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THE EFFECT OF UNIONS ON THE RETURNS TO HUMAN CAPITAL INVESTMENTS OF MATURE WOMEN IN MANUFACTURING INDUSTRIES, 1972

By

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ABSTRACT

THE EFFECT OF UNIONS ON THE
RETURNS TO HUMAN CAPITAL INVESTMENTS
OF MATURE WOMEN IN MANUFACTURING INDUSTRIES, 1972

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Previous research has found that unions decrease returns to total work experience and education of men. This occurs because unions insulate wage determination from external labor market forces. Recognizing that total work experience consists of previous work experience (which is acquired in the external labor market), and tenure with present employer (which is acquired in the internal labor market), it is hypothesized that unions will decrease returns to previous experience and increase returns to tenure. Greater returns to tenure in the union sector are anticipated because of the codification of seniority rules which govern wage increases and promotions. Given that women have relatively "flat" wage-experience profiles, institutional impacts on returns to their experience are of particular interest.

Multiple regression analysis is performed on a data sample from the National Longitudinal Survey of Mature Women. Returns to human capital are allowed to vary between sectors by interacting each measure of human capital with a variable indicating collective bargaining coverage.

The hypothesized differences in returns to the two experience components between union and nonunion sectors were of only borderline statistical significance, but the signs were as predicted by the theory.

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INTRODUCTION

Much research effort has been devoted to the estimation of wage differentials, both male-female and union-nonunion. Few, however, attempt to identify the sources of these differentials. One potentially important source of earnings differences for women is their investment in and returns to work experience. This thesis examines how unions influence the returns women receive on their human capital.

Previous work in this area has investigated union effects on returns to education and total work experience. The presence of seniority rules in the unionized sector introduces a discontinuity between internal and external labor markets. Since total work experience consists of previous experience which is acquired in the external labor market, and tenure with present employer which relates to internal labor market experience, it is predicted that unions will have different effects on returns to the two experience components. Specifically, it is anticipated that unions will decrease returns to previous experience, due to union compression of skill differentials and payment according to broadly comparable job characteristics rather than characteristics of job incumbents. However, through seniority rules, unions may increase returns to tenure by protecting investments in firm-specific training and tying wage increases and promotions to length of service.

These propositions are tested by estimating a wage equation which disaggregates total experience into its two components, and enters them both separately and interactively with a binary variable indicating coverage by a collective bargaining agreement. Tests of significance on

the additional explanatory power of the model which allows returns to human capital to vary are performed. This procedure should contribute to a better understanding of how unions affect the process of wage determination while addressing an issue of importance for women workers.

CHAPTER ONE

LITERATURE REVIEW

Union Wage Studies

Studies examining union relative wages have proliferated since H. Gregg Lewis published the seminal work in the area.[1] Early studies focused on inter-industry effects of unionism. With the growing availability of data sets at the individual level, a voluminous literature developed that estimated union wage effects on individuals, holding human capital characteristics (i.e. labor quality) constant. Relatively few of these studies have analyzed data on women. Those which have done so yield a substantial range of wage increments, between races as well as over time.

Oaxaca estimated a union wage increment in 1967 of 16.2 percent and 7.5 percent for white and black women, respectively.[2] For the same year, Hall reported union wage differentials of 14.2 percent and 7.9 percent for women of the two races.[3] Using 1973 data, Ashenfelter found that unions increased the wages of their female members by 13.5 percent for whites and 14.1 percent for blacks; in 1975 the comparable figures were 18.1 and 18.6 percent.[4] Ryscavage estimated 22 and 19 percent union wage differentials for women of the two racial groups in 1973.[5]

Several researchers have examined how returns to human capital characteristics differ between union and nonunion sectors. Differences are expected because unions are believed to condition or dampen the effects of market forces on wage determination. These studies restrict estimation to all male samples, but the analysis is relevant to all union wage studies.

Johnson and Youmans found that union members receive lower returns to age and education than comparable nonunion workers.[6] The wage-age profile of union workers rose more slowly and peaked ten years later than the profile of their nonunion counterparts. This was postulated to be the result of: 1) the union goal of achieving a standard rate for broadly comparable production workers, 2) the impact of union-caused seniority systems on promotion policies which favor older workers, and 3) greater job security in unionized firms which discourages individual investment in post-formal training.

Bloch and Kuskin also found union wages to be less responsive to differences in education and experience.[7] Their results indicate only a one and one-half year difference in the time wage-experience profiles peak between the two sectors, but the returns to experience were almost twice as great in the nonunion sector.

Among blue-collar workers in manufacturing industries, Richard Freeman estimated substantially lower returns to education for unionized workers.[8] The impact of (potential) experience on wages in the two sectors was mixed. Greater payoffs to experience for union workers was first estimated. After inclusion of a more extensive vector of controls for industry and region, nonunion workers were found to obtain higher returns to experience. Union pressure for wages based on job rates rather than individual rates, and greater reliance on seniority rather than merit for pay increases were cited in support of the expectation for lower returns in the union sector. These influences lessen the dispersion of wages within the unionized sector sufficiently to dominate the more widely cited effect of unions to increase inter-sectoral wage inequality.

These studies represent a significant departure from prior union wage studies, by bringing well known institutional considerations to bear in an attempt to explain rather than simply estimate union impacts. Examining the differential returns to human capital investments, and experience in particular, they have also suggested a fruitful mode of analysis of women's wage determination. To the extent that women's lower earnings are due to lower returns to experience, institutions such as unions which are expected to equalize treatment could provide substantial benefits to them.

The Effect of Experience on Women's Earnings

Studies of women's wages greatly benefit from the growing availability of direct measures of work experience. The use of actual experience provides evidence required to evaluate the validity and scope of competing rival hypotheses in the interpretation of results. Several researchers have found that women's wages do not rise over the life-cycle.[9] Since age (or potential experience, calculated as age minus education minus six) is used to reflect wage progressions resulting from time spent in the labor force, flat wage-experience profiles estimated for women could be due in part to statistical bias caused by systematic measurement errors in these proxies when applied to women.[10]

Using actual experience measures, some researchers have postulated that flatter wage profiles of women result from discontinuous labor force participation. Mincer and Polachek hypothesize that discontinuous experience lowers women's earning capacity by generating lower levels of human capital accumulation, deferring investment in on-the-job training (OJT) per unit of experience until more permanent re-entry into the labor force, and by atrophy of skills during periods of non-market work.[11]

While successfully documenting that intermittent labor force participation results in loss of earning power, the extent to which it accounts for the size of the male-female differential remains disputable.

