WAGE AND EMPLOYMENT EFFECTS OF COMPARABLE WORTH:

THE CASE OF MINNESOTA

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by

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Abstract

During the 1980s, comparable worth policies were adopted by many state and local governments. The point of this policy is to eliminate the pay disparity between female dominated jobs and other jobs deemed comparable within a firm. A few economists have examined the wage and employment effects of these policies, but their efforts have had serious weaknesses which are discussed below. This paper examines the wage and employment effects of comparable worth in the state of Minnesota, the first state to implement a comprehensive comparable worth policy for its employees. I find that for Minnesota government employees, comparable worth increased women's relative pay by 10.4 percent, causing the female/male pay ratio to rise from 72 to 79.5 percent. I also find that this policy had a negligible negative effect on total state government employment, decreasing it by .3 percent. A policy of equal pay for comparable worth has been implemented by a number of state and local governments in the United States. This policy initiative has even spread to our northern neighbor, where the Province of Ontario has imposed equal pay for comparable worth on the public and private sector. Yet, the impact of this policy on the wage and employment opportunities in the jurisdictions implementing comparable worth has not been fully analyzed. As I show below, a few ex ante studies have examined the impact of this policy, but their estimates are somewhat misleading. The ex post studies, on the other hand, have tended to be descriptive or have used models that capture only part of its impact. Hence, this paper offers new estimates of the wage and employment effects of comparable worth in the state of Minnesota.

Comparable worth is a policy aimed at eliminating the pay discrepancy between female dominated jobs and other jobs within a firm that is unaccounted for by differences in job requirements. As I explain in this paper, however, the actual enactment of this policy has varied among jurisdictions. This variation has resulted in different effects on the wage and employment opportunities in these jurisdictions.

For Minnesota state government employees, this paper finds that comparable worth increased women's pay by 10.7 percent and men's pay by .3 percent, resulting in a 10.4 percent rise in women's relative pay. This increased the female/male pay ratio from 72 to 79.5 percent. This rise in women's relative pay had a negligible effect on total employment in the state sector of Minnesota. Overall employment grew from 30,669 to 33,489 between October 1981 and October 1988, but this research finds that if comparable worth had not been implemented, 90 fewer jobs would have been added to the state sector. Hence, comparable worth reduced overall state government employment by .3 percent.

This paper focuses upon the state of Minnesota for several reasons. It was the first state to pass legislation establishing a comparable worth policy for state government employees. In addition, Minnesota is the only state that has

passed legislation requiring all local governments to implement comparable worth. In 1982, the Minnesota legislature adopted a bill establishing the "comparability of the value of the work" as the primary consideration in determining compensation and it included a procedure for implementing comparable worth adjustments for state government employees. Two years later, a similar bill was passed covering all political subdivisions of the state.

The Anticipated Effects of Comparable Worth

1. Anticipated Wage Effects

The initial effect of comparable worth will be on the pay structure of the employer enacting the policy. The basic point of comparable worth is to increase the salaries of female dominated jobs to the level received by other jobs deemed comparable within a firm. Hence, the first question is: to what extent was this goal achieved?

The salaries of jobs not targeted by comparable worth need to be examined as well. Since most public sector employers give across-the-board pay increases, the salaries of non-targeted jobs will probably increase even if comparable worth is implemented. The question is: will comparable worth affect the size of this pay increase? An employer may try to increase these salaries less than he (or she) would in the absence of comparable worth to pay for the higher salaries in female dominated jobs. On the other hand, workers in these jobs and their union representatives will most likely fight against lower than anticipated salary increases. In fact, it may be that non-targeted jobs receive higher salary increases than they would have without comparable worth because an employer is compelled to keep workers in non-targeted jobs satisfied. Hence, it is not known a priori whether an employer will increase the salaries of non-targeted jobs more or less than would have occurred in the absence of comparable worth.

Another salary change worth examining is whether relative pay between women and men has improved. Certainly, a broader goal of comparable worth policies

is to reduce the earnings disparity between women and men. Thus, examining progress towards this goal will also measure the effectiveness of comparable worth policies. Since women hold most of the jobs that are expected to receive increases under comparable worth, it is anticipated that the current pay of women will increase more than it would have otherwise. On the other hand, nontargeted jobs are expected to receive smaller pay increases than those received by targeted jobs. Since men hold most of these positions, it is anticipated that women's earnings relative to men will improve under comparable worth.

2. Anticipated Employment Effects

Neo-classical economic theory predicts that in a competitive labor market, an employer's demand for labor will decline if the price of that labor (the wage rate) increases. Furthermore, an employer will alter his (or her) use of other inputs into the production process in response to higher wages. Since the purpose of comparable worth is to increase the wages of female dominated jobs, this theory predicts that once an employer adopts comparable worth, his (or her) demand for workers will fall in jobs targeted by comparable worth. Furthermore, if women receive higher wage increases than men in targeted jobs, this theory predicts that employers will substitute male for female employment within targeted jobs. Finally, an employer will increase the use of others workers not employed in targeted jobs, if these workers can be used instead of those in targeted jobs to produce the employer's product.

