion under an integrated setting if all employees have identical tastes for discrimination. (Note: Arrow confesses that the model is not clear as to the effects if tastes differ among employees.)

Consumer discrimination

Consumers may also demonstrate tastes for discrimination by preferring to buy products or services from a particular group. An example of consumer discrimination might be for purchasing the services of doctors or lawyers. A prejudiced consumer behaves as though the net price is $P(1+d_k)$, where "P" is the price per unit (or unit of service) and " d_k " is the

discriminatory coefficient. Thus, if a consumer has a preference against group K then d_k will be positive. The consumer acts as if the net price is $P(1+d_k)$ for products from group K. Therefore the consumer behaves as though group K's price is higher in comparison with other preferred group products with similar "market" prices.

To summarize the discrimination models introduced by Becker, the simple models predict employment segregation and no wage dispersion, but the more complex models, presented by Welch and Arrow involving fixed costs and complementary workers, suggest that integration and wage dispersion can be a possibility.

The simple Becker model has not been free from criticism. Marshall (1974) provides a thorough review of some of these criticisms. The basic problem of Becker's model is that discrimination is treated as exogenous, since a discriminating person's taste for discrimination seems to be already established. Treating discrimination as exogenous creates problems for researchers because discrimination is then not subject to direct analysis. It would be much better if a model treated discrimination as endogenous, in this manner the extent of discrimination could be evaluated to determine what influences it.

Another problem with Becker's model is concerned with employers, employees, and consumers that do not physically associate with the discriminated group. According to Becker, discriminating individuals are motivated by a desire to avoid

associating with the nonpreferred group (Marshall, 1974, pp. 851). Some researchers suggest that envy-malice or status considerations need to be taken into account (Alexis, 1974). Individuals with a taste for discrimination would be motivated by a desire to increase the relative wages and status positions of their group. However, Marshall points out that Becker seems to simply stress that relative wages are the basic motivating force behind discriminating workers. Other considerations besides wages could be important such as job control, job stability, opportunity for advancement, working conditions, etc.

The Dual Labor Market Theory

The dual labor market theory is another theory of discrimination that has challenged the proponents of Becker's model. Essentially the dual labor market hypothesis separates the labor market into two sectors, a primary sector and a secondary sector (see Doeringer and Piore, 1975). The primary sector can be distinguished from the secondary sector in that higher wages, better working conditions, employment stability, opportunity for advancement, and the better jobs in general are found here. In addition, unions operate mainly in the primary sector. In contrast, the secondary sector contains poorer quality jobs--wages are lower, there is little opportunity for advancement, plus this sector is burdened with a higher turnover rate.

According to this model, discrimination occurs because a class of workers can be restricted from moving into the "better" jobs of the primary sector. This restriction is not based on

lack of job skills, education, or other productivity considerations. Rather, discrimination causes women to have a higher probability of being restrained to the secondary sector.

Monopsony Power Model

The monopsony power model is a theory that attempts to explain how a group can be paid a lower wage than the competitive wage if there is only one employer willing to offer employment. A monopsony can occur in a situation that requires a specialized skill and the market offers few alternative occupations for that skill. Some evidence of these effects have been demonstrated in the markets for public school teachers, newspaper printing employees, construction workers, and nurses (Lloyd and Niemi, 1979).

As can be seen in Figure 1 the factor monopsony market is similar to an inverted product monopoly market (Hirshleifer, 1980, pp. 433). The rising supply curve of A to the firm, S_A , is also the Average Factor Cost curve (afc_A). The Marginal Factor Cost curve, mfc_A , represents the additional expense incurred by the firm in hiring an incremental unit of factor A. The Marginal Revenue Product curve, mrp_A , refers to the worth of the incremental units of factor A to the firm. Therefore, the monopsonistic firm will maximize profit by operating at $mfc_A = mrp_A$, which establishes the amount of factor A (A^*) employed, but will pay the factor price of h^* . This results in a lower price for the factor h^* and also less utilization of factor A. In contrast, a competitive market would operate at

the intersection of mrp_A and afc_A which results in a higher price, h^{**} , and more use of factor A, A^{**} .

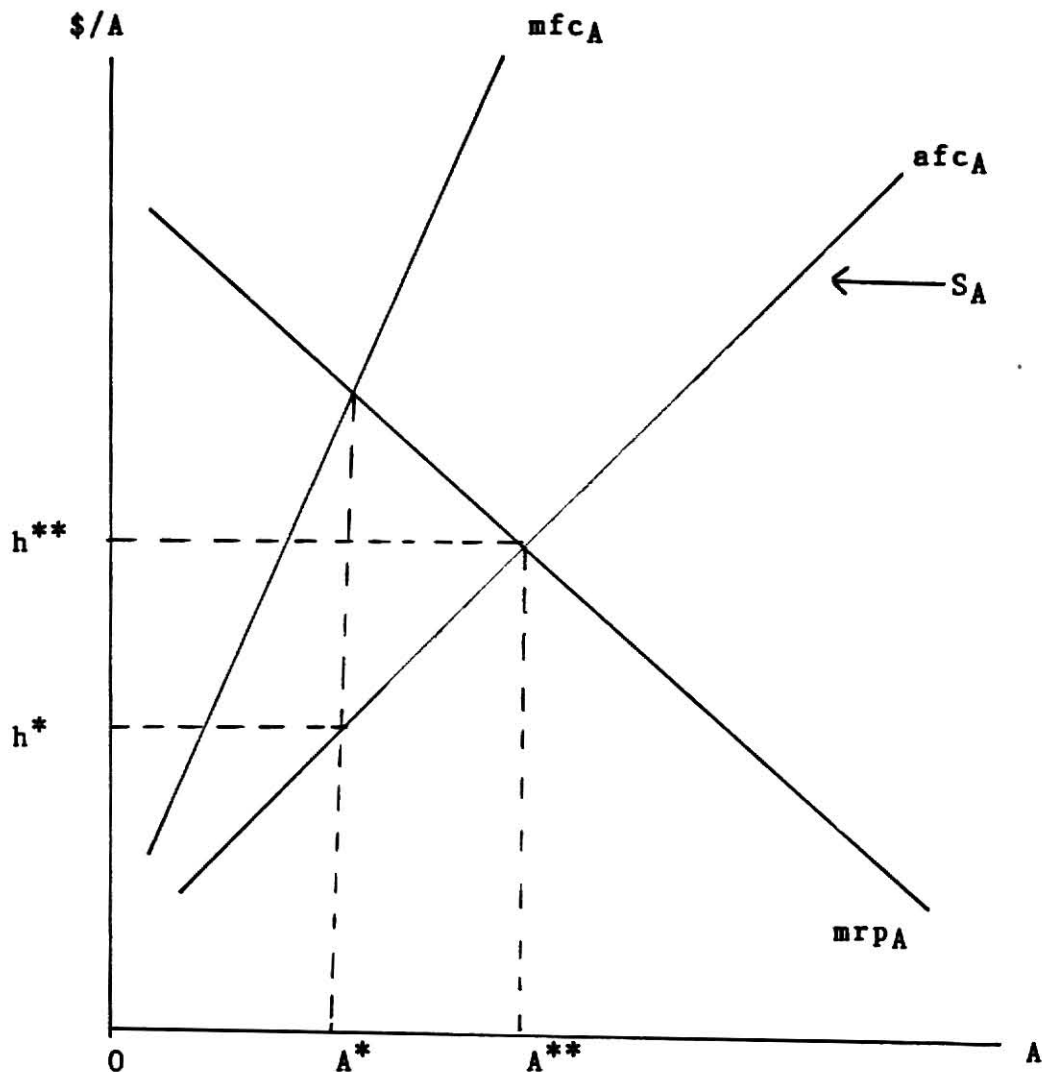


Figure 2

The monopsony power model could depress female wages more than male wages if women have a less elastic supply curve to a particular employer, occupation, or industry. (Note that this elasticity does not refer to "aggregate" labor supply. See Lloyd and Niemi, 1979, pp. 161.) Conceptually women could have

a less elastic supply curve if they are less mobile (geographically and occupationally) than men within the labor force. A second factor that could create a less elastic supply curve for females is their degree of unionization. Only 16 percent of working females are unionized compared to 28 percent of working men (Lloyd and Niemi, 1979). Unionization can establish a reservation wage for the group, which creates a horizontal supply curve at that particular wage. Therefore an employer is prevented from fully exploiting the unionized group.

Human Capital Theory

The theory of human capital depicts earnings as a function of education and training. The amount of resources spent to obtain or receive such training depends on the recipient's expected discounted lifetime income and rate of return to educational investment (Freeman, 1974, pp. 295). In other words, a worker that anticipates a short work horizon will theoretically not invest as much into education. Likewise, an employer would also be less likely to invest heavily in on-the-job training for a worker that only intends to work for a short period of time for the employer.

This concept might be more clearly seen in a typical age-earnings profile. In Figure 3, line L represents the earnings profile of a worker with a continuous work horizon. Line ABC represents the worker with a short work horizon. Both workers have to finance their own education (more will be discussed about this aspect later). Since continuous workers have a longer work horizon, they would be willing to make a

larger investment in education. This larger amount of education should bring a higher rate of return, as exemplified by the steeper slope of line L. On the other hand, the worker with a short work horizon will not invest as much in education and therefore will have higher initial earnings but a smaller growth in earnings. Sawhill (1973) hypothesizes that this scenario of a short work horizon can apply to married females because they generally have a shorter work horizon than single females.

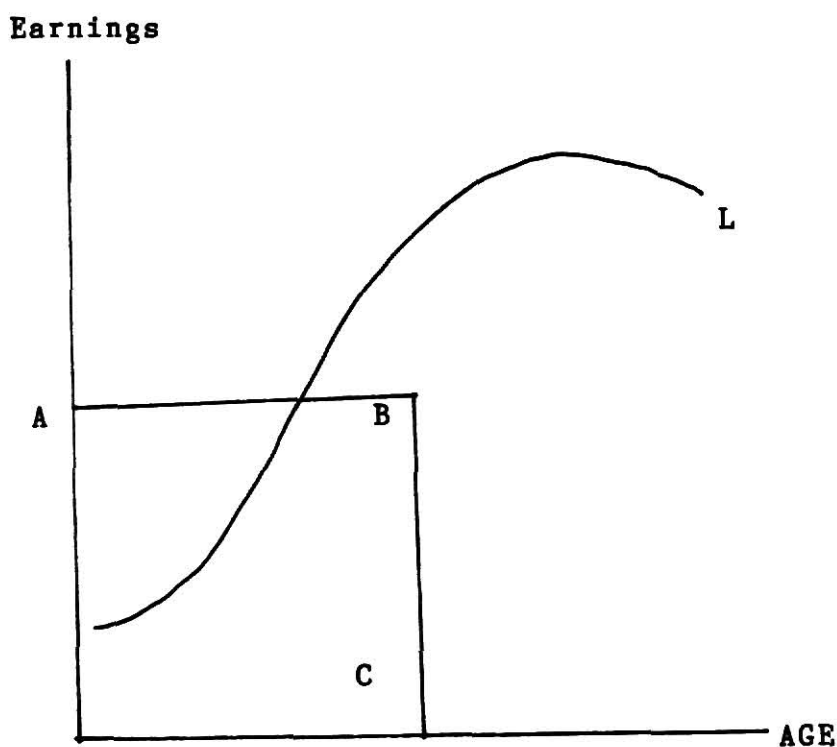


Figure 3

(adapted from Mincer and Ofek, pp. 6, Figure 1)

A more complete diagram of an age-earnings diagram with a work interruption would show that a deterioration of earnings occurs after the interruption. This deterioration theoretically reflects a loss of skills and the cost of retraining. After the

interruption there is an initial "catch-up" period as lost skills are reacquired, but earnings never reach the level that would have prevailed in the absence of labor force withdrawal. Mincer and Ofek observed a .6 to 1.1 percent decline in long run wages for each year out of the labor force. The short-run costs of nonparticipation are even higher because a 3.3% to 7.6% decline in wages occurs per year of nonparticipation.

Polachek expanded human capital theory to explain occupational segregation. Polachek's hypothesis is that workers that plan to have intermittent employment careers will prefer occupations with lower penalties for depreciation. Inherent in Polachek's analysis is that occupations differ in their depreciation rates.

Some Empirical Results

The last section of this chapter presents a very short perusal of the research concerning these theories. The intent is not to provide an extensive analysis of these theories but rather simply to review a small portion of the empirical results in the literature.

Employee Discrimination:

The Ragan and Marcis (1983) study looked at employee discrimination based on sex and found that both male and female employees receive lower wages in a female supervised and a female-intensive work force. These findings are consistent with Arrow's theory if both men and women prefer to have a female supervisor and also prefer to be surrounded with female co-workers. This assumption seems very unlikely, therefore

Ragan and Marcis's results appear to be inconsistent with the hypothesis predicted by the theory.