Sandell and Shapiro argue that the greater returns to experience which occurs after work interruptions can be explained in part by the greater specificity of training embodied in tenure with present employer[12] (the same measure used by Mincer and Polachek to capture experience upon labor force re-entry). Their re-estimation of Mincer and Polachek's model also yielded smaller negative coefficients on the time out of the labor force variables, indicating a lower rate of skill atrophy than originally estimated.

In a study which used detailed, direct measures of several work experience segments, Corcoran and Duncan estimated the separate contribution of each segment to the sex wage differential.[13] Differences in years out of the labor force accounted for 6 percent of the gap, and differences in the proportion of total work experience which was full time accounted for 8 percent. The two variables which accounted for the greatest proportion of the sex differential were years of experience with current employer before current job (12 percent), and years of training completed at present job (11 percent). It should be noted that women have fewer years in the former experience segment either because of fewer total years of tenure, or because they are less likely to experience job mobility with an employer. Tenure before current job may be picking up the effect of fewer promotion opportunities, which could result from the observed tendency for women to receive less OJT. The authors note that this could reflect either sex differences in preferences for training, or unequal access to jobs with good training opportunities.

Duncan and Hoffman used the same data set to investigate the determinants of training for current job.[14] They found that past work experience (both pre-employer experience and tenure prior to present position) yielded high payoffs in training opportunities for men, but had little effect on the chances that women would receive training. This result was obtained after controlling for the individual's work horizon (the difference between age and 65, which is the maximum payoff period), and for attributes thought to be indicative of work force attachment. Since these control variables are positively related to investment in training according to human capital theory, the authors conclude that employer promotion practices may treat women differently than otherwise similarly qualified white men, or that women are hired for jobs in which less training is offered.

These findings can be usefully applied to studies of union relative wage effects which focus on the differences in returns to human capital investment between union and nonunion sectors. By tapping the abundant institutional literature concerning union impacts on the organization of production and the allocation of labor, together with empirical studies which have developed the methodology for estimating differential returns to human capital investments, the determinants of women's access to on-the-job training can begin to be identified.

FOOTNOTES TO CHAPTER ONE

[1]H. Gregg Lewis, Unionism and Relative Wages in the U.S.: An Empirical Inquiry (Chicago: University of Chicago Press, 1963).

[2]Ronald L. Oaxaca, "Male-Female Wage Differentials in Urban Labor Markets", International Economic Review 14 (October 1973): 693 - 709.

[3]Robert E. Hall, "Wages, Income, and Hours of Work", in Income Maintenance and Labor Supply, Glen Cain, ed. (Chicago: Rand-McNally Publishing Co., 1973): 102 - 117.

[4]Orley Ashenfelter, "Union Relative Wage Effects: New Evidence and a Survey of their Implications for Wage Inflation", Report to the Council on Wage and Price Stability (June 2, 1977).

[5]Paul M. Ryscavage, "Measuring Union-Nonunion Earnings Differences", Monthly Labor Review 97 (December 1974): 3 - 9.

[6]George E. Johnson and Kenwood C. Youmans, "Union Relative Wage Effects by Age and Education", Industrial and Labor Relations Review 24 (January 1971): 171 - 179.

[7]Farrel E. Bloch and Mark S. Kuskin, "Wage Determination in the Union and Nonunion Sectors", Industrial and Labor Relations Review 31 (January 1978): 183 - 192. "Potential experience" was used in this study, calculated as age minus education minus six.

[8]Richard B. Freeman, "Unionism and the Distribution of Labor Incomes", Harvard University, September 1977 (manuscript).

[9]See, for example, Alan S. Blinder, "Wage Discrimination: Reduced Form and Structural Estimates", Journal of Human Resources 8 (Fall 1973): 436 - 455, and Hall, "Wages, Income, and Hours of Work".

[10]This problem is discussed at length by Ronald Oaxaca, "Sex Discrimination in Labor Markets", in Discrimination in Labor Markets, eds. Orley Ashenfelter and Albert Rees (Princeton, N.J.: Princeton University Press, 1973): 124 - 154.

[11]Jacob Mincer and Solomon Polachek, "Family Investments in Human Capital: Earnings of Women", Journal of Political Economy 82 (March/April 1974): S76 - S108.

[12]Steven H. Sandell and David Shapiro, "A Re-Examination of the Evidence", Journal of Human Resources 13 (Winter 1978): 103 - 117.

[13]Mary Corcoran and Greg J. Duncan, "Work History, Labor Force Attachment, and Earnings Differences Between the Races and Sexes", Journal of Human Resources 14 (Winter 1979): 3 - 20.

[14]Greg J. Duncan and Saul Hoffman, "Training and Earnings", in Five Thousand American Families--Patterns of Economic Progress, Vol. 6 (Ann Arbor: Institute for Social Research, 1978): 105 - 150.

CHAPTER TWO

PREDICTIONS, DATA AND METHODOLOGY

This chapter will examine the theoretical predictions for the independent variables, the data, and the statistical methods to be used in the analysis of union wage effects accruing to women.

THEORETICAL EXPECTATIONS

Human Capital Theory

Human capital theory provides the core of the model which will be developed and tested in this thesis.[15] The types and amounts of training undertaken by individuals are viewed as a major determinant of the observed wage distribution. This follows from the fact that training increases productivity, and thus the present value of the expected earnings stream.

Three distinct types of human capital investment are examined in the present study: education, and work experience decomposed into tenure with present employer and all previous work experience. All are expected to be positively related to wages.

Human capital accumulation is not a costless activity. A substantial part of the cost is in foregone earnings, since training requires time not spent in production. The amount of investment in training and its timing are determined by individuals who decide at the margin whether the additional returns from another period of training, discounted at the market rate of interest, are equal to the costs of investment. Elements involved in this calculus are the length of time in which returns are received (the shorter the payoff period, the lower the present value of net gains), and the rising opportunity costs of

investment in successive periods as one becomes more productive. These considerations act as incentives to invest heavily at younger ages; but because costs of skill acquisition also increase within each time period, there is a partially offsetting incentive to spread investment out over time (once the period of specialization in training, or formal schooling ends).

Total work experience is decomposed into previous experience and tenure with present employer because they differ systematically in the degree of specificity of skills thus acquired. These differences determine their relevant payoff periods and how they are financed.