These predictions, however, may not hold under certain circumstances. For example, an employer may not necessarily respond to higher wages by minimizing costs, especially if that employer views comparable worth as a legitimate onetime increase in pay. Economists generally assume that government employers minimize labor costs since these funds have alternative uses, such as lowering taxes or financing other expenditures. But it may be that an employer does not attempt to minimize the cost of implementing comparable worth. This outcome is more likely to occur in the following circumstances: the employer views

comparable worth as a legitimate increase in labor costs; the employer's labor force is highly unionized; and the employer is currently experiencing a budget surplus and expects future revenue growth to remain strong. If management views comparable worth as a legitimate increase in labor costs, it may be more willing to finance the policy through increased revenues. On the other hand, if the labor force is highly unionized, union representatives may insist that implementing comparable worth comes out of increased revenues. These two views are certainly much easier to accommodate if an employer, in fact, has a budget surplus at the time comparable worth is implemented.

Both the anticipated wage and employment effects of comparable worth must ultimately be resolved by empirical research. Thus, a review of previous empirical research is presented below. It should be noted that this review updates an earlier survey by Ehrenberg (1989), who reviewed many papers that were not yet published. Since then, most of these papers have been published and some, especially the book by Killingsworth (1990), present different findings than reported by Ehrenberg. One article (O'Neill et al. 1989) was not included in Ehrenberg's review since it was not available. Furthermore, in many instances I evaluate previous research differently than Ehrenberg.

Previous Research on the Wage and Employment Effects of Comparable Worth 1. Previous Estimates of the Wage Effects

This section reviews a number of studies that have estimated the wage effects of comparable worth. These studies can be divided into two approaches: ex ante and ex post. Ex ante studies used cross-section data to estimate the wage effects of comparable worth. These studies were particularly useful during the early 1980s, before comparable worth policies had been widely implemented, since they provided estimates of the likely effect of comparable worth on the pay structure of a government undertaking this policy. But now that a number of jurisdictions have enacted comparable worth policies, estimates of their impact on wages can be made with data that precedes and follows their enactment.

These studies, called ex post studies, can offer a more accurate estimate of the actual effects of comparable worth on wages if they isolate its impact from other factors influencing wages. These studies must answer the following question: what would have happened to wages in a jurisdiction if comparable worth had not been implemented? This prediction is then compared to the actual change in wages and the difference is attributed to comparable worth. a. Ex Ante Studies. Ehrenberg and Smith (1987a) and Sorensen (1987) conducted two ex ante studies using data from job evaluation studies from five state governments and the city of San Jose. All of these jurisdictions eventually implemented some form of comparable worth policy, but these studies use salary information prior to its enactment. These studies found that if comparable worth were adopted by these jurisdictions, salaries of female dominated jobs would increase by an average 20 percent, with the exact figure varying from 15 to 34 percent depending upon the jurisdiction. Sorensen also predicted that a comparable worth policy would increase women's and men's pay by an average 16.6 and 1.4 percent, respectively, translating into a 15 percent increase in women's relative pay. Prior to comparable worth, the earnings ratio between women and men hovered around 75 percent for the six jurisdictions in Sorensen's study. She predicted that if comparable worth was enacted by these governments, the relative wage ratio would increase to an average 87 percent, eliminating almost half of the pay disparity between women and men in these jurisdictions.

The basic problem with these studies, however, is that the authors assumed a comparable worth policy would increase the salaries of female dominated jobs to that received by male dominated jobs deemed comparable by a job evaluation plan. When these studies were undertaken this appeared to be the preferred method of implementing comparable worth. But in these studies, only the state of Minnesota actually implemented comparable worth in this manner. The other jurisdictions compared the salaries of female dominated jobs to <u>all</u> jobs deemed comparable by a job evaluation plan, not just male dominated jobs. This latter

comparison produces much smaller pay disparities for female dominated jobs. Consequently, the actual wage gains from implementing comparable worth were much smaller than predicted by Ehrenberg and Smith and Sorensen. Furthermore, two jurisdictions, Iowa and Washington, did not limit wage increases under comparable worth to female dominated jobs. Instead, they increased the salaries of all jobs that were paid less than the average job deemed comparable by a job evaluation plan. This further reduced the ability of comparable worth to reduce the pay disparity between women and men in these jurisdictions.

These different comparable worth policies result, in part, from different definitions of comparable worth. Some view comparable worth as a method for eliminating the pay disparity between comparable male and female dominated jobs. Jurisdictions accepting this definition of comparable worth increase the salaries of female dominated jobs to that received by male dominated jobs deemed comparable by a job evaluation plan. Others, however, believe that comparable worth requires the occupational salary of all jobs to be determined exclusively by their job evaluation score. This is sometimes referred to as the "pay for points" approach to comparable worth. Jurisdictions using this definition tend to increase the salaries of <u>all</u> jobs paid less than the <u>average</u> job with the same evaluation score. Still other jurisdictions have combined these two views and increased the salaries of female dominated jobs, but only to the <u>average</u> job with the same job evaluation score.