It should also be mentioned that in this same study, Ragan and Marcis concluded that whites appear to practice employee discrimination while blacks do not. White employees, both male and female, earn approximately seven to eight percent more when employed in an integrated workforce. Thus, employee discrimination based on race appears to receive some support for white workers.

Dual Labor Market Theory:

Cain (1976) states that one approach to test the existence of the dual labor market model would be to classify jobs on some type of scale that indicates the job's general status conditions on the horizontal axis and the number of people employed in these jobs on the vertical axis. If the dual labor market exists you would then expect to see a double-humped graph, with each hump indicating either the primary jobs or the secondary jobs. However, Wachter (1974) examined and rejected this test by finding a near-normal shaped distribution of wages and earnings.

Monopsony Power Theory:

The nursing field has generally received the majority of attention in the literature concerning the monopsony market. This market requires immense specialized skill and hospitals (the sole employer) are relatively few in a community. Thus a nurse has few alternatives of employment.

Link and Settle (1981, pp. 977) stated that in 1977 about one million female registered nurses were in the labor force and an additional three hundred thousand women held nursing certificates but were not in the labor force. Rytina (1982, pp. 31) pointed out that 95.8% of all registered nurses were female in 1981.

Further research by other scholars suggests support for a depreciation of nurses' wages caused by monopsony power. Link and Landon (1975, pp. 657-658) state: "Economic theory predicts that monopsony will depress wages, particularly where labor mobility is low and skill levels are high. Hurd (1973, pp. 239) concludes: "Based on the results it can be concluded that monopsony power is exerted in the labor market for nurses in order to hold wages down. These conditions are met in the nurse's labor market."

Human Capital Theory:

England (1982, pp. 36) investigated Polachek's claims which suggested that occupations comprised of predominantly females should have lower rates of depreciation than male-intensive occupations. In other words, since women exhibit more interrupted labor behavior than males they should be more likely to choose jobs in which the training costs are low and the deterioration of earnings, after being out of the labor force, is the least.

England's results do not support Polachek's hypothesis. Predominantly female occupations do not show lower rates of

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depreciation. In addition women that spend a significant portion of time outside of the labor force are not more likely to be employed in female-intensive occupations than male-intensive occupations.

II. Computational techniques

This chapter examines the computational techniques that have been used to produce "adjusted" female/male earnings differentials. Multiple regression techniques will first be examined followed by two standardization procedures that have been used to adjust for differences in hours worked, experience, education, occupations, etc. In addition, an alternative approach to establish the existence (or non-existence) of discrimination will be described: "reverse regression." Finally, a study by Borjas (1978) will be reviewed to demonstrate the difficulty of measuring and establishing the presence of discrimination.

Multiple Regression Techniques

One type of regression analysis is performed in the following manner: (Note: To be technically correct, most regression equations include a constant, B_0 ; however, the

constant has been left out for simplification of discussion.)

$$\ln W = B_1 X_1 + \delta Z + U$$

"W" represents earnings. The natural logarithm of wages is used so that the effect of variables can be interpreted in percentage terms. The variables, X_1 , represent such independent variables as education, experience, age, training, etc. The coefficient, B_1 , represents the coefficient of various independent variables; " δ " is the coefficient of the sex dummy variable, "Z". The dummy variable is set equal to 1 for women and 0 for men. If the coefficient, " δ ", turns out to be negative and significant then this indicates that women earn less than men even after the effects of differing characteristics are taken into account.

An alternative technique for computing the wage differential is to estimate "separate" earnings regression equations for men and women (see Oaxaca, 1973). The sex dummy variable is omitted in this technique. Therefore an earnings equation is estimated for each sex based on such worker characteristics as education, training, and experience.

The female characteristics can then be inserted into the male regression equation to predict what women would earn under a male wage scale. This should close the wage differential somewhat under the assumption of "what if" women were paid this way (for example if females were reimbursed at the same rate as males for their given amount of education). Conversely male characteristics can be inserted into the female regression equation to predict what men would earn if they were rewarded

like females. This should also close the wage differential (it would only be coincidence if the predicted wages for each sex turned out to be similar). Therefore a range of the unexplained portion of the wage differential can be established.

A comparison between the predicted female wage, W_{pf} (using female characteristics and the estimated male coefficients), and the men's actual wage, W_m , can form the ratio, W_{pf}/W_m . It is this ratio that reflects the "adjusted" F/M earnings ratio in Table 1, which summarizes the empirical research concerning the female/male earnings differential.

These results can be combined to estimate how much of the earnings gap may be due to differences in endowments or to differing rates of return (the coefficients of the endowments) or to "discrimination." Blinder (1973, pp. 439) illustrates this concept with the following equation:

$$R = E + C + U$$

R = the raw earnings gap

E = the portion of the earnings gap
attributable to differing endowments

C = the portion of the earnings gap
attributable to differing coefficients

U = the unexplained portion of the
differential

Discrimination can be considered the portion labeled $C + U$.

Blinder believes that the coefficients are more important than the endowments in explaining why women earn less than men. Blinder states (pp. 448-449), "In each case, the sexes barely

differ in their endowments; it is the coefficients that matter. Men earn much larger wage increments for advancing to higher education levels, and they are much less sensitive to local labor market conditions."

Standardizing for Occupational Differences

Standardizing for occupational differences would require inserting dummy occupational variables in the previously described regression analysis procedure. If the data can be classified into different occupational categories, then each occupational category can be assigned a dummy variable, with one occupation serving as a reference group. The regression equations can then be calculated for each sex. Thus, an occupational category earning more than the reference group would have a resulting positive coefficient and an occupational group earning less than the reference group would have a negative coefficient. The proportion of each sex employed in each occupation can then be inserted with the appropriate coefficient of the opposite sex's equation to produce occupational standardization.

There currently is a debate as to whether it is correct to standardize for "occupations." Proponents for standardizing occupational differences feel that women tend to be in lower-paying occupations and this fact needs to be considered and adjusted. However, other researchers (Ragan and Smith, 1981) (Sawhill, 1973) point out that this procedure would be appropriate only if the occupational distribution is due to worker choice. If the occupational distribution is due to job

discrimination, in other words, if women are forced to take these lower-paying jobs because they do not have access to higher paying jobs, then standardizing is not appropriate.

The regression analysis procedure has not been without its problems and critics. As explained earlier, a researcher has a wide variety of independent variables to choose from and there is a problem as to what independent variables to use. Although these independent variables are simple proxies for productivity, Rao (1973) also feels that the use of proxies tends to overestimate discrimination. The education and experience variables are a particularly difficult problem for researchers to use because they are very susceptible to measurement error (Hashimoto and Kochin, 1980), (Kamalich and Polachek, 1982), (Polachek, 1975).

Bieibly et al (1977) calculated that errors from four to seven percent of the observed variance in Census type questionnaires. Discrimination can be proportionally affected by these errors in measurement.

Reverse Regression

These biases in measuring discrimination have caused the development of another approach to measuring discrimination. Kamalich and Polachek (1982) used a technique called "reverse regression" to evaluate discrimination. Basically this approach involves changing the dependent and independent variables in the traditional equation. Reverse regression compares male and female workers earning the same wage and then investigates to see if their qualifications are different. If discrimination is

present you would expect females to be more qualified than males in jobs that pay the same amount. For example you would predict females to have more education, experience, and tenure than equally paid males. Kamalich and Polachek claim that this is a better measure of discrimination because the technique directly measures discrimination and not indirectly as a residual.

The results using reverse discrimination exhibit conflicting results in comparison with the previously described method. They found in their basic model that women have 1.45 more years of education but 2.90 fewer years of experience and 11.57 fewer months of tenure. These latter two figures were in the opposite direction than expected and became the basis for their conclusion that clear-cut discrimination does not exist.

The logical interpretation of studies using either reverse regression or any other method is that accurately measuring discrimination is not an easy task. Further research is needed using the reverse regression technique before conclusive results can be established. However the problem of accurately measuring or even establishing the presence of discrimination is evident as exemplified in the following study by Borjas (1978).

Borjas and the HEW Department

Borjas examined the statistical technique demanded by HEW (the old Health, Education and Welfare Department) to evaluate whether universities have discriminatory practices. Borjas applied the same technique on HEW that HEW had been applying on universities. On an unadjusted basis, men earned 42 percent

more than females at HEW. After standardizing for productivity differences a 19 percent unexplained wage gap remained. Since HEW is a large governmental agency that is strictly governed by civil service rules and affirmative action programs, any wage gap is especially surprising. Borjas attributed the gap to occupational discrimination because men were placed an average of 1.5 to 2 grades above women in an 18 grade job classification scale.

There are two interpretations for the results in Borjas's study. One interpretation would be that HEW is discriminating, while another interpretation could be that HEW's statistical technique to test discrimination is flawed. The logical conclusion appears to be that discrimination is an elusive concept to measure. All measures of discrimination are subject to certain biases and measurement errors. As the next chapter will reveal a researcher's results concerning the earnings differential can be influenced by a a wide variety of factors. A 10 to 46 percent earnings gap will be shown to remain after using the previously described computational techniques.

III. The Female/Male Earnings Differential

This section examines how much more men earn than women. A wide variance of results exists which is partially due to the variety of independent variables that a researcher chooses to consider, the use of proxies, and the researcher's data base.

A significant number of studies have been conducted to investigate the extent of the female/male (F/M) earnings gap (see Table 1). The comparison of results finds a wide range of earnings differentials. The results show an unadjusted F/M earnings ratio of .39 to .78.¹ After adjusting for various productivity differences this ratio can be raised to .54 to .90. Sawhill's (1973, pp. 384) review of a number of empirical studies of sex discrimination finds an unexplained earnings gap ranging from 12 to 37 percent.

¹ This ratio is simply female earnings divided by male earnings. A ratio of 1.00 would indicate that women earn the same amount as men.

The wage differential in the U.S. has remained relatively stable during the last several decades (Mincer, 1984). This is in contrast to most foreign countries (except U.S.S.R.) in which the wage differential has narrowed. Business cycles may cause slight variations in the differential. Mellor (1984, pp. 27) finds that the unadjusted F/M earnings ratio for full-time workers rose from 61 percent to 64 percent during early 1980's. Mellor suggests that the recent recession which disproportionately hit male-intensive jobs, may have played a role.

Why the wide variance of results?

An obvious factor that can contribute to the wide variance of "adjusted" F/M earnings ratios is the number and types of independent variables that are controlled (or standardized) for. As can be seen on Table 1, a variety of controls have been used, ranging from basic schooling and experience to the number of publications and honors. This consideration can have a significant impact on the adjusted F/M earnings ratio. Oaxaca stated (1973, pp. 699):

"A researcher's choice of control variables implicitly reveals his or her attitude toward what constitutes discrimination in the labor market. If it were possible to control for virtually all sources of variation in wages, one could pretty well eliminate labor market discrimination as a significant factor in determining wage differentials by sex (or race)."

A second contributing factor to the wide variance of results is due to the fact that many data sets do not have information regarding actual years of experience (see Oaxaca,

1973, pp. 697). Researchers generally would like to standardize for experience as they adjust the raw wage differential. If a data set lacks actual experience information, researchers use a proxy, either age or potential experience.

Potential experience is calculated by:

$$X_i = A_i - E_i - 6$$

where,

X_i = potential experience

A_i = the age of the i -th individual

E_i = the number of years of schooling completed by the i -th individual

However, potential experience tends to overstate the actual years of work experience for females because females are more likely to have left the labor force for some period in the past due to household and childbearing reasons. In any event, data sets with actual experience should be more reliable than using proxies for experience. The use of proxies for experience vs. actual experience contributes to the disparity of adjusted results.

A third reason for the wide variance of results is partially due to the data base that a study utilizes. Census data tend to group workers into broad occupational categories. Women are generally concentrated in lower paying occupations (more will be discussed on this aspect later); hence even though Census data groups workers by occupations, the job categories have still been criticized for being too broad. Fuchs (1974, pp. 125) suggested that if more refined occupational data could

be obtained then most of the observed earnings differential might be eliminated. This observation by Fuchs precisely indicates the problem of using data with broad occupational categories. Data that combine a diverse set of occupations contain a wide variance of duties and training, which can translate to a wide variance in earnings.

In pursuit of Fuch's notion, Zincone and Close (1978) examined the earnings of physical therapists. They felt that their data base described a sample of individuals that do quite similar, if not identical, work. In addition all physical therapists have received a nearly equivalent education since only 61 schools offer physical therapy training. Their results show that the unadjusted and adjusted F/M ratios, .605 and .820, respectively, are higher than studies using more general occupational data. The study also examined further refined data by categorizing physical therapists according to supervisors and staff. The results again show the F/M ratio increases further with unadjusted F/M ratios of .744 (supervisors), .781 (staff) and adjusted F/M ratios of .852 (supervisors) and .903 (staff). Using this refined occupational data and obtaining higher F/M ratios enabled Zincone and Close to conclude (pp. 85), "Finally, it was shown that narrowing the occupational category substantially reduces the salary differentials, no matter how they are computed. Because of this, we would urge that future studies of discrimination in wages be conducted with a national data base that refers to specific and narrowly defined occupations."