General skills are equally productive in all firms. Formal schooling, by transmitting literacy, social norms, communication skills, etc., is considered the major producer of general skills. It is financed entirely by individuals and public subsidies because it is as portable as is the worker possessing it. The payoff period is remaining working life.

Skills acquired in the accumulation of work experience are a changing mixture of general and specific training. The essence of the specific human capital concept is that workers of the same general skill class are differentiated by experience in a particular firm's operations. Included under this definition of specific investment are hiring costs of firms, information and moving costs of workers, and the time and resources utilized in general orientation, assessing employee ability to make job assignments, and on-the-job training (OJT) which increases productivity more in the firm providing it than in other firms.

The portion of OJT which imparts general skills is analogous to education with respect to financing and payoff period. The portion of training embodying specific knowledge will be shared by worker and firm.

This results from the fact that specific training is of value only as long as the individual possessing it is employed by the firm providing it. (The payoff period is tenure with present employer.) If only one party financed the training, it would suffer a capital loss upon separation. Since the likelihood of quits depends on the wage rate, firms can protect their investment in OJT by raising wages of trained workers above that obtainable in alternative employment, i.e., to offer workers some of the return from the training. In order to avoid an excess supply of trainees, which would be precipitated by the higher post-training wage and drive it downward, the firm will also shift some of the costs of training to employees in the form of lower wages during the training period.[16] Bartel and Borjas have demonstrated that competitive equilibrium requires the worker's share of specific training costs to equal his or her share of its returns.[17]

The parameters determining the costs and benefits of human capital investment lead to the assumption of a linearly declining investment ratio over the payoff period. For general human capital, investment will decline over the entire period of working life. Specific human capital investment, however, will decline within each work experience segment. Job mobility will on average precipitate a discontinuous increase in specific human capital investment, because expected remaining time on the job--the relevant payoff period--has increased.[18] The concavity of wage-experience profiles follows from the predicted pattern of investment.[19] Squares of both experience components are included in the model for this reason, and are expected to have a negative effect on wages.

Full specification of a model which disaggregates work experience requires the inclusion of an interaction term between its two components.[20]

This allows the pattern of human capital investment over time within the tenure segment to depend on the amount of previous experience. The length of time remaining in the present job will depend positively on previous experience, since gains from mobility decline with age. This, in turn, will have a positive effect on investment in the present job, within some range, because an increase in the expected payoff period would result in greater investment. Under these conditions, the interaction between experience components would have a positive effect on wages. However, at a later stage in the life-cycle, the effect of a finite working life will predominate and age, as measured by previous experience, will lead to less investment in current job. In this case, the interaction term will have a negative impact on wages. The net effect of the interaction is therefore ambiguous.

An important implication of the preceding analysis is that since the process of specific training imposes costs on firms providing it, they will adopt hiring procedures and criteria which screen out workers with high perceived quit propensities.[21] Given common conceptions, women are likely to have unequal access to jobs with training and promotion opportunities, relative to white men with equal qualifications.[22]

The Role of Unions in Human Capital Investment and Returns

Recognizing that investment in human capital is a joint decision of employer and employee, recent work focusing on women suggests that structural and institutional factors may be important intervening variables in the determination of human capital investments. Unionism is an institution of major significance within this framework. In addition to predicting a positive "lump-sum" per hour of work effect of union membership on wages, it is expected that different rates of return to

human capital investment will be obtained in union and nonunion sectors. The present study differs from prior work in this area by examining the union wage effect while distinguishing between investments which are acquired in and rewarded by the external labor market (education and previous experience), and that acquired in the internal labor market (tenure with present employer).

The decomposition of work experience is essential for union studies concerned with identifying the impact of institutional structures on wages. Administrative rules governing promotions and layoffs define the boundaries of an internal labor market by setting relatively fixed standards of seniority and ability for those in non-entry jobs, while entry criteria must respond to changes in the external market (unemployment, wages paid by competitors, local labor supply). Since it is the rigidity of these rules which causes the interruption or transformation of external economic influences, union codification of seniority rules in collective bargaining agreements is believed to contribute to the development of internal labor markets. This puts a premium on internal labor market experience by encouraging and protecting investments in enterprise-specific human capital.[23]

Two sources have been identified in the literature which dampen the effect of individual differences in educational attainment and previous experience on wages in the union sector. The widespread adoption of formal and informal job evaluation and classification systems during and after World War II, usually due to management initiative with impetus from the War Labor Board, was a response to the often chaotic and inequitable wage structures existing in most industries at that time. Although initial union response was in opposition to such plans,

acceptance was in most cases won when accompanied by joint participation of labor and management in the evaluation process.[24] Its effect was to base wages on job characteristics rather than the characteristics of job incumbents, which necessarily reduces wage dispersion due to personal differences in education and previous experience.

A second source of compression of skill differentials in the union sector is the union goal of achieving a "standard rate" for broadly comparable production work. Although development of job evaluation systems occurred in both union and nonunion firms, union participation led to minimization of merit increases, and promotion based largely on seniority. Achievement of a standard rate is indispensable to collective bargaining because "it is required for any wholesale determination of wages upon broad principles."[25] This "most widely heralded union wage policy"[26] has worked in conjunction with job evaluation to reduce pay differences due to external market and judgment-based criteria in unionized firms. Therefore, union members are expected to receive lower returns to education and previous experience than nonunion workers, i.e., interaction terms of union membership with education and previous experience should have a negative effect on wages.

A critical test of the utility of internal labor market analysis applied to union wage studies is whether union members receive greater returns to tenure with present employer (seniority) than their nonunion counterparts. The prediction that this is the case derives from the use of seniority as a principal criterion for promotion and training in collective bargaining agreements. Internal labor market theory implies that, by insulating the internal labor market from external forces, seniority rules should simultaneously depress returns to previous

experience and increase returns to tenure.