Orazem and Mattila (1989) examined the impact of comparable worth on the pay structure of Iowa. In this state, the comparable worth policy increased the salaries of <u>all</u> jobs that were paid less than the <u>average</u> job with the same job evaluation score. Orazem and Mattila used this approach when predicting the impact of comparable worth on salaries in the state of Iowa. They found that comparable worth increased the real pay of female employees by an average 9 percent, but men's real pay increased by an average 4 percent. Furthermore, women's earnings relative to men only increased by 4 percentage points, from 78

to 82 percent. In contrast, Sorensen (1987) estimated that women's pay would have increased by 11 percent and men's would have increased by 1 percent, with an 8 percentage point improvement in relative pay if comparable worth had been implemented as it was in the state of Minnesota. Hence, the comparable worth policy enacted by the state of Iowa seriously muted the gains to female workers while increasing the gains to male workers.

b. Ex Post Studies. O'Neill et al. (1989) examined the impact of comparable worth in the state of Washington. They examined Washington State personnel files in 1983, three years prior to the implementation of comparable worth, and 1987, the second year of a seven year program to phase in comparable worth salary adjustments. They found that female pay as a percent of male pay increased 6 percentage points, from 80 to 86 percent between 1983 and 1987. They also found that the wage ratio for non-state workers in Washington State increased 3 percentage points during the same period, half as much as that of state government workers, suggesting that comparable worth increased women's relative pay.

Kahn (1987) examined the impact of comparable worth on the pay structure of the city of San Jose. She found that between July 1980 and July 1986, wages in jobs targeted by comparable worth increased 12 percent a year. All other wages, on the other hand, increased 8 percent a year. Since these different wage increases could have been caused by general trends in the economy, she compared them with wage increases given by several other local governments in California. She found that in these city governments, wages increased by 5 to 9 percent a year for jobs that were equivalent to those targeted by San Jose for comparable worth increases. Wages for other jobs in these cities increased between 6 and 7 percent. Hence, she concluded that the wage patterns in San Jose were not simply mirroring changes taking place in the economy at large.

The problem with these two ex post studies is that they do not adequately control for factors other than comparable worth that may influence wage growth

in these particular jurisdictions. Both studies basically make descriptive comparisons between the jurisdiction implementing comparable worth and some other jurisdiction or broad geographic area (Kahn compares San Jose to other local governments in California; O'Neill et al. compare state government workers in Washington to non-state workers in Washington). By making these comparisons, these authors are assuming that in the absence of comparable worth, wages in these jurisdictions would have changed as they did in the comparison group. But other factors that are specific to a jurisdiction surely affect wage growth, such as changes in occupational structure, seasonal changes, and technological change. Yet, these studies have no other controls besides wage growth in a comparison group.

Killingsworth (1990), on the other hand, used econometric modeling to examine the wage effects of comparable worth in San Jose and Minnesota. He estimated a fixed-effect model of wage determination using pooled crosssection, time-series data from the city of San Jose and the state of Minnesota. In San Jose, he found that comparable worth increased the salaries of female dominated jobs by 5.8 percent after abstracting from other factors thought to influence wages, such as inflation, local wage growth and a time trend. In contrast, he found that comparable worth had no impact on the salaries of male dominated jobs. In Minnesota, he found that comparable worth increased women's and men's pay by 11.7 and 1.8 percent, increasing women's relative pay by 9.9 percent. One problem with the analysis of Minnesota, however, is that it only included the first three of four comparable worth wage adjustments given in Minnesota between July 1983 and July 1986. Hence, these results most likely underestimate the wage effects of comparable worth in this state.

In summary, all of these studies find that comparable worth either increased the salaries of female dominated jobs relative to male dominated jobs or it increased women's pay relative to men's pay. Two of the ex ante studies predicted that comparable worth would increase the salaries of female jobs by

an average 20 percent and women's relative pay by an average 15 percent. In contrast, the ex post studies found that comparable worth increased women's relative pay by at most 10 percent. This difference is due, in part, because the ex ante studies assumed that comparable worth would increase the salaries of <u>female</u> dominated jobs to that received by comparable <u>male</u> dominated jobs. But most jurisdictions actually increased the salaries of female dominated jobs to the average salary of all jobs with the same job evaluation score. This comparison reduces the size of the wage gain from comparable worth.

2. Previous Estimates of the Employment Effects

As with studies of the earnings effect of comparable worth, studies examining the employment effect of comparable worth have consisted of both ex ante and ex post evaluations. Ex ante studies have used cross-section data to simulate the likely effect on female employment if comparable worth increased female earnings. Ex post studies have examined employment trends both before and after the implementation of a comparable worth policy.

a. Ex Ante Studies. Ehrenberg and Smith (1987b) predicted the extent to which state and local governments would alter their employment of women if comparable worth resulted in a 20 percent increase in women's pay. They used data from the 1980 Census of Population for state and local government employees to make these predictions. They estimated the employment effects of two relative price changes: an increase in the pay of women relative to men within occupations and an increase in the pay of major occupational groups containing many female dominated jobs relative to those major occupational groups containing few female dominated jobs. They used constant elasticity of substitution (CES) production functions to estimate within-occupation male-female substitution elasticities, and they used translog cost functions to estimate acrossoccupation substitution elasticities. They concluded that a 20 percent increase in women's pay would result in a 2 to 3 percent reduction in women's employment in these sectors.