Ferber and Green (1982) also utilized refined occupational data. Their data base was the full-time faculty at the University of Illinois. Their results produced one of the highest F/M earnings ratios, .77 and .88 for unadjusted and adjusted, respectively. The .88 F/M adjusted ratio translates to women faculty being paid approximately \$2200 less than male faculty. Ferber and Green attributed their findings to women being less likely to obtain tenure-track positions and are more likely to receive a lower rank with the same qualifications (pp. 564). They found no evidence of affirmative action at the University of Illinois.

A significant aspect of Ferber and Green's study is that higher F/M earnings ratios occurred when the data base contained very narrowly defined occupations. Some wage differential studies have not used a very refined data base (as can be seen in Table 1), thus providing a partial reason for the wide disparity of findings.

A fourth contributing factor concerns the choice of hourly, weekly, quarterly, or annual earnings. Women, on the average, work fewer hours than men and are involved in more part-time work. For example in the second quarter of 1984 working women averaged 34.9 hours a week on the job compared with 42.0 hours for men, or a 20 percent difference (U.S. Dept. of Labor, Report 713, 1984). Researchers try to avoid the part-time work problem by using only the earnings of year-round, full-time workers; however there still exists the decision of which type of earnings to use. Mellor (1984) points out that

even if full-time workers are used, men still work more hours than women. In the second quarter of 1984, women working full-time averaged 40.9 hours a week, compared with 44.9 hours for men (U.S. Dept. of Labor, Report 713, 1984).

The use of hourly earnings data seems more appealing than the use of annual data (see Blinder, 1973, pp. 441). For example, the median weekly earnings of full-time workers during the second quarter of 1984 shows that women earned 65 percent as much as men, \$258 vs. \$399, (U.S. Dept. of Labor, USDL 84-326, 1984). On an hourly basis women earned 71 percent as much as men ($\$258/40.9$ vs. $\$399/44.9$). Therefore hourly earnings data create a smaller wage differential.

Yet while hourly data would be preferred over other earnings data, hourly data can be more difficult to obtain. For example, Ragan and Smith (1981, pp. 350) (1982, pp. 110) point out that Census data for hourly wages are only available for extremely broad categories. As indicated earlier, data with broad occupational categories tend to create a larger earnings gap. Therefore, "annual" earnings Census data can provide the added advantage of more refined occupational earnings data. Thus a trade-off seems apparent when using Census data, if more refined occupational data is needed then annual earnings will generally have to be used. Thus, on conceptual grounds, hourly data would be preferred; however data limitations sometimes prevent its use.

IV. PRODUCTIVITY DIFFERENCES

This section examines human capital differences (education and firm-specific) to see its effect on earnings. The impact on earnings of turnover (refers to movement out of the labor force) will also be investigated. In brief, both sexes have nearly identical median years of education, but the literature disagrees as to whether women are rewarded less for furthering their education. Both sexes appear to be rewarded at the same rate for firm-specific training; however, men receive considerably more of it. In addition, research has found that turnover can affect earnings.

Training has been viewed as an important factor for explaining women's flatter age-wage profile (Sawhill, 1973), (Goldfarb and Hosek, 1976), (Duncan and Hoffman, 1978). A distinction needs to be made regarding general training and firm-specific training. General training is training that can

increase a worker's productivity in "several" firms (Goldfarb and Hosek, 1976). A high school or college education is an example of general training because the worker gains human capital that can be applicable for many different employers. On the other hand, firm-specific training is useful only for one specific employer. Thus firm-specific training is a much more specialized form of training.

Other distinctions between general and firm-specific training are that the former is theoretically financed solely by the worker while the latter's training cost is shared between the employer and the employee. Employers are willing to share with the firm-specific costs because they can theoretically capture a return on their investment by setting the worker's wage below their marginal product in the post-training period. An employer cannot adjust the generally-trained worker's wages in the same manner because, assuming worker mobility, the worker would leave. The specifically trained workers would accept a wage below their marginal product provided that their opportunity wage were no higher. Since other firms do not value the specific training, the opportunity wage will not rise.

Figure 4 graphically illustrates the relationship between the generally trained, specifically trained, and untrained workers in an age-earnings type of profile (adapted from Lloyd and Niemi, pp. 124, Figure 3.8). Initially, general training receives lower earnings because the worker theoretically bears all the cost of training while the specifically trained worker can share this cost with the employer. Generally-trained

workers receive the higher later earnings because the employer has no

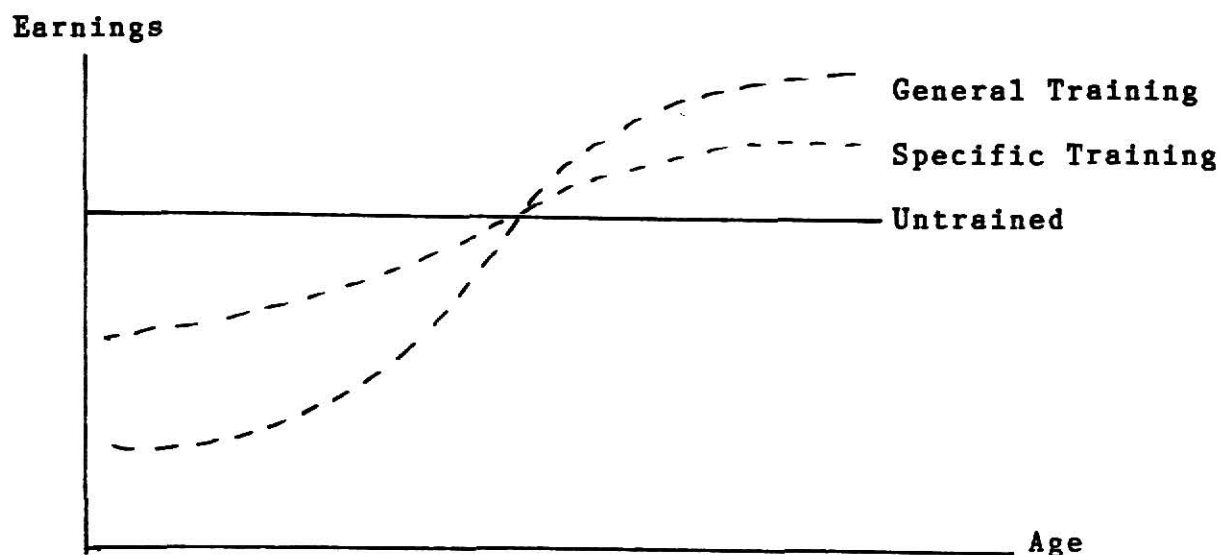


Figure 4

power to lower wages less than the worker's marginal product; otherwise the worker would simply leave.

Education

Education, a form of general training, has been received in nearly equal amounts for males and females. For example in 1977 the median years of education for males and females were 12.4 years and 12.3 years, respectively (Lloyd and Niemi, pp. 99) (Gwartney and Stroup, 1973). However, the surprising finding is that in previous decades women actually had higher median years of education. In 1952 males' median years of education was only 10.1 compared to females' 11.0. Therefore the education gap between the sexes has been narrowed and virtually eliminated. This closing of the sex's education gap

has been mainly due to the growth of male median years of education (Lloyd and Niemi, pp. 99).

It must be pointed out that although women have a slightly greater probability of finishing high school than men, women are generally less likely to finish college and even less likely to enter graduate school (Cox, 1977, pp. 54). For example the breakdown of educational attainment for the entire working age population aged sixteen years and over was the following for 1977:

	Elementary	High School		College	
		1-3 yrs.	4 yrs.	1-3 yrs.	4 yrs.
Males	17%	19.5%	32.3%	15.4%	15.9%
Females	16%	20.1%	38.8%	13.9%	10.5%

The types of courses selected for study are different for males and females (Lloyd and Niemi, 1979). Women are generally under represented in courses with a strong vocational emphasis. For instance women have traditionally enrolled in very general fields such as English and the fine arts. On the other hand, men are more likely than women to be enrolled in business and engineering courses, although this distinction appears to be diminishing.

A superficial review of statistics published by the Department of Labor's Women's Bureau seems to suggest that women appear to be rewarded less than men in regards to the amount of schooling for each sex. In 1981, women workers with four or

more years of college education had approximately the same income as men who had only one to three years of high school--\$12,085 and \$11,936, respectively. Employed, full-time, year-round, women high school graduates (with no college) had nearly the same income, on average, as fully employed men who had not completed elementary school--\$12,332 and \$12,866, respectively. However, researchers that try to calculate a rate of return to education differ in their results.

The conclusions depend on the calculation technique. Two techniques have generally been used. The "discounted present value approach" has produced results suggesting that women receive a lower rate of return for furthering their education. The "earnings function approach" suggests a higher rate of return for women that further their education.

The discounted present value approach calculates a "rate of return" (actually an interest rate) by comparing the earnings streams of various education levels for each sex. This rate of return attempts to equalize (or discount) these earnings streams so that their present values equal zero. For example a comparison would be made between the relative earnings of male high school graduates and male college graduates. A rate of return is developed that will equalize these discounted earnings streams, net of costs. The same method would then be performed on female high school graduates and for female college graduates. If women are believed to benefit less from furthering their education, the hypothesis would predict a smaller "rate of return" for females in relation to males.

This expectation is exactly what has been found using this methodology. Carnoy and Marenbach (1975) concluded that men have higher rates of return than women for graduating from college vs. high school (16.2 for men and 14.9 for women). In a similar comparison in 1960, Niemi (1975) found rates of return of 7.75 for men and 5.25 for women. Hines, Tweeton, and Redfern (1970) found that men have a higher rate of return than women for both 1-3 years of college vs. high school graduation (12.1 for men and 6.9 for women) and college graduation vs. partial college completion (15.1 for men and 13.4 for women).

A criticism of the discounted present value approach is that the technique does not allow for adjustments of other factors that can affect earnings, such as experience. This could be an important consideration. Lloyd and Niemi (1979, pp. 114) state, "For men at all education levels, age, and years of job experience are extremely well correlated, but for women they are not, and the relationship between age and job experience varies accordingly to the level of education."

A slightly different method of calculating a rate of return to education is the earnings function approach. This method creates the following equation in its analysis of rates of return to education (Lloyd and Niemi, 1975, pp. 115):

$$Y = Y_0 + r \sum C$$

Y = individual's current earnings

Y₀ = some initial level of earnings

C = years of school completed

r = rate of return

In this manner, individual microdata can be used in a better fashion since the "actual" years of job experience can be used and analyzed. The rate of return can then be computed for individuals and compared with the opposite sex.

The results using this method generate higher rates of return for females rather than males. Landes (1977) produced rates of return to education of 9.7 for women and 9.3 for men. Corcoran and Duncan (1978) separated blacks and whites which produced the following rates for whites: 7.6 (women) and 6.0 (men); for blacks: 7.9 (women) and 6.0 (men). Madden's (1978) study was in a similar format and produced rates of return of 7.5 for white women, 5.0 for white men, 9.3 for black women and 4.6 for black men.

Firm-specific training

Studies investigating firm-specific training have posed problems for researchers because it is not directly measurable (Sandell and Shapiro, 1980, pp. 339 and 1978, pp. 104). Duncan and Hoffman (1979) have also found that measuring specific training is difficult because of the inability to distinguish between general and specific training.

The typical manner to measure specific training is to utilize some fraction of job tenure as a crude proxy. In an alternate method, Duncan and Hoffman measured specific training by using surveys that directly questioned workers in a wide variety of occupations as to how long it would take the average new person to become fully trained and qualified. The respondent's tenure was then compared with the calculated

average training period for that particular job to establish if the worker was currently receiving training. Their results found that men hold jobs that, on average, require two and a quarter years of specific training, while women hold jobs that require less than one year of specific training. Thus it seems that women are concentrated into jobs that require less training. Goldfarb and Hosek (1976) and Bartel and Borjas (1977) also concluded that women receive less firm-specific training than men.

Some factors found to adversely influence the probability of receiving specific training are (Duncan and Hoffman):

- past labor force interruptions
- expectation of having children (6% decrease in probability for white women but not for black women).
- small amount of education (Note: An additional year of education increases the chance of receiving on-the-job training by 3% for males, 2% for females.)
- age (Lloyd and Niemi, 1979)

Calculating the rates of return for specific training is particularly difficult because it has to be measured indirectly. However, some research has concluded that males and females are rewarded equally for specific training. For example, Duncan and Hoffman (pp. 601) state, "The labor market appears to be 'fair' in the sense that training actually received is rewarded equally, irrespective of race or sex."