According to the Bureau of Labor Statistics survey of major collective bargaining agreements, 93 percent of all manufacturing agreements (covering 95 percent of workers under these agreements) contained promotion provisions. Among agreements with these provisions, 97 percent (covering 95 percent of workers) specified the use of seniority as a factor in promotions. However, only 42 percent of the agreements covering blue-collar workers (which cover only 29 percent of the workers) specified seniority to be the most important criterion. Typical provisions specified that if certain minimum standards are met, seniority becomes a major factor. (Only 15 percent of agreements covering white-collar workers have seniority in promotion provisions.) Most contracts provided for the joint criteria of skill and ability as well as seniority for promotions.[27]

Although length of service is also an important determinant of promotion in the nonunion sector, the codification of criteria for promotion in collective bargaining agreements is more restrictive of management discretion. A less senior, but more ambitious worker would enjoy a greater probability of promotion in the absence of a union. Such judgment-based criteria could be particularly disadvantageous to women, if they are perceived to be more likely to quit. Therefore, they may benefit greatly by adherence to the more objective seniority rule.[28] The greater importance of seniority in the union sector is indicated by court rulings that seniority rights are not legally recognized outside a collective bargaining agreement.[29] In addition, there is greater enforceability of seniority rules internally via the grievance and arbitration machinery in unionized firms.

It is more difficult to document that seniority systems influence

training from union contracts, since most training occurs informally. Among the major contracts analyzed by the BLS, less than 20 percent (covering 20 percent of workers) had provisions for training and retraining.

Most such clauses stressed on-the-job training rather than more formal methods.[30] Both internal labor market and human capital theories emphasize the importance of skills acquired in the performance of work. Mincer acknowledges the compatibility of seniority criteria in promotions with the human capital notion of productivity-augmenting investment, and the reliance upon OJT as "a vivid demonstration of the processes of accumulation of human capital on the job."[31] In addition, the operation of seniority rule may encourage the creation of job ladders which insure equal access to required OJT, if incumbents more or less automatically progress into higher rated jobs. "Career progressions of some kind are the usual, though not the universal concomitant of seniority rules."[32]

The combination of greater enforceability of seniority rules in the union sector, its greater objectivity, and the accompanying development of promotional ladders which capture the natural learning process that occurs on the job lend support to the expectation that tenure will yield larger returns to women in the union than in the nonunion sector.

However, there are other aspects of union sector wage determination which work in the opposite direction, and may predominate. First, vacancies which occur within a promotional sequence can attract sufficient applicants by offering compensating differentials such as superior

working conditions, preferred shifts, or greater discretion or variety of tasks,[33] rather than wage differentials. As a result, while women who are union members may have greater promotional opportunities, it may not be reflected in wage increases. Second, the higher initial wage rates of unionized jobs, and the observed narrowing of skill differentials in the union sector, may act to restrain wage growth with tenure. The age-wage profiles estimated by Johnson and Youmans for males, which begin at the peak wage of nonunion workers and rise and fall more gradually among unionized workers, suggest this possibility.[34]

In addition to the first-order interaction terms of the three types of human capital with union membership, the squares of previous experience and tenure, and the previous experience-tenure interaction variables are interacted with union membership. There is no a priori expectation regarding this set of union interactions. They are included to allow the rate of decline in human capital investment and returns to differ between sectors.

Control Variables

The focus of interest in this thesis is on the variables discussed above. A vector of control variables is also included in order to avoid misspecification of the model through omission of variables which might have independent effects on wages and are correlated with the set of included variables. They are of two general types: individual characteristics which are known to have an impact on wages, and industry characteristics which are highly correlated with density of union organization.

A variable indicating whether the individual is white or nonwhite is included since discrimination and possibly lower educational

quality among non-whites are known to lead to lower wages. A variable indicating full-time work is necessary because it may be a strong signal to employers of labor force attachment, and is likely to influence the amount of training provided on the job, which in turn increases wages. Location of the job in an SMSA will influence wages, since it indicates high area wage levels, relative to rural areas, and higher educational attainment of the local labor supply.

Industry characteristics are included in the model to insure that biases are not imparted to the estimates of union wage effects by omitting variables which are correlated with unionization and may have independent effects of wages. The percentage of women in total employment is negatively related to both wages and union organization. Industries with high proportions of women are typified by flat to moderate job structures, which provide minimal opportunities for promotion and acquisition of OJT.[35] The average establishment size and degree of concentration in an industry are positively related to wages and highly correlated with density of union organization, due to differences in capital intensity and thus productivity.

Two models were used to estimate differences in returns to human capital between union and nonunion women. The first model (equation 1) includes a set of two-digit occupational dummies in order to control for differences in the structure of job ladders, and the varying mix of general and specific training across occupations. These differences may influence the shape of the wage-tenure profiles. The estimate obtained using this model reflects wage progressions which occur within major occupational groups. It can be argued that this is appropriate when examining the effects of specific human capital investment.

(A change in occupation creates a loss of applicable specific skills which were acquired in a previous occupation, similar to that which occurs with a change in employer.) That is, wage increases that occur with increases in tenure across occupational groups are not entirely attributable to the accumulation of specific human capital.

The second model (equation 2) excludes the occupational variables. Since education and experience affect occupational access, holding occupation constant controls for one avenue by which human capital effects wages, and therefore depresses the estimated impact of human capital characteristics. This approach is more appropriate for estimating returns to general human capital.

These competing considerations are difficult to resolve when studying union effects on all types of human capital. The results of both models will be presented, but discussion and analysis will pertain to the second model unless otherwise noted.

Table 1 summarizes the theoretical expectations developed in this chapter and defines the variables.

THE DATA

The data on individuals are from the 1972 National Longitudinal Survey of Mature Women, who were 40 - 49 years of age in that year. The restricted age range used in the analysis makes inferences to younger women hazardous, and will be avoided. An advantage of the restricted age sample is that weak labor force attachment due to family responsibilities of younger women should be minimized.

The sample of data is further restricted to women who were employed in manufacturing industries in that year, because of the higher density of union organization in the manufacturing sector, the

TABLE 1. Variable Descriptions and Hypothesized Effects on Wages

Variable Name	Definition	Expected Sign
Dependent Variable:		
lnWAGE	the natural logarithm of the hourly wage rate, in cents	
Independent Variables:		
ED	years of educational attainment	+
PREV	the number of years in which the individual worked at least six months, prior to current job	+
TENURE	the number of years worked for present employer	+
PREV*TEN[a]	an interaction term between previous experience and tenure with present employer	?
$PREV^2$	years of previous work experience squared	-
$TENURE^2$	years of experience with present employer squared	-
UNION	equals 1 if the individual is covered by a collective bargaining agreement, 0 otherwise	+
PREV*U[a]	an interaction term between previous experience and collective bargaining coverage	-
TENURE*U[a]	an interaction term between tenure with present employer and coverage by a collective bargaining agreement	+
ED*U[a]	an interaction term between years of education and collective bargaining coverage	-
PR*TEN*U[a]	an interaction term among collective bargaining coverage, previous experience, and tenure with present employer	?
$PREV^2$*U[a]	an interaction term between previous experience squared and collective bargaining coverage	?
$TENURE^2$*U[a]	an interaction term between tenure with present employer squared and collective bargaining coverage	?
RACE	equals 1 if non-white race, 0 otherwise	-
JSMSA	equals 1 if the individual's job is in an SMSA, 0 otherwise	+

TABLE 1. (cont'd.)