Aldrich and Buchele (1986) simulated the employment effects of a nationwide comparable worth policy that increased women's pay by 14 percent throughout the economy. They used the National Longitudinal Survey of Young Men and Young Women for this simulation. They examined the effect of the same relative price changes using the same estimation techniques as Ehrenberg and Smith, except they used three-digit industries rather than geographic areas as their unit of analysis. They concluded that a 14 percent increase in women's pay nation-wide would result in a 3.5 percent decline in women's employment.

A basic problem with these two studies is that they infer employer behavior from results that are most likely affected by other factors. In essence, their analysis compares labor markets with certain demographic characteristics to those without these characteristics. For example, they find that labor markets with low relative employment for women tend to also have high female relative earnings. They infer from this negative correlation that employers are willing to substitute males for females when female wages rise relative to male wages. Yet, relative employment is influenced by many other factors that differ across labor markets, such as the size of the labor market, the average level of earnings in the labor market, and the industrial mix within the labor market. Hence, specific characteristics of the labor markets may be causing these results rather than employers responding to relative pay. In other words, these authors have not isolated the underlying labor demand function from other explanatory variables.

b. Ex Post Studies. O'Neill et al. (1989) examined the employment effects of comparable worth in the state of Washington. They found that the size of a comparable worth pay increase was negatively correlated with an occupation's share of employment growth. In other words, the higher the comparable worth wage adjustment the lower an occupation's share of employment growth. Furthermore, they compared these figures from 1983-1987, a period during the implementation of comparable worth, to 1980-1983, a period prior to comparable

worth, and found that this negative correlation increased after comparable worth was implemented. They concluded that the state of Washington was substituting away from occupations made more expensive by comparable worth and increasing employment in jobs not targeted by comparable worth.

Kahn (1987) examined the employment effects of comparable worth in the City of San Jose and found that comparable worth had no significant contracting effect on the size of government employment in this city. She compared the growth in government employment in San Jose with government employment growth in the 12 largest cities in California and in neighboring cities in Silicon Valley. She found that government employment grew more rapidly in San Jose than in any of these cities except Palo Alto. She also compared employment growth in San Jose to employment growth in the private sector in the surrounding area and found that San Jose government and private sector employment grew at roughly the same rate.

Unfortunately, neither of these studies presents a statistically rigorous analysis of this issue. Kahn is basically assuming that, in the absence of comparable worth, employment growth in San Jose would have been similar to other cities in California or to the local private sector. But these comparisons do not isolate comparable worth from other factors unique to the occupational structure or geographic location of the city of San Jose which may influence employment growth. O'Neill et al., on the other hand, make a simple comparison between two periods of time, which does not take into account other factors that may influence relative employment growth over time such as the business cycle, seasonal changes and technological factors.

Killingsworth (1990) also examined the employment effects of comparable worth in San Jose, but drew opposite conclusions from Kahn. He estimated labor demand equations for male and female dominated jobs using a fixed-effects method on pooled cross-section, time-series data. He found negative own-wage elasticities of demand equal to -1.15 and -.52 for female and male dominated

jobs, respectively. Since he estimated that comparable worth increased the pay of female dominated jobs by 5.8 percent, he concluded that comparable worth caused a ceteris paribus employment decline in female dominated jobs of 6.7 percent (5.8 * -1.15). In addition, he found that comparable worth did not affect the wages of male dominated jobs. Thus, he reasoned that it had no effect on employment in these jobs. As Killingsworth pointed out, other forces besides comparable worth caused employment in female dominated jobs to grow during this period by over 10 percent per year. Hence, comparable worth wage adjustments meant a loss of employment that was roughly equal to two-thirds of a year of job growth in female jobs.

In addition, Killingsworth examined the employment effects of comparable worth in the state of Minnesota using the same method as the San Jose study. The estimated own-wage elasticities in this state were -.62 and -.40 for male and female dominated jobs, respectively. According to Killingsworth, comparable worth increased men's and women's pay by 1.8 and 11.7 percent, respectively. Thus, he concluded that comparable worth reduced employment ceteris paribus by -4.7 percent (11.7 * -.40) in female dominated jobs and 1.2 percent (1.8 * -.62) in male dominated jobs.

The basic problem with these analyses of San Jose and Minnesota is that Killingsworth only estimates own-wage elasticities, ignoring any possible substitution effects. In other words, he assumes that once the wages of female dominated jobs are increased, an employer makes no attempt to substitute other other forms of labor for this relatively more expensive group of workers. Yet, there is no a priori reason to believe that an employer would avoid such substitutions. These kind of substitutions may reduce the effect of comparable worth on employment. Women's employment, for example, may rise in jobs not targeted by comparable worth, offsetting some of the employment loss to women. Similarly, men's employment may rise as a result of comparable worth, offsetting some of the total employment loss due to comparable worth. Hence, a

more complete estimate of comparable worth's effect on employment would estimate cross-elasticities as well as own-wage elasticities.

Another problem with Killingsworth's analysis of Minnesota is that he incorrectly assumes that comparable worth has the same effect on the salaries of male and female dominated jobs as it has on the salaries of male and female workers. He estimates that comparable worth increases the salaries of male and female and female workers by 1.8 and 11.7 percent. But then he estimates wage elasticities for male and female dominated jobs. To reconcile these different units of analysis, he assumes that comparable worth increased the salaries of male dominated jobs by 1.8 percent and female dominated jobs by 11.7 percent. But, as I will show below, these estimates are incorrect.