Turnover

Researchers in the early 1970's were skeptical of the

relationship between turnover¹ and earnings. Turnover seemed to offer little insight into explaining the female/male wage differential. Sawhill (1973, pp. 385) stated, ". . . while such factors as unionism, absenteeism, and turnover play at best a minor role in explaining observed earnings differentials." Goldfarb and Hosek (1976, pp. 106) concluded, "Even under unfavorable assumptions, and using turnover data which tend to overstate sex differences, sex differentials in quit rates and absenteeism cannot explain large wage differentials within occupations."

Further and later research of the relationship between turnover and earnings has yielded different results. Landes (1977) concluded that differences in turnover and training account for at least two thirds of the sex differentials in occupational earnings. Corcoran and Duncan (1979) found that workers planning to quit earned less than workers who did not plan to quit.

One way turnover can lower a person's earnings is through "statistical discrimination," a concept introduced by Phelps (1972), which transpires during the hiring process. Statistical discrimination results when the costs of obtaining information about a prospective employee are high. It may be too expensive for an employer to fully investigate the work history and capability of an applicant. Therefore, in order to cut costs,

¹Turnover can refer to employee-initiated separations (quits), employer-initiated separations (layoffs), and "other separations" (death, retirement, transfers, etc.).

an employer may categorize the applicant according to some easily identifiable characteristic such as sex, age, race, handicapped, etc. Basically any characteristic will do as long as it is easily identifiable, inexpensive to obtain, and the employer believes that a correlation exists at least most of the time with some work attribute.

For example, as will be pointed out later, females have higher turnover rates than males. Employers that realize this fact feel that even though they do not know the potential quit rate for a specific female applicant, the odds are that this female applicant is more likely to quit than a male. Employers with very high training costs would be concerned about an applicant's potential to quit and would therefore prefer a more stable worker. However, an employer has generally no indication, in advance, of when a particular worker will quit. Therefore the theoretical construct of statistical discrimination would have the employer pay lower wages to the group with a higher quit rate. In this respect the firm can recover some of the hiring and training costs should that "high-risk" employee prematurely quit.

An important aspect of a characteristic (see Ragan and Smith, 1982) is that the observable characteristic should not be easily changeable. For instance, their results show that marital status seems to be ignored by employers. (Another difficulty of using marital status is simply establishing it.) Thus, it seems that characteristics such as hair-length or religion may or may not have an impact on an employer's hiring

decision because it can be changeable or too difficult to establish. Further research is needed though to identify specific characteristics that employers may use.

Certain uses of statistical discrimination has been ruled illegal by our court system. In *City of Los Angeles, Department of Water and Power vs. Marie Manhart* (1978), the Supreme Court ruled that the comparison of class characteristics rather than individual characteristics, in regards to sex, violates Title VII of the 1964 Civil Rights Act. This case involved the debate of whether females should contribute more to a pension fund based on the fact that females, as a class, live longer than males.

Ragan and Smith (1981) (1982) concluded that earnings are strongly related to turnover. Females have a higher quit rate than males, 20.35 and 14.78, respectively. (A quit rate refers to the average number of quits per 1,000 workers per month.) A ten percent increase in the quit rate reduces earnings by 1.7 percent for males and 3.1 percent for females. Since men tend to have higher earnings than females this indicates that females are penalized more severely (in terms of a percent of their earnings) for their high probability of quitting. However, in terms of dollar amounts, females are not assessed more heavily than males. A one point increase in the monthly quit rate reduces male earnings by \$81 per year and female earnings by \$56 per year. Their conclusions suggest that a group's higher quit rate can lower the group's earnings. Since women have higher

quit rates than males this could have a significant impact on women's earnings.

In regards to employer-initiated turnover, workers tend to be compensated for being employed in occupations with high layoff rates. In a sense, workers are compensated for their job insecurity. For example, higher wages are found in industries with high layoff rates. Ragan and Smith found that an industry with a sex-specific layoff rate one standard deviation above the mean results in an earnings premium of 7.8 percent for males and 4.3 percent for females. No reason is apparent for females obtaining less compensation than males. Statistical tests investigating this particular sex difference were significant at the 10 percent level but not the 5 percent level. Thus further research is needed in this area.

To summarize the turnover research, consistent with the hypothesis of statistical discrimination, it seems that earnings are reduced when a worker is a member of a group with a high quit rate. Employers offer lower wages, *ceteris paribus*, to compensate for expected shorter tenure on the job. Women not only have a higher quit rate than males, but they also seem to be penalized more severely for their quit rates in terms of a percentage of their earnings. In regards to employer-initiated turnover, research suggests that women may not be compensated as much as males for working in occupations with a high layoff rate.

V. OCCUPATIONAL DIFFERENCES

The purpose of this next section is to examine the occupational differences between men and women. The fact that women are concentrated into low paying occupations is cited as the main factor for the existence of the earnings gap (Sieling, 1984, pp. 29), (Rytina, 1981, pp. 49), (Shack-Marquez, 1984, pp. 15), (Mellor, 1984, pp. 18), (Rytina and Bianchi, 1984, pp. 11). Shack-Marquez concluded that occupational differences can help explain as much as 88 percent of the earnings gap between the sexes. Mellor, in an analysis of several different factors of the F/M earnings ratio, (age, years of education, occupation, industry and hours worked), found that if women were distributed in employment more like men it would raise the F/M earnings ratio by 5.1 percent. The occupational distribution factor had a larger impact on the F/M earnings ratio than any other factor.

Male-Intensive and Female-Intensive Occupations

All of the above mentioned studies tend to focus on one main theme: The majority of female workers are concentrated into a few occupations and these occupations tend to be lower paying. Beller (1982) provides the best review of data pertaining to this fact and states that the majority of occupations are "male-dominated" (occupations composed of five or more percentage points of males over the male share of the experienced labor force). For example in 1960, 65.7 percent of 440 major occupations were dominated by males, 28.2 percent of the occupations were dominated by females and 6.1 percent were labeled as "integrated" occupations. In 1970 the extent of male-dominated occupations had increased to 69.3 percent with a resulting 25 percent and 5.7 percent for female-intensive occupations and integrated occupations, respectively.

Beller (1982) points out that in 1967 only 8.7 percent of all women were employed in male-intensive jobs; in 1974 this proportion increased to 15.3 percent. Thus women seem to be breaking the barrier into male-intensive jobs, although it is still far less than their proportion of the work force.

Although reaching the same results, Rytina and Bianchi (1984) utilized a different scale for categorizing male-intensive and female-intensive occupations. Basically their definition of a male-intensive occupation is one that has a female labor force composition of less than 20 percent. Conversely a female-intensive occupation would have a female labor force composition of 60 percent or more. Their results

show that in 1970, 59 percent of all occupations were male-intensive, 21 percent were female-intensive, and 20 percent were integrated occupations. In 1980, the percentage of integrated occupations increased slightly, male-intensive occupations decreased slightly, and female-intensive occupations showed no change. Thus it seems apparent that there are considerably more male-intensive occupations than female-intensive occupations and recent trends have only begun to change the situation.

Another way to look at the female occupational situation is to examine the number of different types of occupations that females tend to be employed in. When this is done it is found that women are clustered into a small number of occupations. In addition, as will be pointed out later, these occupations tend to be low paying.

These statistics might be better visualized if specific occupations and industries are examined. Mellor (1984) found that 78 percent of all clerical workers are female. Medical secretaries, legal secretaries, and receptionists have a female composition of 100 percent, 99.4 percent, 98 percent, respectively (Rytine, 1982). In contrast, Norwood (1982) points out that the following occupations have a very low percentage of female workers: engineers (1.6%), lawyers-judges (4.7%), physicians-osteopaths (8.9%), carpenters (1.3%), and mechanics (2%). Norwood also revealed that the apparel and other textile products industry is the highest ranking industry in terms of percentage of female employees, 81.9 percent.

Bianchi and Rytina (1984) found that in 1970, 75 percent of working women were employed in female-intensive occupations, 16 percent in integrated occupations, and 9 percent in male-intensive occupations. By 1980, both sexes increased their respective percentage of workers in neutral occupations. From the men's perspective, in 1970 more than 50 percent of all men were employed in occupations with fewer than 10 percent women; by 1980 this fraction was reduced to 37 percent. There again, these statistics seem to indicate that male domination in certain occupations has been slightly eroded although it is still highly significant.

In a separate study, Rytina (1981, pp. 50) analyzed 419 occupations and found that 41 had a female work force of 90 percent or more. These 41 female-intensive occupations accounted for 40 percent of the women's total labor force. Male-intensive occupations comprised 179 of the 419 occupations and contained 50 percent of the male labor force.

In summary, the literature suggests that women are grouped into a smaller number of occupations than men. On the other hand, males seem to be employed in a much wider variety of occupations. The fact that men comprise a larger percentage of the total labor force, (.672 in 1960 and .619 in 1970 (Beller, pp. 374)) does not help to explain the disparity.

Earnings of Female-Intensive Occupations

A main conclusion of most researchers is that the female-intensive occupations tend to be lower paying. Beller (1982) found that in 1967 women in male-intensive jobs generally

earn one third more (12.3% net after controlling for such factors as education, experience, region, number of offspring, etc.) than women employed in integrated and female-intensive occupations. In 1974 the gross earnings differential was reduced to 29.5%; however, the net differential remained relatively unchanged at 11.9%. In the same study, the 1967 data showed that males in male-dominated occupations earned 29.4% more (11.9% net) than men employed in other occupations. In 1974 the data found that males in male-intensive jobs earned 29.4% more (9.7% net). An informal comparison of the net earnings differentials for males and females in male-dominated occupations (i.e. for the above 1974 data, 11.9% females and 9.7% males) seem to suggest that women benefit more than males for being employed in male-dominated occupations.

In a related study Sommers stated that in 1973, 40 percent of all employed women were in just ten occupations; however, only three of these occupations (elementary teacher, registered nurse, and secretary) were in the top half of the earnings distribution for all occupations.

Mellor (pp. 19) found that women make less than men in almost every occupation and skill level. (The only occupation that women earn more is for the occupation of "messenger.") In general, for most occupations, 40 percent of the men earn at least as much as the highest 10 percent of the women workers.

Rytina (1981) found that the earnings of male-intensive occupations tend to be more diverse. In other words, male-intensive jobs include some very high paying and also some

very low paying occupations. Rytina (1982) also revealed that the most highly paid occupations are the same for both sexes, which are professional and managerial-type jobs. However, women are less represented in these types of occupations. For instance in 1970 only 18 percent of all managers were female. Some improvement has been made by 1980 because 31 percent of all managers were female.

To summarize the occupational material, a significant portion of the literature has focused on the occupational differences of males and females to explain the wage differential. In general, women seem to be under represented in the better paying jobs. Sieling (1984, pp. 32) observed that women are being shut out from the upper levels of an occupation. He states, "Consistently, the share for women was smallest at the highest levels of the occupation and except for two occupations, was largest at the lowest levels." For example, in a review of various levels within an occupation, women tend to be concentrated into the lower half of these levels (closer to entry level positions). However, women at the upper levels of an occupation tend to have a larger F/M earnings ratio than the lower levels.

Correlation of an Industry's Earnings and Percentage of Females

In spite of the fact that female-intensive occupations tend to be lower paying there exists an on-going debate of the existence of a correlation between the proportion of females within an occupation and earnings for that occupation. For example, is an occupation or industry low paying simply because

it is composed of a large proportion of females? The results are yet unclear as will be pointed out below.

Norwood (1982) stated that an inverse relationship exists between the percentage of females within an occupation and earnings. In her brief analysis of 52 industries (Note: Norwood did not conduct a statistical analysis), the textile industry ranks first in female employment (81.9%) but also ranks 50th in average hourly earnings (\$5.18). In contrast, the bituminous coal and lignite mining industry ranks 52nd in percentage of female workers (5.2%) and first in average hourly earnings. Presenting a similar argument for occupations, Rytina (1982, pp. 32) also declared that an inverse relationship exists between an occupation's female proportions and earnings.

Other researchers do not make such clear-cut claims. Mellor (1984, pp. 27) found a weak inverse relationship between weekly earnings of women in a specific occupation and the proportion of females employed in it (Note: E=weekly earnings, F=percentage of female workers in the occupation, numbers in parentheses are the t-values):

$$E = \$333.9 - 1.28(F) \text{ with an } r^2 = 0.192 \\ (21.04) \quad (-5.11)$$

Mellor also created a regression equation for the weekly earnings of men in a specific occupation based on the proportion of females with the occupation:

$$E_m = \$398.30 - 0.57(F) \text{ with an } r^2 = 0.014 \\ (30.02) \quad (-1.55)$$

Thus, Mellor's results indicate a very weak relationship. In

addition, Sieling (1984, pp. 32) found no correlation between earnings of an occupation and the proportion of females employed in it.