Variable Name	Definition	Expected Sign
FULLTIME	equals 1 if the individual usually works 35 or more hours per week, 0 otherwise	+
PCTWOM	the proportion of women in total employment in each three-digit Census industry	-
SIZE	average establishment size (measured by number of all employees) in each three-digit Census industry	+
CON	average concentration ratio (percent of value added accounted for by the four largest firms) in each three-digit Census industry	+
OCC (eq. 1)	a series of binary variables indicating the individual's two-digit Census occupation, omitted reference category is clerical	

[a]The interaction terms are created by multiplying the components together. Since the union variable has a zero value for nonunion workers and one for union members, use of a binary variable for union membership and union interaction terms gives equivalent information as would be obtained by estimating separate wage equations for each sector. The UNION coefficient allows the constant to differ for workers in the union sector, the interactions allow the mean response of wages to a change in human capital characteristics to differ between sectors.

high concentration of women in white collar occupations in non-manufacturing industries where seniority is of less relevance and job ladders outside the professional-technical group are less well developed, and the lack of data on establishment size and concentration in many non-manufacturing industries.

See data appendix for details on sources and variable construction.

METHODOLOGY

The statistical method used in this thesis is multiple regression analysis. In order to assess the contribution which all the terms involving union membership make to the explanatory power of the model, linear restrictions are placed on the coefficients of the coresponding variables which set them equal to zero. An F test is performed on the difference in the regression sum of squares due to the restriction.[36] A significant F value indicates that the null hypothesis, that there is no appreciable difference between the restricted and unrestricted coefficients, should be rejected.

An important assumption which is required for unbiased estimation via regression analysis is that all the independent variables are exogenous, i.e., their values are determined by forces outside the model, and that they influence the dependent variable but are not influenced by it. Some empirical work has investigated the possible simultaneous determination of wages and union membership. Early work on this thesis centered on this question, but both theoretical and practical reasons led to the use of a single equation. The lack of a well developed theory for the determinants of union membership, the lack of data on job characteristics which are expected to be important for individual decisions in a union election, and the analytical problems which arise

once an establishment has been organized because employment and union membership become a "tied sale", prevented the development of a satisfactory equation predicting union membership. Theoretically, the wage which should appear in the union equation is that obtained prior to unionization, but is not observable.

This thesis shares a weakness with many published and otherwise excellent studies of wage determination in the omission of an equation determining hours of work. Since the vest majority of women in the data sample worked full time, and the inclusion of a second equation would take the analysis far beyond the focus of interest, estimation was restricted to a single equation model.

FOOTNOTES TO CHAPTER TWO

[15]Gary S. Becker, Human Capital (New York: National Bureau of Economic Research, 1964), and Jacob Mincer, Schooling, Experience and Earnings (New York: National Bureau of Economic Research, 1974).

[16]Ibid., pp. 20 - 23.

[17]Ann P. Bartel and George J. Borjas, "Specific Training and its Effects on the Human Capital Investment Profile", Southern Economic Journal 44 (October 1977): 333 - 341.

[18]Ibid., p. 338.

[19]Observed wages are initially depressed (i.e. net of foregone earnings), but rise more steeply than in the absence of investment (since they are gross of returns on previous investment).

[20]This is strictly true mathematically, since expansion of a quadratic equation with two components yields a cross-product term. See Einar Hardin, "Disaggregating the Work Experience Measure in the Earnings Equation", Proceedings of the American Statistical Association, Social Statistics Section (1978): 616 - 620.

[21]Donald O. Parsons, "Specific Human Capital: An Application to Quit Rates and Layoff Rates", Journal of Political Economy 80 (November/ December 1972): 1120 - 1143.

[22]See Duncan and Hoffman, "Training and Earnings", and William J. Grinker, et. al., Climbing the Job Ladder (New York: E.F. Shelley and Co., 1970) for research findings supporting this contention.

[23]Peter B. Doeringer and Michael J. Piore, Internal Labor Markets and Manpower Analysis (Lexington, Mass.: D.C. Heath and Co., 1971): 1 - 5.

[24]Sumner H. Slichter, James J. Healy, and E. Robert Livernash, The Impact of Collective Bargaining on Management (Wash. D.C.: The Brookings Institution, 1960): 558 - 564.

[25]Sidney and Beatrice Webb, Industrial Democracy (New York: Longmans, Green and Co., 1897), p. 281.

[26]Slichter, Healy and Livernash, Impact of Collective Bargaining, p. 606.

[27]U.S. Bureau of Labor Statistics, Bulletin 1425-11, Major Collective Bargaining Agreements: Seniority in Promotion and Transfer Provisions, (Wash. D.C.: U.S. Government Printing Office, 1970), p. 3.

[28]These considerations predict individuals' votes in union elections. Workers who believed a union would improve fairness of treatment were more likely to vote in favor of representation, and those who felt they had a good chance for promotion before unionization were less likely to vote for a union. Women were no less likely to vote for a union, contrary to arguments based on weak labor force attachment. See Henry S. Farber and Daniel H. Saks, "Why Workers Want Unions: The Role of Relative Wages and Job Characteristics", 1978 (manuscript).

[29]Richard N. Block, "The Impact of Union-Negotiated Job Security Provisions on Labor Turnover and Labor Mobility" (Ph.D. dissertation, Cornell University, 1974), p. 58.

[30]U.S. Bureau of Labor Statistics, Bulletin 1425-7, Major Collective Bargaining Agreements: Training and Re-Training Provisions (Wash. D.C.: U.S. Government Printing Office, 1969), p. 2.

[31]Mincer, Schooling, Experience and Earnings, p. 82.

[32]Frederick Meyers, "The Analytic Meaning of Seniority", Proceedings of the 18th Annual IRRA Winter Meeting, 1965, p. 267.