In summary, most of these studies conclude that a comparable worth policy causes small negative employment effects. Nonetheless, each suffers from a serious weakness in design, suggesting further research in this area.

Estimates of the Wage and Employment Effects of Comparable Worth:

The Case of Minnesota

The state of Minnesota enacted comparable worth legislation for state government workers in 1982. The following year, the legislature appropriated \$21.7 million for comparable worth salary adjustments. These were distributed to state government workers in July of 1983 and 1984. The legislature earmarked another \$11.7 million in 1985 for comparable worth salary adjustments, which were distributed in July of 1985 and 1986. Hence, the state legislature allocated a total of \$33.4 million to implement comparable worth, increasing total labor costs by approximately 3.7 percent.

1. Descriptive Statistics

The first task of this section is to present descriptive statistics about the Minnesota state government workforce and the individuals who received comparable worth pay adjustments. In July 1983, the state of Minnesota employed 31,370 people, 9,692 of whom received comparable worth adjustments.

Over the next three years, 11,198 new individuals came to work for the state of Minnesota. In addition, another 4,107 individuals received comparable worth adjustments. Hence, as Table 1 shows, the state of Minnesota employed a total of 42,568 individuals between July 1983 and July 1986, 32 percent of whom received a comparable worth pay adjustment. Comparable worth adjustments were given to 60 percent of the female workforce, but only 9 percent of the male workforce received these adjustments. Ninety-eight percent of all comparable worth adjustments went to workers in female dominated jobs; only 2 percent of these adjustments were given primarily to clerical and non-professional health care workers. These two groups received 75 percent of all comparable worth wage adjustments. In contrast, no one in the craft, maintenance, or law enforcement bargaining units received a comparable worth adjustment.

Insert Table 1 here

2. The Impact of Comparable Worth on Earnings

The relative pay of women working for the state of Minnesota increased dramatically during the four years of pay equity implementation. Figure 1 shows that prior to comparable worth in January 1983, women working for the state of Minnesota earned 72 percent as much as men. In January 1987, after four years of pay equity implementation, women's relative pay increased 9 percentage points, to 81 percent. During this same period, women's pay relative to men increased nation-wide, but it only increased 3 percentage points, from 66 to 69 percent, about one-third of the increase for Minnesota state workers.

Insert Figure 1 here

Although this comparison between women's relative pay in the state of Minnesota and the national trend in women's relative pay is informative, it does not control for other factors specific to the state of Minnesota that may have led to such substantial rises in women's relative pay. A statistical analysis of wage trends that controls for other factors that influence pay besides comparable worth will permit a more precise estimate of its effect on pay. Such an analysis is undertaken using data from the Minnesota State Department of Personnel and the U.S. Department of Labor.

The original data from the state of Minnesota were individual-level, crosssection data for 29 quarters, from October 1981 to October 1988. Individuallevel information included a person's hourly wage, age, job tenure, and employment tenure. This information was averaged separately for all male and female workers for each quarter. A data file was then created with 29 observations, one for each quarter, containing average personal characteristics of male and female workers. An additional variable was added to this data, the average hourly earnings of private sector production workers in the Minneapolis/St. Paul metropolitan area.²

The dependent variables in this analysis are average male and female earnings. The set of explanatory variables includes four variables labeled CW783, CW784, CW785, CW786, which indicate the quarter and year in which the comparable worth wage adjustments were given. Each of these variables equals zero prior to the implementation of comparable worth and one once the comparable worth adjustment is implemented. Other control variables include the age, job tenure and employment tenure of the men and women employed by the State of Minnesota. These variables were included since the average characteristics of male or female workers may vary over time and influence wage growth. The natural logarithm of hourly earnings for private sector production workers in the Minneapolis/St. Paul area were also included to control for variations in the tightness of the local labor market for the state capital of

Minnesota. Finally, a time trend variable is included in these earnings regressions, since it may be that pay is increasing over time even after controlling for these other factors.

Separate earnings equations were estimated for male and female workers using a generalized least squares method. This approach was employed rather than an ordinary least squares analysis, since it is likely that the error terms in these equations are correlated. The random factors that influence male wages over time are also likely to influence female wages. The findings from these regressions are reported in Table 2.

Table 2 shows that comparable worth increased women's pay by about 3 percent each year from 1983 to 1986, for a total increase of 10.7 percent. It increased men's pay by .3 percent over the total four year period. Thus, comparable worth increased women's relative pay by 10.4 percent (10.7 - .3). In January of 1983, the ratio of women's to men's pay for Minnesota state government workers was 72 percent. This study finds that comparable worth increased that ratio 10.4 percent to 79.5 percent. The actual sex pay ratio after comparable worth in January of 1987 was 81 percent. The other 1.5 percentage point increase in women's relative pay was caused by other factors besides comparable worth.

Insert Table 2 here

Although Table 2 shows that comparable worth increased men's pay by .3 percent, the question is which men received this pay increase? To analyze this question, I further divided the male workforce into those employed in jobs receiving comparable worth adjustments and those not receiving comparable worth adjustments. The last two columns of Table 2 show that the pay rates of men employed in jobs targeted by comparable worth increased by 16.5 percent, but pay rates of men employed in other jobs not targeted by comparable worth were

unaffected by this policy.³ These results suggest that in Minnesota the wage effects of comparable worth were limited to those in targeted jobs. Comparable worth did not increase or decrease the wages of male workers in jobs not targeted by comparable worth.