I performed a regression analysis of Norwood's 52 industries to see if there is a correlation between an "industry's" overall hourly earnings and the proportion of female's employed within that industry (see Appendix 1 for calculations). The results show a correlation. The analysis yielded the following straight line regression equation: (Note: E=average hourly earnings, F=percentage of female workers in an industry, the numbers in parentheses are the t-values, P=correlation coefficient=r since there is only one independent variable.)

$$\begin{array}{lll} E=10.81 - 0.074(F) & r^2=0.478 \\ (24.55) & (-6.76) & P=0.69 \end{array}$$

The above correlation coefficient of 0.69 suggests that there is some correlation; also the t-statistics are all highly significant at the .001 level.

A plot of the data suggests that a nonlinear model may fit the data better. Three more models were run utilizing logarithms which produced similar results:

$$\begin{array}{lll} E=16.33 - 2.418 (\log F) & r^2=0.5507 \\ (15.52) & (-7.83) & P=0.74 \end{array}$$

$$\begin{array}{lll} \log E=2.395 - 0.009 (F) & r^2=0.485 \\ (43.97) & (-6.87) & P=0.70 \end{array}$$

$$\begin{array}{lll} \log E = 3.053 - 0.293 (\log F) & r^2 = 0.5217 \\ (22.57) & (-7.38) & P = 0.72 \end{array}$$

The correlation coefficient was slightly improved for all three models; however the functional form of the model (linear or nonlinear) does not appear to be that important. In conclusion, these results show that a correlation exists between average hourly earnings and the percentage of females within an industry.

This report's investigation of the sex's wage gap seems to show that the problem is mainly due to the types of occupations that women tend to be employed in. In general, women are employed in a relatively smaller number of occupations than men and these occupations tend to be low paying.

Why are women concentrated into low-paying occupations?

Lacking from the literature is an adequate explanation for this occupational segregation. Norwood (1984, pp. 5) recently summarized this lack of knowledge by saying, "We do not know exactly why women continue to work more in jobs that have traditionally been female intensive rather than in other jobs. We do not know how much of their occupational choice may result from the demands of family responsibilities; how much may still reflect discrimination in promotion, hiring, or recruiting practices; or how much may reflect other factors."

Shack-Marquez (1984, pp. 16) had this to say, "Why are women in lower-paying jobs? Labor market discrimination--that is, unequal access to high paying occupations--may be the only

answer." This remark seems to suggest some support for the dual labor market theory, although she does not specifically refer to the theory. She goes on to say that more study should be done investigating whether parents or schools encourage young women to pursue educational programs that are different than what young men pursue.

An extremely superficial expectation might be that women should be equally represented in all occupations. However, such an expectation would be naive because the type of occupation that a worker chooses can depend on many factors. Women have a shorter work horizon than men. Therefore according to human capital theory, women would not be concentrated into occupations requiring a significant amount of human capital investment (i.e. doctors, lawyers, dentists, etc.). Thus, the expectation would predict less female representation in these particular types of fields.

Another factor affecting a worker's choice for an occupation can depend on their spouses. For example, Frank (1978) stated that married women are hindered in their employment search because they are limited to exploring the area where their husbands work. This limitation greatly decreases a wife's employment possibilities. Incidentally, Frank's study indicates that women in small Standard Metropolitan Statistical Areas (SMSA) earn approximately 8 percent less than husbands with similar levels of education and experience.

In conclusion, occupational differences can be present and would even be expected between the sexes in a

nondiscriminatory world. Occupational differences can be caused by such factors as differences in human capital, tastes, expected work life, etc. The problem for researchers is determining whether discrimination plays a role in these occupational differences. At the present time, research has not provided an answer to this question.

Discrimination in recruitment and reverse discrimination

Newman (1978) felt that if discrimination is to occur it will transpire during the recruitment process. Newman's study is notable because it is the first research to investigate this. Newman states (pp. 18), "There certainly is no empirical precedent, simply because no effort has been previously made to measure recruitment discrimination."

Newman's study sent two resumes to 207 companies¹ that had equivalent credentials but contained different pictures of the applicants; one applicant's picture was of a black male while the other applicant's picture was of a white male. (Note: similar research has not been done for females). Another set of companies was sent two non-equivalent resumes that also had the differing pictures of the applicants. These non-equivalent resumes gave better credentials to the white applicant. Thus this second set of resumes tested for reverse discrimination in the sense that blacks should not receive as good of response. Responses from the companies were rated on a basis of five categories ranging from no response to receiving a

¹It should be noted that all 207 companies had been awarded federal contracts and have affirmative action programs.

response indicating that the resume will not be placed in the active file to a request for an interview.

The results indicate that for the equivalent resume group 32.65% (or 15 of 46 responses) preferred the minority applicant. While for the non-equivalent resumes, 70% (35 out of 50 responses) preferred the minority applicant, which suggests that reverse discrimination is occurring. Particularly interesting was that larger companies (over 25,000 employees) tended to exhibit more reverse discrimination than smaller companies. Newman conjectured that this might be due to the fact that they are monitored more frequently by affirmative action organizations.

The practice of reverse discrimination (employers hire a lesser qualified applicant based solely on the sex or race of the applicant) has been ruled illegal by our court system. (Griggs vs. Duke Power Company, 401 U.S. 424, 3 FEP Cases 175, 1971) and (Defunis vs. Odegaard, 416 U.S. 312, 40 L. Ed, 2d 164, 1974).

VI. CONCLUSION

The literature seems to be in wide disagreement as to the exact extent of the wage gap between the sexes. A general consensus seems to find, at the very least, approximately a ten percent unexplained earnings gap. Simply observing an unexplained earnings gap does not signify discrimination because the type of data base, the number of independent variables, and the use of proxies, can all influence the size of the wage differential. Furthermore, no reliable technique of establishing clear-cut discrimination has yet been developed.

Male and female productivity differences only provide a partial explanation for the earnings gap. Median years of education are found to be nearly equal between males and females; however, the results are mixed concerning the rates of return for education. On the other hand, specific training appears to be rewarded equally regardless of sex, but men

receive over twice as much as women. In regards to turnover, women seem to be punished more severely than men for their high turnover rates when a percentage of earnings are considered.

Occupational differences exist between the sexes. Moreover, women tend to be concentrated into a relatively small number of jobs that tend to be low paying. This observation seems to account for a large portion of the female/male earnings differential. However, unclear in the literature is whether discrimination plays a role in determining these occupational differences.

General policy considerations suggest that more emphasis might be placed on opening up employment opportunities for women. As opposed to concentrating solely on equal pay laws, more attention could be given to equal opportunity laws to ensure that qualified women are not denied job advancement or higher ranking positions. Sawhill (pp. 394) also points this out by stating that equal pay laws are not very helpful because they tend to reduce the amount of training opportunities available to women.

TABLE 1

Table 1

Summary of Empirical Work on Sex Differentials in Earnings

Author	Data Source	Unadjusted F/M Earnings Ratio	Controls Used	Adjusted F/M Earnings Ratio
Blinder (1973)	Michigan Survey Research Center's "Panel Study of Income Dynamics": white persons, except household heads younger than age 25 or did not work for money in 1967	.54 (hourly)	age, region, parents' income, father's education, place of birth, number of siblings, health, local labor market conditions, geographic mobility, seasonal employment	.54
Ferber & Green (1982)	University of Illinois full-time faculty	.77 (annual)	highest degree, experience, number of publications, honors, field	.88
Fuchs (1971)	1:1000 sample of the 1960 Census: nonfarm employed persons	.60 (hourly)	schooling, age, city size, color	.61
Gwartney & Stroup (1973)	U.S. Dept. of Commerce, Current Population Reports, P-60 series; 1960 Census: employed persons	.60 (hourly)	age, education	.60
Landes (1977)	1967 SEO: whites, 14-65, employed in civilian labor force (aggregate in 96 occupations)	.71 (hourly)	percent working full-time, percent who reported current job different from longest job in 1966, variance in weeks worked, growth in male earnings in occupation.	.90
Malkiel & Malkiel (1973)	272 professional employees of a private corporation	.65 (annual)	education, experience, tenure in present job	.84

Author	Data Source	Unadjusted F/M Earnings Ratio	Controls Used	Adjusted F/M Earnings Ratio
Morgan et al (1962)	Heads of household (1959)	.64 (hourly)	occupation, education, age, city population	.63
Oaxaca (1973)	1967 Survey of Economic Opportunity: urban white, aged 16 and over, who report an hourly wage for the week preceding the survey	.65 (hourly)	children, city size, education, experience, health, hours of work, marital status, migration region, union membership	.72
Sawhill (1973)	1967 Current Population Survey: employed wage and salary workers in the civilian labor force	.46 (annual)	race, region, age, education, weeks worked per year, hours worked per week	.56
Suter & Miller (1973)	1967 Longitudinal Survey: women aged 30-44, from the unpublished data from the March 1967 Current Population Survey: men aged 30-44	.39 (annual)	education, occupation, work exper., hours of work	.62
Zincone & Close (1978)	American Physical Therapy Association Supervisors Staff	.605 (weekly) .744 .781	age, schooling, experience, weekly hours, population of area in which practicing, children, marital status	.82 .852 .903

APPENDIX

1 S A T L O G DS SAS B2.4 V5274V5 J0H CACMJ0HN STEP SAS PRJC
 NOTE: THE JOB CACMJ0HN HAS BEEN RUN UNDER RELEASE R2.4 OF SAS AT STATE DATA CENTER 1016990011.

NOTE: CPROD VERSION = 03 SERIAL = 021818 MODEL = 3081 *
 CPROD VERSION = 03 SERIAL = 221818 MODEL = 3081 *

NOTE: SAS OPTIONS SPECIFIED ARE:
 SORT=4

1 DATA WOMEN;
 2 INPUT PERCENT EARNING #B1;
 3 CARDS;
 4

NOTE: SAS WENT TO A NEW LINE WHEN INPUT STATEMENT
 REACHED PAST THE END OF A LINE.
 NOTE: DATA SET WORK.WOMEN HAS 52 OBSERVATIONS AND 2 VARIABLES. 953 OBS/79K.
 NOTE: THE DATA STATEMENT USED 0.05 SECONDS AND 208K.

13 PROC PRINT;
 NOTE: THE PROCEDURE PRINT USED 0.11 SECONDS AND 208K AND PRINTED PAGE 1.

14 PROC PLOT; PLOT EARNING*PERCENT;
 NOTE: THE PROCEDURE PLOT USED 0.12 SECONDS AND 216K AND PRINTED PAGE 2.

15 PROC GLM; MODEL EARNING=PERCENT/P1
 NOTE: THE PROCEDURE GLM USED 0.17 SECONDS AND 279K AND PRINTED PAGES 3 TO 4.

NOTE: SAS USED 278K MEMORY.