[33]Doeringer and Piore, Internal Labor Markets, p. 78.

[34]Johnson and Youmans, "Union Relative Wage Effects", p. 175.

[35]See Grinker et. al., Climbing the Job Ladder

[36]Specifically, the F statistic used is: $$\frac{\frac{RSS_u - RSS_r}{df_u - df_r}}{EMS_u}$$

where: RSS = regression sum of squares, df = degrees of freedom, EMS = error mean square, and the u and r subscripts refer to restricted and unrestricted regression models.

CHAPTER THREE

EMPIRICAL RESULTS

Results of the regression analysis of hourly wages are reported in Table 2. Since the dependent variable is measured in natural logarithms, coefficients of the independent variables indicate percentage effects on wages. Because the union variable is binary, the coefficients of the main effect human capital variables can be interpreted as the returns to investment which nonunion women receive. The coefficients of the union-human capital interaction variables indicate the direction and magnitude of the difference in returns which unionized women receive, relative to those who are not covered by collective bargaining agreements. The model is specified with quadratic and interaction terms involving the work experience measures in order to estimate the time-path of wages. Therefore, the discussion of union impacts on returns to experience will proceed via estimated wage-tenure and wage-previous experience profiles, and first partial derivatives of the wage equation with respect to each experience component. Although the results are discussed in terms of differential returns to human capital investments, it should be noted that the coefficients reflect differences in the amount of investment per year as well as differences in returns between sectors.

Before examining the pattern of union wage effects through differential returns to human capital, it is useful to compare the average or "lump sum" union increment estimated in this study with those reported by other researchers for comparable time periods. Differentiating the wage equation with respect to union membership,

TABLE 2. Determinants of Women's Hourly Wages in Manufacturing Industries, 1972 (n = 384)

Independent Variables	Coefficients	
	(1)	(2)
Constant	4.95	4.68
ED	.026**	.041**
	(.008)	(.007)
PREV	.019	.027**
	(.011)	(.010)
$PREV^2$	-.00077	-.0012*
	(.0005)	(.0005)
TENURE	.029**	.032**
	(.009)	(.009)
$TENURE^2$	-.00068*	-.00069*
	(.0004)	(.0004)
PREV*TEN	.00035	.00045
	(.0009)	(.0009)
UNION	.25*	.35**
	(.13)	(.13)
ED*U	-.010	-.019
	(.010)	(.012)
PREV*U	-.030	-.040*
	(.020)	(.020)
$PREV^2$*U	.0022**	.0027**
	(.001)	(.001)
TENURE*U	.0075	.00059
	(.015)	(.010)
$TENURE^2$*U	-.00051	-.00029
	(.0005)	(.0005)
PR*TEN*U	-.00058	-.00054
	(.0015)	(.0016)
JSMSA	.13**	.14**
	(.03)	(.03)
RACE	-.014	-.025
	(.029)	(.029)

TABLE 2. (cont'd.)

Independent Variables	Coefficients	
	(1)	(2)
FULLTIME	.19**	.19**
	(.06)	(.06)
PCTWOM	-.0027**	-.0034**
	(.0006)	(.0006)
SIZE	.000073	.00012
	(.0001)	(.0001)
CON	.0027**	.0025**
	(.001)	(.001)
R^2	.51	.47
$\bar{R}^2$	.48	.44
S.E.E.	.23	.24
F	14.4	16.9

Notes: standard errors in parentheses

*coefficients significant at .05 confidence level

**coefficients significant at .01 confidence level

Data Sources: 1972 National Longitudinal Survey of Women, 1970 Census of Population, 1971 Survey of Manufactures.

and evaluating it at the means of the independent variables appearing in the cross-product terms, women received 15.2 percent higher wages when covered by a collective bargaining agreement. When the equation is estimated with a single binary variable indicating collective bargaining coverage, and no union-human capital interactions are included, the union impact remains unchanged. Ryscavage[37] and Ashenfelter[38] report union wage differentials of 22 percent and 13.5 percent, respectively, for white women in 1973.

Use of a single binary variable representing union membership does not bias the estimate of the overall union impact on wages. However, specifying the model to allow union relative wage effects to vary by human capital characteristics may provide insights into the mechanisms through which unions influence wages, and has been an attempt to integrate union wage studies into the mainstream of labor economics research.

The customary rule for statistical significance is the attainment of a .05 or .01 confidence level. The discussion which follows will adhere to this convention. Results which conform to the theoretical predictions, although they fail to attain conventional significance levels, are also of considerable interest. Some of the estimated differences in returns to experience components between sectors fall into this latter category. They are reported and analyzed due to the exploratory nature of this inquiry. Obviously, final conclusions regarding the usefulness of this hypothesis must await further research.

To test the additional explanatory power of the wage equation which includes union-human capital interaction variables, as compared to use of a single binary union membership variable, all union inter-

action coefficients were restricted to equal zero. The F statistic pertaining to the difference in regression sums of squares between the full and restricted models is 1.9. The null hypothesis that there is no significant difference in returns to human capital characteristics between union and nonunion sectors is rejected at the .08 confidence level.

All measures of human capital investment yielded significantly positive returns at the .05 confidence level. Each year of education increased wages of nonunion women by 4.1 percent. Unionized women received substantially lower returns to education, or 2.2 percent per year of educational attainment. The coefficient of ED*U was not statistically significant at conventional levels, but is on the borderline at the .12 level. Its negative sign is consistent with the expectation that unions will minimize differences in pay based on individual characteristics, and promote wage scales according to job characteristics. By compressing skill differentials, union membership benefits less educated individuals more than those with high levels of education.

It was predicted that greater returns to tenure would be obtained in the union sector, because of heavier reliance on seniority as a criterion for pay increases and promotions in unionized firms. The results fail to directly confirm this proposition, but they do support the need to disaggregate total work experience in the estimation of union effects on returns to human capital. The F test on the difference between the full regression model and one which restricts the union-tenure interaction coefficients to zero is not statistically significant. This indicates that allowing returns to tenure to vary between sectors does not add to the explanatory power of the model. However,

when the union-tenure coefficients are constrained to equality with the union-previous experience coefficients, the resulting F statistic is significant at the .02 confidence level. The returns to tenure are significantly different than the returns to previous experience in both sectors. (See Table 3)

Figure 1 displays the predicted wages of union and nonunion women with no previous work experience, at various levels of tenure. The wage-tenure profile of unionized women lies above the nonunion profile at all levels of tenure. However, the greatest union wage differential of 16.5 percent occurs at zero years of tenure. Due to the small absolute size of the TENURE*U coefficient and the greater rate of decline in returns to tenure over time in the union sector, the marginal returns to tenure of union women are only initially greater than those obtained in the nonunion sector, and fall below at three years of tenure.