3. The Impact of Comparable Worth on Employment

Women's employment relative to that of men in the state sector of Minnesota increased steadily throughout the 1980's, as shown in Figure 2. This figure also shows that women's relative employment in the state of Minnesota grew faster than in the economy as a whole. These trends suggests that pay equity had no negative impact on women's relative employment, even though women's relative earnings increased by 10.4 percent. Furthermore, total employment in the state of Minnesota increased, from 30,669 to 33,489 between October 1981 and October 1988. This also suggests that comparable worth did not reduce overall employment in the state of Minnesota.

Insert Figure 2 here

But, once again, simple trends may be misleading. These trends do not isolate the effect of comparable worth from other factors affecting employment. To measure the impact of comparable worth on earnings, a more sophisticated model is estimated, the results of which are presented below.

First, let me summarize the anticipated effects of comparable worth on wages and employment:

(1) Women's pay relative to men may increase within targeted jobs. Although men and women employed in the same targeted job will receive the same comparable worth adjustment, comparable worth adjustments tend to vary among targeted jobs. If comparable worth adjustments increase as the proportion of women in the job increases, then female salaries will increase more than male

salaries within targeted jobs. Hence, an employer may substitute males for females within targeted jobs if male labor is substitutable for female labor. (2) Male and female salaries in targeted jobs may increase more than male and female salaries in non-targeted jobs. Employers may respond to these relative wage changes by reducing employment in targeted jobs and increasing employment in non-targeted jobs. These employment changes will depend upon the extent to which male and female employees in non-targeted jobs can be substituted for male and female employees in targeted jobs.

(3) Finally, total employment may decline since comparable worth increases the salaries of targeted jobs.

a. A Theoretical Model of the Production Process. The impact of comparable worth on employment can be measured by using a translog cost function. I divide labor into four inputs: women in jobs targeted by comparable worth, men in jobs targeted by comparable worth, women in other jobs, and men in other jobs. I assume that capital and labor are weakly separable and thus ignore capital as an input in these estimations. In its general form, a cost function can be written as:

 $C = f(Y, W_1, W_2, W_3, W_4)$

where C is total cost, Y is total output, W_i are the wage rates for each of the four inputs listed above. I assume that the state of Minnesota minimizes its labor costs as specified in a translog cost function that is continuous, twice differentiable and characterized by constant returns to scale. Given the level of output is held constant, the following input share equations can be used to obtain the substitution effects discussed above:

 $S_{1} = b_{1} + a_{11} \ln w_{1} + a_{12} \ln w_{2} + a_{13} \ln w_{3} + a_{14} \ln w_{4}$ $S_{2} = b_{2} + a_{21} \ln w_{1} + a_{22} \ln w_{2} + a_{23} \ln w_{3} + a_{24} \ln w_{4}$ $S_{3} = b_{3} + a_{31} \ln w_{1} + a_{32} \ln w_{2} + a_{33} \ln w_{3} + a_{34} \ln w_{4}$ $S_{4} = b_{4} + a_{41} \ln w_{1} + a_{42} \ln w_{2} + a_{43} \ln w_{3} + a_{44} \ln w_{4}$

where S_i is the share of input i in the total wage bill, $\ln W_j$ is the natural log of input j's mean wage.

Given the aforementioned assumptions regarding the cost function, symmetry and homogeneity constraints are imposed on this system of equations. They are:

$$a_{ij} = a_{ji} \text{ for all } i,j$$

$$\Sigma_j a_{ij} = 0 \text{ for all } i$$

$$\Sigma_i b_i = 0.$$

Once these constraints are imposed, the share equations can be rewritten as:

$$\begin{split} s_1 &= b_1 + a_{11} \ln (W_1/W_4) + a_{12} \ln (W_2/W_4) + a_{13} \ln (W_3/W_4) \\ s_2 &= b_2 + a_{12} \ln (W_1/W_4) + a_{22} \ln (W_2/W_4) + a_{23} \ln (W_3/W_4) \\ s_3 &= b_3 + a_{13} \ln (W_1/W_4) + a_{23} \ln (W_2/W_4) + a_{33} \ln (W_3/W_4) \end{split}$$

The remaining coefficients can be determined using the homogeneity and symmetry requirements (see Berndt and Wood, 1975 for further detail).