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 CARY, N.C. 27511-4000

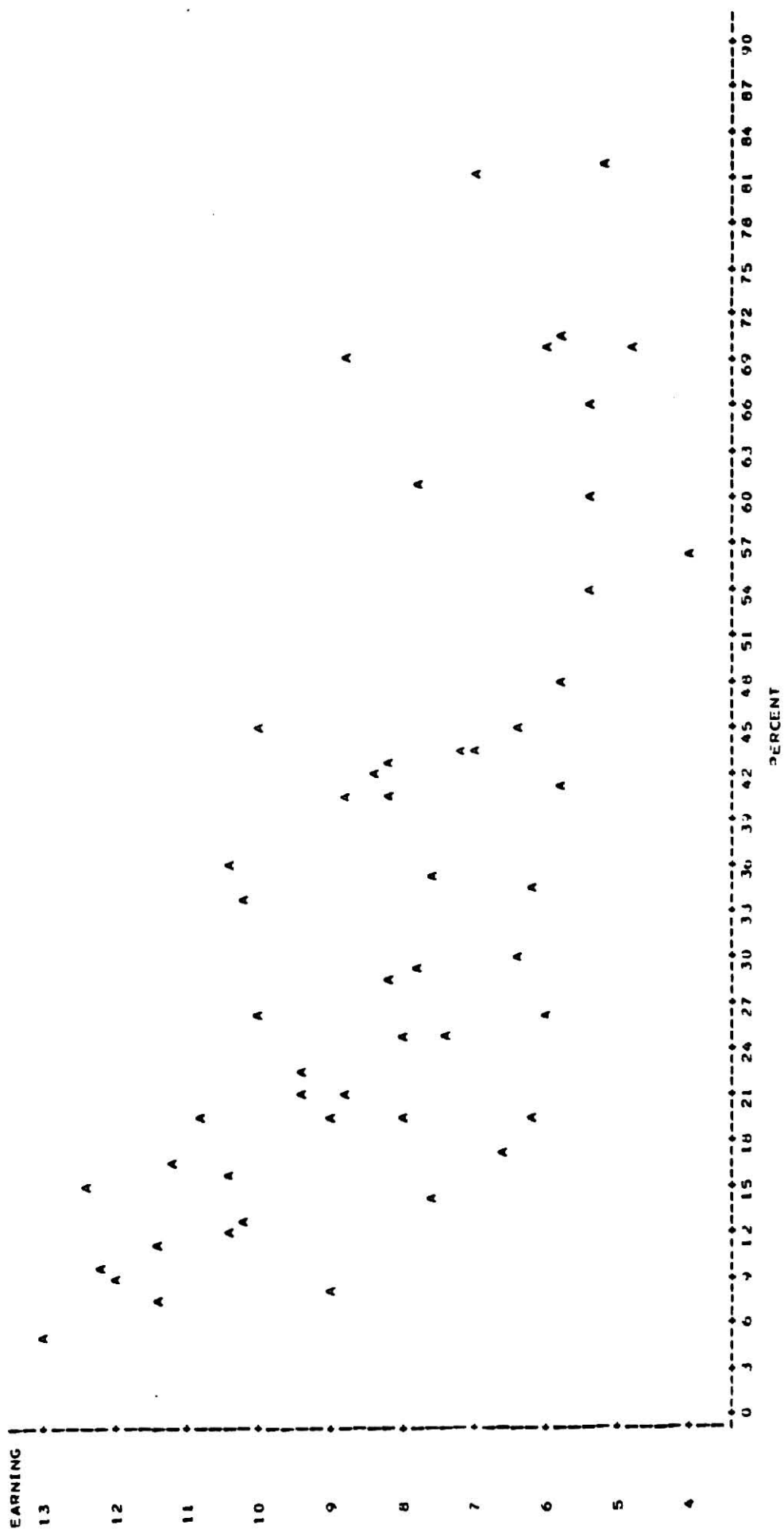
00800003
 00810030
 00811030
 00812030

00819230

00819330

00819430

UBS	SAS PERCENT	EARNING
1	61.3	5.19
2	61.3	7.01
3	70.8	5.80
4	70.0	4.55
5	67.7	5.74
6	67.3	8.75
7	65.0	5.40
8	63.6	7.70
9	60.2	5.31
10	56.3	6.06
11	54.3	5.56
12	48.0	5.81
13	45.3	6.40
14	44.9	10.01
15	43.5	7.25
16	43.5	7.03
17	42.5	4.19
18	42.1	9.10
19	41.2	5.87
20	40.6	8.22
21	40.5	8.72
22	36.2	10.32
23	36.9	7.67
24	34.2	6.20
25	34.0	10.22
26	33.1	6.13
27	29.4	7.87
28	28.9	4.17
29	25.1	10.01
30	25.9	9.02
31	25.0	7.43
32	24.1	7.77
33	21.4	7.40
34	21.0	4.11
35	21.0	8.85
36	17.5	10.70
37	17.4	8.00
38	17.4	8.23
39	17.3	6.24
40	17.3	6.24
41	16.4	11.26
42	15.9	10.47
43	15.3	12.40
44	14.5	7.63
45	12.7	10.26
46	11.7	10.41
47	11.2	11.14
48	7.7	12.24
49	7.1	12.04
50	4.0	4.94
51	7.2	11.47
52	5.1	13.05



SAS
GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: EARNING

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	N-SQUARE	C.V.	
MODEL	1	120.90362546	120.90362546	45.71	0.0001	0.477612	19.7044	
ERROR	50	132.23834954	2.64478699		ROOT MSE		EARNING MEAN	
CORRECTED TOTAL	51	253.14197500			1.62627396		8.25250000	
SOURCE	DF	TYPE III SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
PERCENT	1	120.90362546	45.71	0.0001	1	120.90362546	45.71	0.0001

PARAMETER	ESTIMATE	T FOR HQ2 PARAMETER=20	PR > T	STD ERROR OF ESTIMATE
INTERCEPT	10.81005331	24.55	0.0001	0.44034416
PERCENT	-0.07392594	-6.76	0.0001	0.01091179

OBSERVATION	OBSERVED VALUE	PREDICTED VALUE	RESIDUAL
1	5.18000000	4.75518555	0.42481445
2	7.01000000	4.79287412	2.21012588
3	5.80000000	5.57604652	-0.22390348
4	4.85000000	5.63523728	-0.78523728
5	5.99000000	5.65741506	-0.33259494
6	1.75000000	5.68124544	-3.93124544
7	5.40000000	5.91034105	-0.51034105
8	7.70000000	6.31014114	1.38985886
9	5.31000000	6.35971152	-1.04971152
10	4.06000000	6.64802270	-2.58802270
11	5.36000000	6.79567459	-1.43567459
12	5.61000000	7.26160403	-1.65160403
13	6.40000000	7.46120808	-1.06120808
14	10.01000000	7.49077445	2.51922555
15	7.25000000	7.59427477	-0.34427477
16	7.03000000	7.59427477	-0.56427477
17	8.16000000	7.66820072	0.51179928
18	9.30000000	7.68238591	0.61761409
19	5.87000000	7.76430444	-1.89430444
20	8.22000000	7.80466001	0.41533999
21	8.72000000	7.81605260	0.90394740
22	10.32000000	8.13393416	2.18606584
23	7.67000000	8.21003789	-0.54003789
24	6.24000000	8.24144005	-2.00144005
25	10.22000000	8.29657124	1.92342876
26	6.33000000	8.54459241	-2.21459241
27	7.87000000	8.63661057	-0.76661057
28	8.17000000	8.69577133	-0.52577133
29	10.01000000	8.69594613	1.31405387
30	6.02000000	8.89537134	-2.87537134

SAS
GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: EARNING

OBSERVATION	OBSERVED VALUE	PREDICTED VALUE	RESIDUAL
31	7.43000000	8.96190472	-1.53170472
32	7.99000000	8.99896770	-1.00896770
33	9.40000000	9.13932690	0.26067301
34	9.31000000	9.25760850	0.05239150
35	8.45000000	9.25760850	-0.40760850
36	10.70000000	9.34631963	1.35368037
37	8.00000000	9.34631963	-1.34631963
38	8.93000000	9.37589001	-0.44589001
39	6.29000000	9.39328260	-3.10328260
40	6.68000000	9.53113449	-2.85113449
41	11.26000000	9.59766784	1.66233216
42	10.43000000	9.63463081	0.79536919
43	12.40000000	9.67896637	2.72103363
44	7.63000000	9.73812713	-2.10812713
45	10.26000000	9.87114383	0.38885617
46	10.41000000	9.94511977	0.46488023
47	11.38000000	9.95251236	1.42748764
48	12.24000000	10.09297166	2.14702834
49	12.09000000	10.13732722	1.95267278
50	8.94000000	10.21864576	-1.27864576
51	11.47000000	10.27778651	1.19221349
52	13.05000000	10.43303100	2.61696900

SUM OF RESIDUALS
SUM OF SQUARED RESIDUALS
SUM OF SQUARED RESIDUALS - ERROR SS
FIRST ORDER AUTOCORRELATION
DURBIN-WATSON U

0.00000000
132.23614954
-0.00000000
0.06013403
1.31418004

14:38 FRIDAY, SEPTEMBER 21, 1984

1 S A S L O G US SAS B2.4 VS2/MVS JJB CACMJOHN STEP SAS PROC
NOTE: THE JOB CACMJOHN HAS BEEN RUN UNDER RELEASE B2.4 OF SAS AT STATE DATA CENTER (01697001).

NOTE: CPUID VERSION = 03 SERIAL = 021819 MODEL = J081 .
NOTE: CPUID VERSION = 03 SERIAL = 221818 MODEL = 3081 .

NOTE: SAS OPTIONS SPECIFIED ARE:
SORTF4

1 DATA WOMEN;
2 INPUT PERCENT EARNING @@;
3 LOG_PCT=LOG(PERCENT);
4 LOG_ERN=LOG(EARNING);
5 IF PERCENT<29 THEN X1=PERCENT; ELSE X1=29;
6 IF PERCENT<29 THEN X2=0; ELSE X2=PERCENT-29;
7 CANS; 00600003
8 00810030
00811030
00811132
00811232
00811332
00811432
00812030

NOTE: SAS WENT TO A NEW LINE WHEN INPUT STATEMENT
REACHED PAST THE END OF A LINE.
NOTE: DATA SET WOMEN HAS 52 OBSERVATIONS AND 6 VARIABLES. 366 OBS/TX4.
NOTE: THE DATA STATEMENT USED 0.07 SECONDS AND 208K.

17 PROC PRINT; 00819232

NOTE: THE PROCEDURE PRINT USED 0.12 SECONDS AND 208K AND PRINTED PAGE 1.

18 PROC PLOT; PLOT LOG_PCT*LOG_ERN PERCENT*LOG_ERN LOG_PCT*EARNING; 00819332

NOTE: THE PROCEDURE PLOT USED 0.16 SECONDS AND 216K AND PRINTED PAGES 2 TO 4.

19 PROC GLM; MODEL EARNING=LOG_PCT/P; TITLE SEMILOG MODEL; 00819432

NOTE: THE PROCEDURE GLM USED 0.17 SECONDS AND 278K AND PRINTED PAGES 5 TO 6.

20 PROC GLM; MODEL LOG_ERN=PERCENT/P; TITLE SEMILOG MODEL; 00819532

NOTE: THE PROCEDURE GLM USED 0.18 SECONDS AND 279K AND PRINTED PAGES 7 TO 8.

21 PROC GLM; MODEL LOG_ERN=LOG_PCT/P; TITLE DOUBLELOG MODEL; 00819632

NOTE: THE PROCEDURE GLM USED 0.18 SECONDS AND 278K AND PRINTED PAGES 9 TO 10.

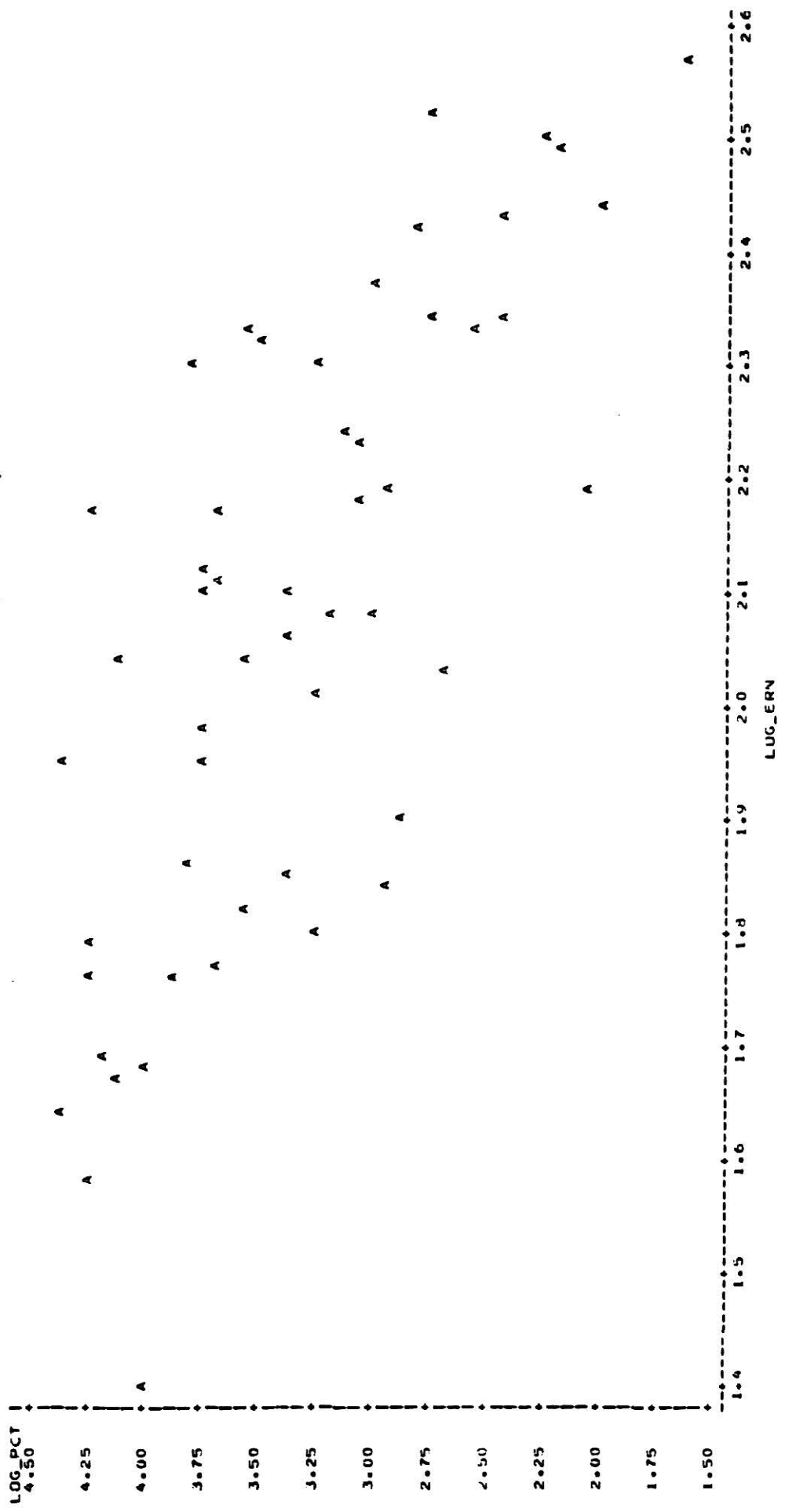
22 PROC GLM; MODEL EARNING=X1 X2/P; TITLE LINEAR Spline MODEL;
23 /* PROC CORR; VAR LOG_ERN LOG_PCT EARNING PERCENT;*/ 00819732
00819832