Table 4 shows the rates of wage change with changes in tenure, holding previous experience constant at three year intervals. Examination of this table reveals that the rate of return to tenure decreases the greater the accumulation of previous experience among unionized women, whereas the rate of return to tenure increases with increases in previous experience for nonunion women. The result of this relationship between returns to tenure and the amount of previous experience across sectors is that there is a smaller union wage differential among women who have invested in previous experience. The greatest union wage differential among women with the average previous experience in the sample (3.6 years) is 11.0 percent, compared to 16.5 percent for women with no previous experience. This result is further demonstrated by comparing Figures 1 and 2, where the latter displays the estimated

TABLE 3. Tests of Significance on Restrictions of Regression Coefficients

	(1)		(2)	
Restriction	F	Significance Level	F	Significance Level
All union interactions equal to zero	1.3	.27	1.9	.08
All union-previous experience interactions equal to zero	1.9	.13	2.7	.05
All union-tenure interactions equal to zero	0.7	.55	0.8	.48
βU*ED equals zero	0.7	.39	2.5	.12
βPREV*U = βTENURE*U βPREV^2*U = βTENURE^2*U	3.2	.04	3.8	.02

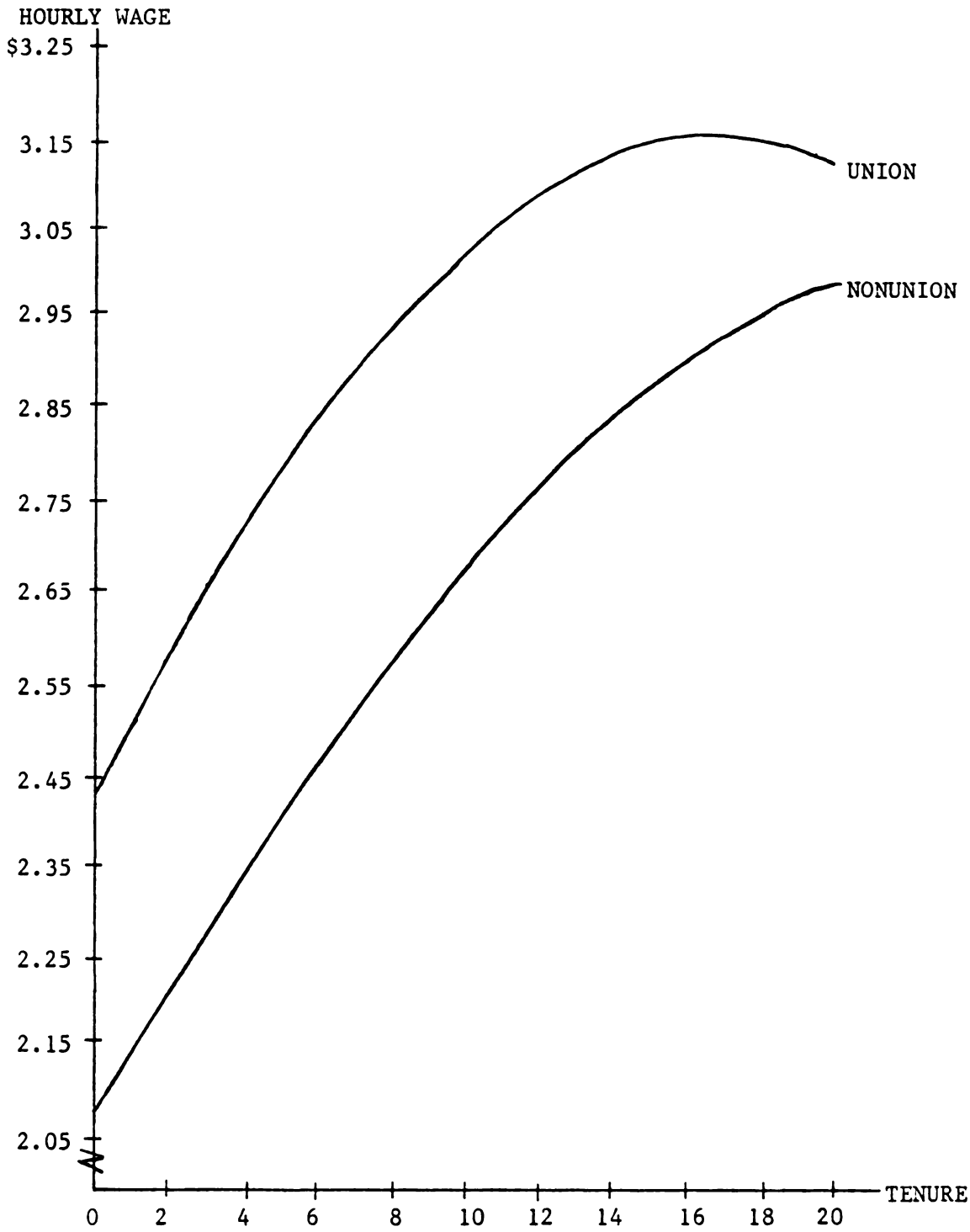

Figure 1. Predicted Wage-Tenure Profiles of Women with no Previous Work Experience in Union and Nonunion Sectors, 1972