Although the a_{ij} have little economic meaning of their own, they are related to the elasticity of substitution σ_{ij} in the following way:

$$\sigma_{ij} = (a_{ij} + S_i S_j) / S_i S_j \text{ for all } i,j; i \neq j$$

$$\sigma_{ii} = (a_{ij} + S_i^2 - S_i) / S_i^2 \text{ for all } i.$$

The price elasticities of demand, output held constant are:

 $\varepsilon_{ij} = \sigma_{ij}S_j.$

This latter system of three equations is estimated using an iterative three-stage least squares model, the results of which are reported below.⁴ b. Empirical Results from the Translog Cost Function. The data used to estimate the share equations is from the Minnesota State Department of Personnel. The original data was individual-level, cross-section data for 29 quarters, from October 1981 to October 1988. Individual-level information included hourly wage, hours worked per week, and detailed job classification. This information was aggregated into the four input factors listed above. The system of share equations is analyzed using an iterative three stage least squares estimation.⁵ Besides factor prices as explanatory variables each equation includes a time trend variable, which allows for non-neutral technological change during the seven year period of analysis. The wage variables in the share equations were predicted using the following instruments: four dummy variables indicating the four comparable worth adjustments, a time trend variable, three dummy variables indicating the season of the year, the age of each group relative to the age of the group omitted from the analysis, the employment tenure of each group relative to the employment tenure of the group omitted from the analysis, and the unemployment rate for the Minneapolis/St. Paul metropolitan area.

The parameter estimates and standard errors for the estimated factor share equations are shown in Table 3. This table shows that 19 of the 24 estimated coefficients are statistically significant at the 10 percent level. Table 4 presents the implied elasticities of substitution and the implied elasticities of demand. They were calculated using the average values of S_i , the share of input i in the total wage bill (i.e. \overline{S}_1 =.209, \overline{S}_2 =.027, \overline{S}_3 =.165, \overline{S}_4 =.599). This table shows that all of the own-wage elasticities are negative. The results also suggest strong substitution between women and men within targeted and nontargeted jobs, but very little substitution between these two types of jobs. In fact, these results suggest that men in targeted jobs and non-targeted jobs are complements rather than substitutes in the production process. All of the other types of labor are substitutes.

Insert Table 3 and 4 here

To determine the impact of comparable worth on employment the pay increases generated by comparable worth were multiplied by the appropriate demand elasticities as follows:

$${}^{4}_{\text{$\Delta N_i = \sum_{j=1}^{L} \varepsilon_{ij} * \&\Delta W_j \text{ for all } i=1,2,3,4 }$$

where ΔN_i is the percentage employment change for the ith factor, ϵ_{ij} is the cross elasticity between input i and j, and ΔW_j is the percentage wage increase due to comparable worth for input j. This formula states that the effect of comparable worth on employment for the ith input factor depends upon the cross-elasticities between the input factors as well as the size of the wage increases received under comparable worth.

Comparable worth increased women's pay in targeted jobs by 16.2 percent; it increased men's pay in these same jobs by 16.5 percent. It also caused a slight increase in the salaries of non-targeted jobs. These salaries increased by 1.1 percent for women and .3 percent for men. Hence, ΔW_1 , ΔW_2 , ΔW_3 , and ΔW_4 are equal to 16.2, 16.5, 1.1 and .3, respectively. The differences in percent increases between women and men in targeted jobs (and non-targeted jobs) occurred because women and men have different occupational distributions within these job categories.

Comparable worth decreased employment for women in jobs receiving comparable worth adjustments by 3 percent, ceteris paribus. On the other hand, comparable worth increased employment for women in jobs <u>not</u> receiving comparable worth adjustments by 1.3 percent, other things equal. Hence, comparable worth caused women's overall employment to decline ceteris paribus by 1.35 percent (i.e. $3.0 \times 38 - 1.3 \times 62$, where .38 and .62 are the proportion of women working, on average, in non-targeted and targeted jobs, respectively). In contrast, comparable worth increased men's employment by .7 percent (i.e. $.53 \times .93 + 3.13 \times .07$, where .93 and .07 are the proportion of men working, on average, in non-targeted and targeted jobs, respectively). Hence, comparable worth increased women's relative pay by 10.4 percent which in turn led to a 2.1 percent ceteris paribus decline in women's <u>relative</u> employment. In fact, the female/male employment ratio grew from .78 to .89 between October 1981 and

1988, but if comparable worth had not been enacted, women's relative employment would have increased another 2.1 percent to .91.

Put another way, if comparable worth had <u>not</u> been implemented, women's employment would have increased another 212 jobs, from 15,732 to 15,889 jobs in October 1988. In contrast, men would have held 122 fewer jobs than they actually did if comparable worth had not been adopted. Instead of employing 17,757 males in October of 1988, the state would have employed 17,635. Hence, total employment growth was 90 jobs less than it would have been if comparable worth had not been enacted, reducing total state employment by .3 percent.

Conclusions

For Minnesota state government workers, the policy of comparable worth increased women's pay by 10.7 percent and men's pay by .3 percent, resulting in a 10.4 percent rise in women's relative pay. This increased the female/male pay ratio from 72 to 79.5 percent. This same policy did, however, cause women's employment in the state of Minnesota to grow slightly slower than it would have had comparable worth not been implemented. Instead of growing at 17.2 percent between October 1981 and 1988, women's employment would have grown at 18.5 percent if comparable worth had not been implemented, adding another 212 jobs to the state sector. On the other hand, this study finds that comparable worth increased men's employment by .7 percent. In actuality, men's employment grew by 4.4 percent between October 1981 and 1988, but if comparable worth had not been implemented it would have grown at 3.7 percent, losing 122 jobs. In other words, comparable worth resulted in 90 fewer jobs being created by the state government of Minnesota. Hence, on average, both men and women working for the state of Minnesota gained from the implementation of comparable worth. At the same time, comparable worth had negligible negative employment effects, reducing overall employment in the state government by .3 percent.