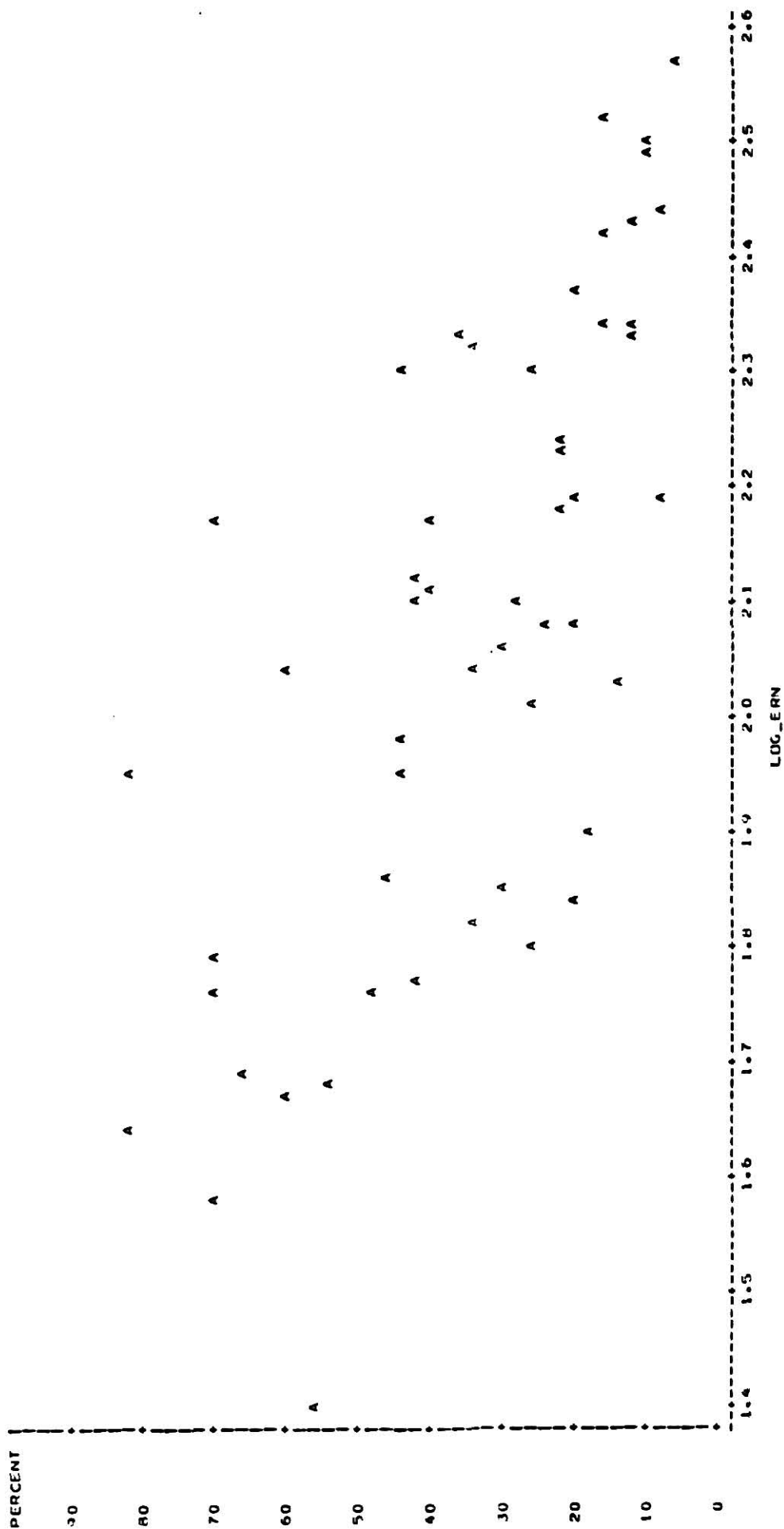
NOTE: THE PROCEDURE GLM USED 0.18 SECONDS AND 278K AND PRINTED PAGES 11 TO 12.
NOTE: SAS USED 278K MEMORY.

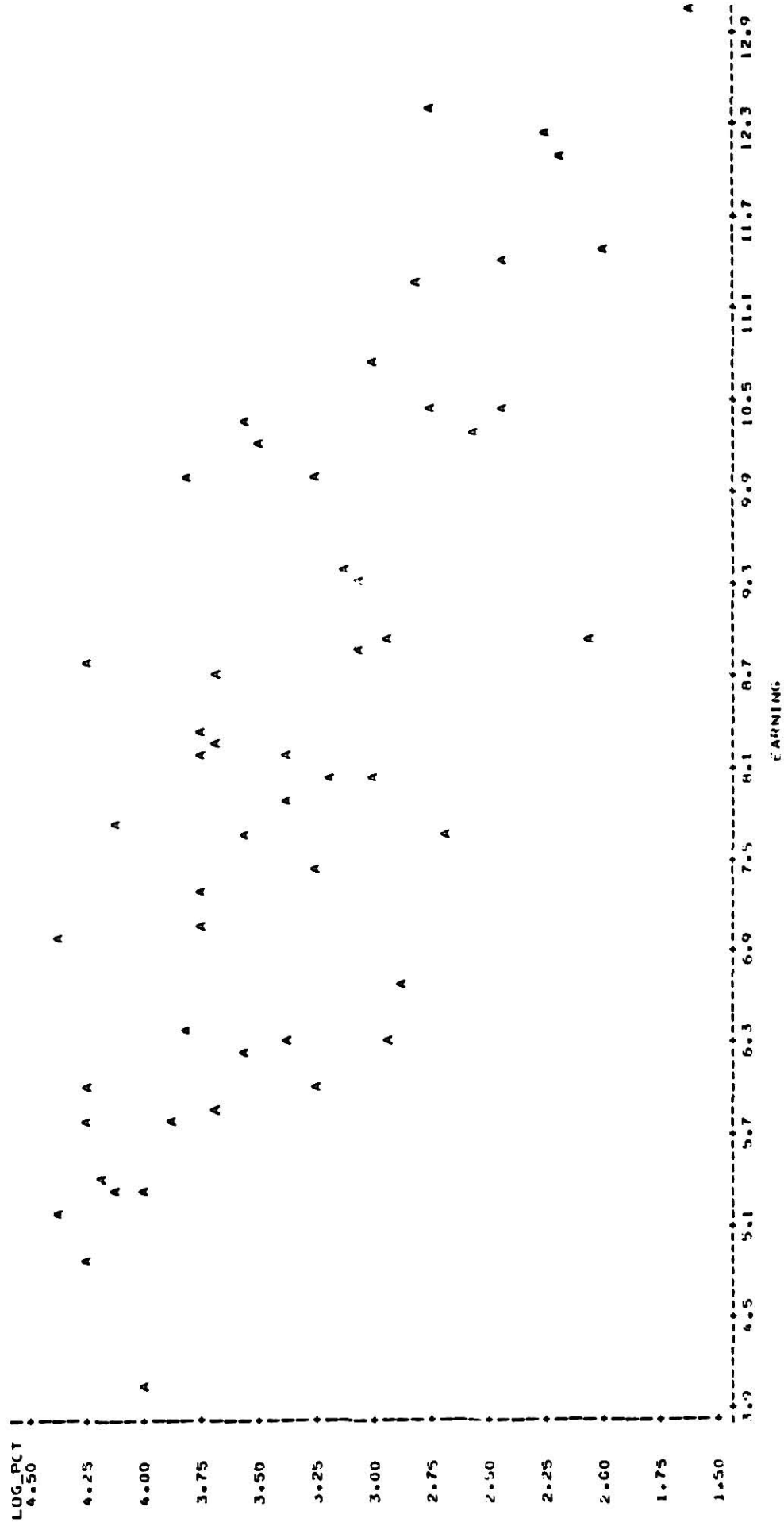
NOTE: SAS INSTITUTE INC.
SAS CIRCLE
PU BOX 8000
CARY, N.C. 27511-8000

SAS

OBS	PERCENT	EARNING	LOG_PCT	LOG_ERN	X1	X2
1	81.9	5.14	4.40550	1.64481	29.0	52.9
2	81.3	7.01	4.39815	1.94734	29.0	52.3
3	70.8	5.80	4.25986	1.75786	29.0	41.8
4	70.0	4.85	4.24850	1.57898	29.0	41.0
5	69.7	5.99	4.24420	1.74009	29.0	40.7
6	59.3	4.75	4.21944	2.16905	29.0	40.3
7	66.0	5.40	4.18965	1.68640	29.0	37.0
8	60.4	7.70	4.10429	2.04122	29.0	31.6
9	20.2	5.31	4.03767	1.66959	29.0	31.2
10	56.3	4.06	4.03069	1.40118	29.0	27.3
11	54.3	5.36	3.99452	1.67896	29.0	25.3
12	48.0	5.81	3.87120	1.75958	29.0	19.0
13	45.3	6.40	3.81331	1.95630	29.0	16.3
14	44.9	10.01	3.80444	2.30358	29.0	15.9
15	41.5	7.25	3.77276	1.98100	29.0	14.5
16	43.5	7.03	3.77276	1.95019	29.0	14.5
17	42.3	8.18	3.74950	2.10169	29.0	13.5
18	42.3	8.30	3.74479	2.11626	29.0	13.3
19	41.2	5.87	3.71844	1.76985	29.0	12.2
20	40.6	3.22	3.70377	2.10657	29.0	11.6
21	40.5	8.72	3.70130	2.16562	29.0	11.5
22	36.2	10.32	3.59906	2.33408	29.0	7.2
23	34.9	7.67	3.55249	2.03732	29.0	5.9
24	34.2	6.20	3.53223	1.82455	29.0	5.2
25	34.0	10.22	3.52636	2.32435	29.0	5.0
26	30.1	6.33	3.40453	1.84530	29.0	1.1
27	29.4	7.97	3.38099	2.06306	29.0	0.4
28	28.6	8.17	3.35341	2.10047	28.6	0.0
29	26.1	10.01	3.26194	2.30359	26.1	0.0
30	25.9	6.02	3.25424	1.79509	25.9	0.0
31	25.0	7.43	3.21888	2.00553	25.0	0.0
32	24.5	7.99	3.17467	2.07819	24.5	0.0
33	22.0	7.40	3.11771	2.24071	22.0	0.0
34	21.0	7.31	3.04452	2.23109	21.0	0.0
35	21.0	9.95	3.04452	2.18042	21.0	0.0
36	19.8	10.70	2.98568	2.37024	19.8	0.0
37	19.8	8.00	2.94568	2.07944	19.8	0.0
38	19.4	9.93	2.96527	2.18742	19.4	0.0
39	19.3	6.28	2.96011	1.83737	19.3	0.0
40	17.3	6.68	2.85071	1.49912	17.3	0.0
41	16.4	11.26	2.79728	2.42126	16.4	0.0
42	15.9	10.43	2.76632	2.34469	15.9	0.0
43	15.3	12.40	2.72785	2.51770	15.3	0.0
44	14.5	7.63	2.67415	2.03209	14.5	0.0
45	12.7	10.20	2.54160	2.32825	12.7	0.0
46	11.7	10.41	2.45959	2.34277	11.7	0.0
47	11.6	11.34	2.45101	2.43146	11.6	0.0
48	9.7	12.24	2.27211	2.50471	9.7	0.0
49	9.1	12.05	2.20827	2.49155	9.1	0.0
50	8.0	8.94	2.07944	2.19054	8.0	0.0
51	7.2	11.47	1.97408	2.43973	7.2	0.0
52	5.1	13.03	1.62924	2.56879	5.1	0.0