Footnotes

- The state of Minnesota originally targeted only female dominated jobs for comparable worth wage adjustments, but some of these jobs changed to integrated jobs during the four years of comparable worth implementation, explaining the 2 percent figure.
- The average hourly earnings of private-sector production workers in the Minneapolis/St. Paul metropolitan area is from <u>Employment and Earnings</u>, U.S. Department of Labor, various issues.
- 3. A generalized least squares method was used to analyze these wages with the same set of explanatory variables as described in the text for male and female earnings.
- 4. A three stage least squares model is needed since the right-hand side wage variables may be correlated with the error term. Since the share and wage variables are functions of one another, any error in the share variable is likely to be an error in the wage equation as well. To reduce this possible simultaneity, instrumental variables can be used to obtain predicted values for the wage variables. The procedure should be iterated until it converges so that the 3SLS estimates are invariant to the equation deleted.
- 5. This system of equations is first estimated without the fourth share equation and then re-estimated to obtain the estimates and standard errors for the omitted variables.

	Number in State Workforce 1983-1986	Percent Receiving Comparable Worth Wage Adjustments	Distribution of Comparable Worth Wage Adjustments
Total Employment	42,568	32%	13,799
Gender			
Women Men	19,655 22,913	60% 9%	86% 14%
Race			
Whites Minorities	40,454 1,814	328 328	96% 4%
Occupational Compositi	on		
¥ Female <u><</u> 30% 30% < % Female < 70 % Female <u>></u> 70%	18,601 8,163 15,804	0% 14% 86%	0% 2% 98%
Bargaining Unit			
Law Enforcement Craft, Maintenance Service Health Care (non-pr Clerical Technical Professionals Supervisors Other	1,855 2,800 4,087 7,310 3,354 7,983 4,496 5,374	0% 0% 22% 72% 95% 9% 4% 20% 20%	0% 0% 7% 25% 50% 2% 2% 7% 8%

Table 1. The Allocation of Comparable Worth Wage Adjustments in Minnesota State Workforce

Source: Minnesota State Personnel Data.

	Women		Men	Men in CW Jobs	Men in Other Jobs
CW783	.030* (.009)		016 (.012)	.044* (.012)	015 (.011)
CW784	.037* (.008)		.009 (.008)	.045* (.010)	.011 (.008)
CW785	.008 (.009)		010 (.009)	.028* (.009)	013 (.009)
CW786	.032* (.009)		.020 (.010)	.048* (.010)	.020 (.010)
Sum	.107		.003	.165	.003
F-M Difference		.104			

Table 2. Summary of GLS Wage Regressions (standard errors in parentheses)

Note: CW Jobs are jobs that received comparable worth salary adjustments.

* Significant at the 0.01 level.

Source: Minnesota State Personnel Data; U.S. Bureau of Labor Statistics, Employment and Earnings, various issues.

	Share Equations				
	First	Second	Third	Fourth	
b _i	.241*	.035*	.101*	.624*	
	(.022)	(.006)	(.012)	(.021)	
a; 1	.086*	.033*	013	~.105*	
* *	(.046)	(.014)	(.028)	(.043)	
a _{i2}	.033*	006	.006	033*	
	(.014)	(.008)	(.015)	(.016)	
a ₁₃	013	.006	251*	.258*	
	(.028)	(.015)	(.051)	(.046)	
a _{i 4}	105*	033*	،258 *	120*	
	(.043)	(.016)	(.046)	(.053)	
Time	.001*	.2E-03*	.002*	003*	
	(.3E-03)	(.8E-04)	(.2E-03)	(.3E-03)	

Table 3. I3SLS Parameter Estimates of Translog Cost Function (standard error in parentheses)

Share Equations

* Significant at the 0.1 level.

Source: Same as Table 2.

Table 4. Implied Elasticities of Substitution

and Price Elasticities of Demand

	Implied E			
	Women in CW Jobs	Men in CW Jobs	Women in Other Jobs	Men in Other Jobs
Women in CW Jobs	-1.822			
Men in CW Jobs	6.689	-43.528		
Women in Other Jobs	.621	2.338	-14.302	
Men in Other Jobs	.160	991	3.613	-1.005

	Implied Price Elasticities of Demand				
	Women in CW Jobs	Men in CW Jobs	Women in Other Jobs	Men in Other Jobs	
Women in CW Jobs	381	.183	.102	.096	
Men in CW Jobs	1.399	-1.191	.385	593	
Women in Other Jobs	.130	.064	-2.357	2.163	
Men in Other Jobs	.033	027	.595	602	

Note: CW Jobs are jobs that received comparable worth salary adjustments. Source: Same as Table 2.

Figure 1

Women's Relative Pay: Minnesota and National Trends*



---- Minnesota ----- National

* Minnesota male and female pay equal the hourly pay of these workers. The U.S. figures are usual weekly earnings of wage and salary workers who work full-time.

Source: Minnesota State Personnel Data; U.S. Bureau of Labor Statistics, "News," various issues and unpublished tables. 29 Figure 2





Source: Minnesota State Personnel Data; U.S. Bureau of Labor Statistics, "Employed Women (and Men) 16 years and over," unpublished tables.

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