SEMILOG MODEL
GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: EARNING

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	1	139.42170324	139.42170324	61.30	0.0001	0.550765	18.2746
ERROR	50	113.72027176					EARNING MEAN
CORRECTED TOTAL	51	253.14197500	2.27440544				8.25250000
							1.50811320

SOURCE	DF	TYPE I SS	F VALUE	PR > F	WF	TYPE III SS	F VALUE	PR > F
LOG_PCT	1	139.42170324	61.30	0.0001	1	139.42170324	61.30	0.0001

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > T	STD ERROR OF ESTIMATE
INTERCEPT	16.32754487	15.52	0.0001	1.05235865
LOG_PCT	-2.41779027	-7.83	0.0001	0.30880717

OBSERVATION	OBSERVED VALUE	PREDICTED VALUE	RESIDUAL
-------------	-------------------	--------------------	----------

1	5.18000000	5.67507229	-0.49507229
2	7.01000000	5.69375024	1.31624976
3	5.80000000	6.02809924	-0.22809924
4	4.85000000	6.05557442	-1.20557442
5	5.99000000	6.06535865	-0.07535865
6	8.75000000	6.07987403	2.67012597
7	5.40000000	6.17781441	-0.77781441
8	7.70000000	6.40427062	1.29572938
9	5.31000000	6.42023254	-1.11023254
10	4.06000000	6.58217035	-2.52217035
11	5.36000000	6.66362307	-1.30362307
12	5.81000000	6.96779274	-1.15779274
13	6.40000000	7.10776824	-0.70776824
14	10.01000000	7.12921220	2.88078780
15	7.25000000	7.20580019	0.04419981
16	7.03000000	7.20580019	-0.17580019
17	8.18000000	7.26203041	0.91796959
18	8.30000000	7.27343510	1.02656490
19	5.87000000	7.33714104	-1.46714104
20	8.22000000	7.37261049	0.84738951
21	8.72000000	7.37857298	1.34142702
22	10.32000000	7.61995266	2.70004734
23	7.67000000	7.73437679	-0.06437679
24	6.20000000	7.78736409	-1.58736409
25	10.22000000	7.80154471	2.41845529
26	6.33000000	8.09611704	-1.76611704
27	7.87000000	8.15300885	-0.28300885
28	8.17000000	8.21971074	-0.04971074
29	10.01000000	8.44086941	1.56913059
30	6.02000000	8.45946789	-2.43946789

SEMILOG MODEL
GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: EARNING

OBSERVATION	OBSERVED VALUE	PREDICTED VALUE	RESIDUAL
31	7.43000000	8.56497823	-1.11437823
32	7.99000000	8.50382414	-0.60312414
33	9.40000000	8.78899593	0.51100407
34	9.31000000	8.96652815	0.34347185
35	8.85000000	8.96652815	-0.11652815
36	10.70000000	9.10879214	1.59120786
37	8.00000000	9.10879214	-1.10879214
38	8.93000000	9.15813651	-0.22813651
39	6.24000000	9.17063158	-2.89063158
40	6.68000000	9.43513443	-2.75513443
41	11.26000000	9.56430528	1.69569472
42	10.43000000	9.63916545	0.79083455
43	12.40000000	9.73216885	2.66783115
44	7.63000000	9.85201429	-2.23201429
45	10.26000000	10.18248431	0.07751569
46	10.41000000	10.38077471	0.02922509
47	11.38000000	10.40152860	0.97847140
48	12.24000000	10.83402102	1.40597898
49	12.08000000	10.98840048	1.09159952
50	8.94000000	11.29889135	-2.35889135
51	11.47000000	11.55463098	-0.08463098
52	13.05000000	12.38838295	0.66161705

SUM OF RESIDUALS
SUM OF SQUARED RESIDUALS - ERROR SS
SUM OF SQUARED RESIDUALS - ERROR SS
FIRST ORDER AUTOCORRELATION
DURBIN-WATSON D

0.00000000
113.72027176
-0.00000000
-0.01814522
2.07167810

SEMILOG MODEL
GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LOG_ERN

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	1	1.90650334	1.90650334	47.13	0.0001	0.485246	9.6390
ERROR	50	2.02249975					
CORRECTED TOTAL	51	3.92900329	0.04045000		ROOT MSE		LOG_ERN MEAN
					0.20112185		2.07364167
SOURCE	DF	TYPE I SS	F VALUE	PR > F	TYPE III SS	F VALUE	PR > F
PERCENT	1	1.90656334	47.13	0.0001	1.90656334	47.13	0.0001

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > T	STD ERROR OF ESTIMATE
INTERCEPT	2.33480848	43.97	0.0001	0.05446369
PERCENT	-0.00929331	-6.87	0.0001	0.00135219

OBSERVATION	OBSERVED VALUE	PREDICTED VALUE	RESIDUAL
1	1.64480506	1.63450543	0.01029963
2	1.94733770	1.64007541	0.30726229
3	1.73785792	1.73755016	0.02030776
4	1.57897870	1.74497681	-0.16599810
5	1.73009141	1.74776180	-0.01767039
6	2.15405370	1.75147513	0.40257857
7	1.66619175	1.74211007	-0.07591832
8	2.04122033	1.83223942	-0.20994041
9	1.66459184	1.83595324	-0.16636141
10	1.40118297	1.87215815	-0.47097514
11	1.67896398	1.89072477	-0.21176079
12	1.75958057	1.94920962	-0.18962905
13	1.85629799	1.97427455	-0.11797656
14	2.30354459	1.97787884	0.32566575
15	1.98100147	1.99038451	-0.00938304
16	1.95018671	1.99098451	-0.04079781
17	2.10169215	2.00026782	0.10142433
18	2.11625551	2.00267448	0.11413103
19	1.76985463	2.01233612	-0.24248149
20	2.10657021	2.01770611	0.08886410
21	2.16561924	2.01881444	0.14678480
22	2.33408376	2.058175267	0.27590849
23	2.03731662	2.07082037	-0.03350436
24	1.82454929	2.07731929	-0.25277000
25	2.32434659	2.07917595	0.24517063
26	1.84530024	2.11538046	-0.27008062
27	2.06305906	2.12187918	-0.05892111
28	2.10468891	2.12930532	-0.02461641
29	2.30358459	2.15251410	0.15107050
30	1.79508726	2.15433706	-0.35924980

SEMLOG MODEL
GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LOG_EHN

OBSERVATION

OBSERVED
VALUEPREDICTED
VALUE

RESIDUAL

31	2.00552586	2.16272574	-0.15719984
32	2.07819076	2.16736734	-0.08917663
33	2.24070969	2.18500568	0.05570401
34	2.23108909	2.19985898	0.03123011
35	2.14041746	2.19985898	-0.01944152
36	2.37024374	2.21099895	0.15924479
37	2.07944154	2.21099895	-0.13155741
38	2.16941639	2.21471227	-0.02529588
39	1.83736998	2.21564060	-0.37827062
40	1.69411799	2.23420722	-0.53508923
41	2.42125662	2.24256220	0.17869442
42	2.34468627	2.24720386	0.09748241
43	2.51769647	2.25277384	0.26492263
44	2.03208785	2.26020049	-0.22811264
45	2.32825284	2.27691045	0.05134239
46	2.34276688	2.28619376	0.05657313
47	2.43185743	2.28712209	0.14473534
48	2.50470928	2.30476017	0.19994890
49	2.49155119	2.31033036	0.18122083
50	2.19053559	2.32054200	-0.13000641
51	2.43973493	2.37796865	0.11176528
52	2.56878813	2.34746360	0.22132454

SUM OF RESIDUALS
SUM OF SQUARED RESIDUALS
SUM OF SQUARED RESIDUALS - ERROR SS
FIRST ORDER AUTOCORRELATION
DURBIN-WATSON D

0.00000000
2.02248995
-0.00000000
0.05903986
1.15764403

DOUBLELOG MODEL
GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LOG_ERN						
SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE
MODEL	1	2.04970744	2.04970744	54.53	0.0001	0.521678
ERROR	50	1.87935585				
CORRECTED TOTAL	51	3.92906329	0.03758712			
					ROUT MSE	LOG_ERN MEAN
					0.19387397	2.07364167
SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS
LOG_PCT	1	2.04970744	54.53	0.0001	1	2.04970744
						F VALUE
						54.53
						PR > F
						0.0001

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > T	STD ERROR OF ESTIMATE
INTERCEPT	3.05273861	22.57	0.0001	0.13528490
LOG_PCT	-0.29315639	-7.38	0.0001	0.03969839

OBSERVATION	UNRESERVED VALUE	PREDICTED VALUE	RESIDUAL
1	1.64480506	1.76123841	-0.11643335
2	1.94733770	1.76339398	0.18394372
3	1.75785792	1.80393370	-0.04607579
4	1.57897870	1.80726506	-0.22828635
5	1.79009141	1.80852414	-0.01843273
6	2.16905370	1.81021138	0.35884232
7	1.08639845	1.82451453	-0.73811557
8	2.04122033	1.84953641	0.19168392
9	1.66359184	1.85147975	-0.18788792
10	1.40118297	1.87111473	-0.46993176
11	1.67896399	1.88171829	-0.20275431
12	1.75958057	1.91787128	-0.15829070
13	1.85629799	1.93484327	-0.07854528
14	2.30358459	1.93744334	0.36614125
15	1.99100147	1.94672961	0.04427185
16	1.95018671	1.94672961	0.00345709
17	2.10169215	1.95454751	0.14714464
18	2.11625551	1.95493033	0.16132519
19	1.76985463	1.96265465	-0.19280002
20	2.10657021	1.96695531	0.13961490
21	2.16561924	1.96767826	0.19794097
22	2.33408376	2.00058298	0.33350078
23	2.03731662	2.01130438	-0.07401224
24	1.82454929	2.01724407	-0.19269478
25	2.32434658	2.01896347	0.30538312
26	1.84530024	2.05468028	-0.20938005
27	2.06305906	2.06157840	0.00147966
28	2.10046891	2.06966598	0.03080293
29	2.30358459	2.09664141	0.20701318
30	1.79508726	2.09973647	-0.30364921

DOUBLEDOS MODEL
GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LOG_ERN

OBSERVATION	OBSERVED VALUE	PREDICTED VALUE	RESIDUAL
31	2.00552586	2.10910458	-0.10357872
32	2.07819076	2.11502713	-0.03683637
33	2.24020969	2.1369165	0.10201804
34	2.23108909	2.16021739	0.07087171
35	2.16041746	2.16021739	0.02020007
36	2.37024374	2.17746685	0.19277689
37	2.07944154	2.17746685	-0.09802531
38	2.18941639	2.18344985	0.00596655
39	1.83736998	2.18495487	-0.34759489
40	1.99111749	2.21703577	-0.22591728
41	2.4212562	2.23269770	0.18855893
42	2.3468627	2.24177447	0.10291120
43	2.51769647	2.25305111	0.26464537
44	2.03208785	2.26877443	-0.23670698
45	2.32825284	2.30765173	0.02060111
46	2.34276684	2.33167441	0.01107247
47	2.43185743	2.33421077	0.09764664
48	2.50470928	2.35000037	0.15470891
49	2.49155117	2.40500034	0.08655083
50	2.13003344	2.43133702	-0.30130358
51	2.43775493	2.47402413	-0.03626920
52	2.56878813	2.57511632	-0.00632819

SUM OF RESIDUALS
SUM OF SQUARED RESIDUALS
FIRST ORDER AUTOCORRELATION
DURBIN-WATSON D

0.00000000
1.77215585
-0.00000000
0.01211420
1.77332739

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This report is dedicated to my dog, Eschen Van Eschen.

THE FEMALE/MALE EARNINGS DIFFERENTIAL

by

JOHN VAN ESCHEN

B.S., The University of Iowa, 1982

An Abstract of a MASTER'S REPORT submitted
in partial fulfillment of the requirements
for the degree MASTER OF ARTS

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1985

Research has shown that women earn approximately 10 to 46 percent less than men after productivity and other adjustments have been made. While there is no statistical method that can accurately establish clear-cut discrimination, this unexplained portion of the wage gap is viewed as a crude measure of discrimination. Four theories concerning the earnings differential and discrimination are reviewed: Becker's theory, dual labor market theory, monopsony power theory, and human capital theory.

This report examines the various factors that can contribute to the earnings gap. The major factor appears to be occupational differences between the sexes. Women seem to be concentrated into a relatively small number of jobs and these occupations tend to be low paying. Productivity characteristics are also examined. Women and men have the same median years of education but the literature is mixed regarding whether men receive a higher rate of return for their education. On-the-job training is rewarded equally between the sexes, but men receive over twice as much of it as women. Women also have higher quit rates than men and appear to be penalized more severely for this fact (in terms of a percentage of their earnings).