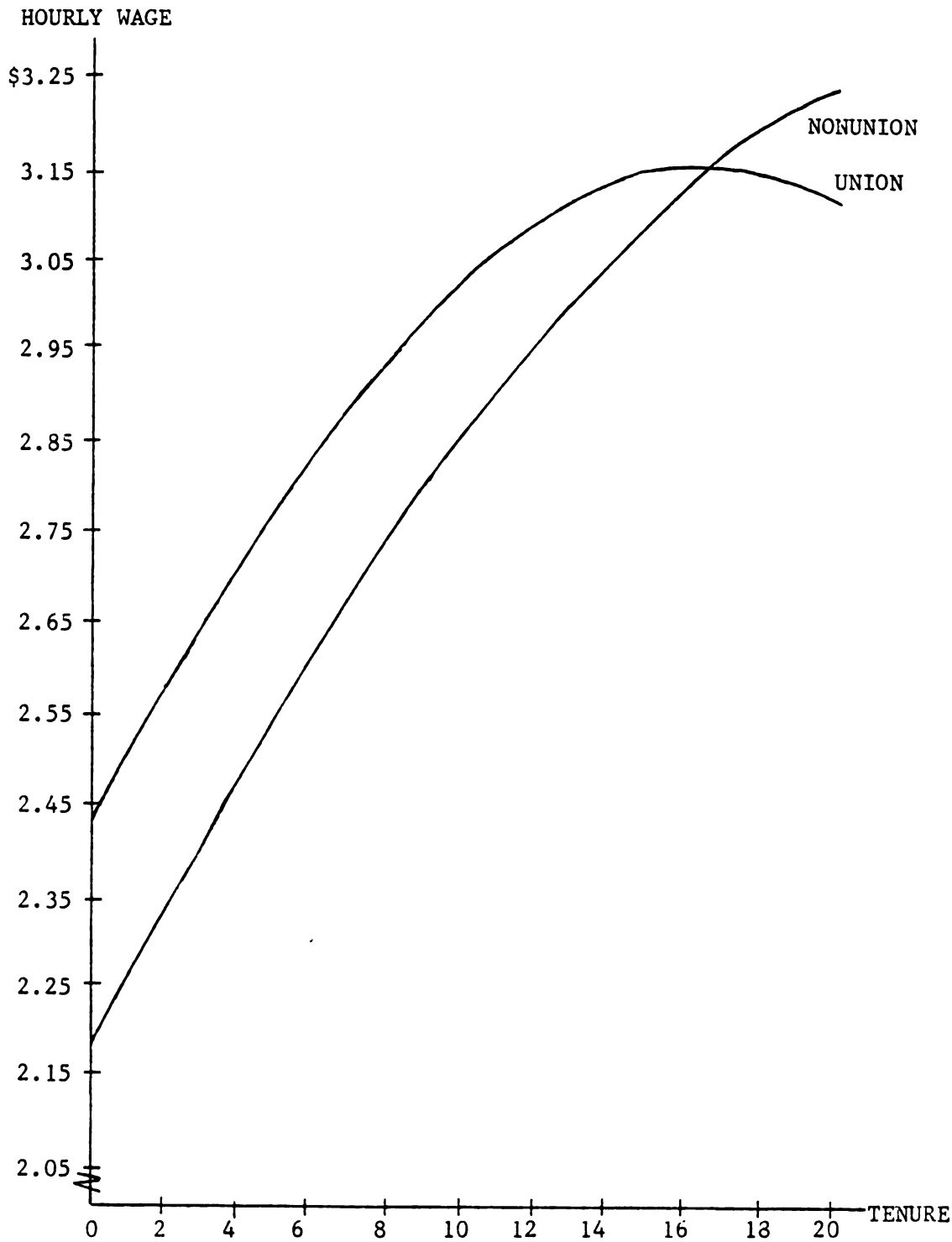

Figure 2. Predicted Wage-Tenure Profiles of Women with 3.6 Years of Previous Experience in Union and Nonunion Sectors, 1972

TABLE 4. Estimated Rates of Wage Change with Respect to Changes in Tenure with Present Employer for Women in Union and Nonunion Sectors, 1972 (in percent)

UNION

Previous Experience	Tenure 0	3	6	9	12
0	3.3	2.7	2.1	1.5	1.0
3	3.2	2.6	2.1	1.5	0.9
6	3.2	2.6	2.0	1.4	0.8
9	3.2	2.6	2.0	1.4	0.8
12	3.1	2.6	2.0	1.4	0.8

NONUNION

Previous Experience	Tenure 0	3	6	9	12
0	3.2	2.8	2.4	2.0	1.5
3	3.3	2.8	2.5	2.1	1.7
6	3.5	3.1	2.6	2.2	1.8
9	3.6	3.2	2.8	2.4	1.9
12	3.7	3.3	2.9	2.5	2.1

wage-tenure profiles of women with 3.6 years of previous experience. The predicted union wage differential is negative at tenure levels greater than sixteen years of tenure, but only 10 percent of the sample possessed seventeen or more years of tenure. These findings suggest that, assuming the mix of general and specific training is the same across sectors, unionization inhibits the transferability of skills acquired in previous jobs, and/or that unionized employers are more constrained by formal job evaluation systems in rewarding their work force for skills previously acquired.

When occupation is held constant in the estimation of wage-tenure profiles, marginal rates of return to tenure are greater in the union sector for women with six or less years of tenure, which includes two-thirds of the sample. The difference in returns to tenure between sectors is not statistically significant, however. See Appendix A for estimated wage-tenure profiles and marginal rates of return derived from equation 1.

There are a number of possible reasons for the failure to find significantly greater returns to tenure in the union sector. First, the restricted age range of the sample used for estimation reduces the amount of variability in the experience variables. More fundamentally, the ways in which unions affect access to highly developed job structures in which OJT can be utilized to progress into higher rated jobs, and any sex differences in access, are not known.

There are two distinguishable sources of potentially greater returns to tenure in the union sector. One is a "pure seniority effect", whereby wage growth results from progression to the top of the pay range within a given job classification. The other is more equal access

to training and promotion opportunities, based on seniority. If women are systematically assigned to flat job structures in both sectors, seniority provisions will have little or no impact on wage growth with increases in tenure. This could be the result of concentration of female employment in occupations (e.g. clerical) and industries (e.g. textiles and garments) in which flat job structures are the norm, as well as any sex differential in job assignment within unionized establishments. The analysis utilized in this thesis needs to be repeated on a data sample which includes men and women, and a full age range before conclusions can be drawn.

It was also expected that union members would receive lower returns to previous experience due to use of job evaluation and minimization of judgment-based and external labor market criteria in unionized firms. The joint significance test of all union-previous experience coefficients yielded an F value of 2.7, which is significant at the .05 confidence level. The explanatory power of the regression model is significantly greater when returns to previous experience are allowed to vary across sectors.

Predicted wage-previous experience profiles are shown in Figures 3 and 4. Figure 3 depicts the wage-previous experience profiles of women with no tenure. It can therefore be interpreted as representing the distribution of wages received by newly hired women who differ in the amounts of previous experience accumulated. As implied above, the wage-previous experience profiles are interpreted as cross-sectional relationships, since the time periods to which they refer are fixed by the level of tenure utilized in the calculations.

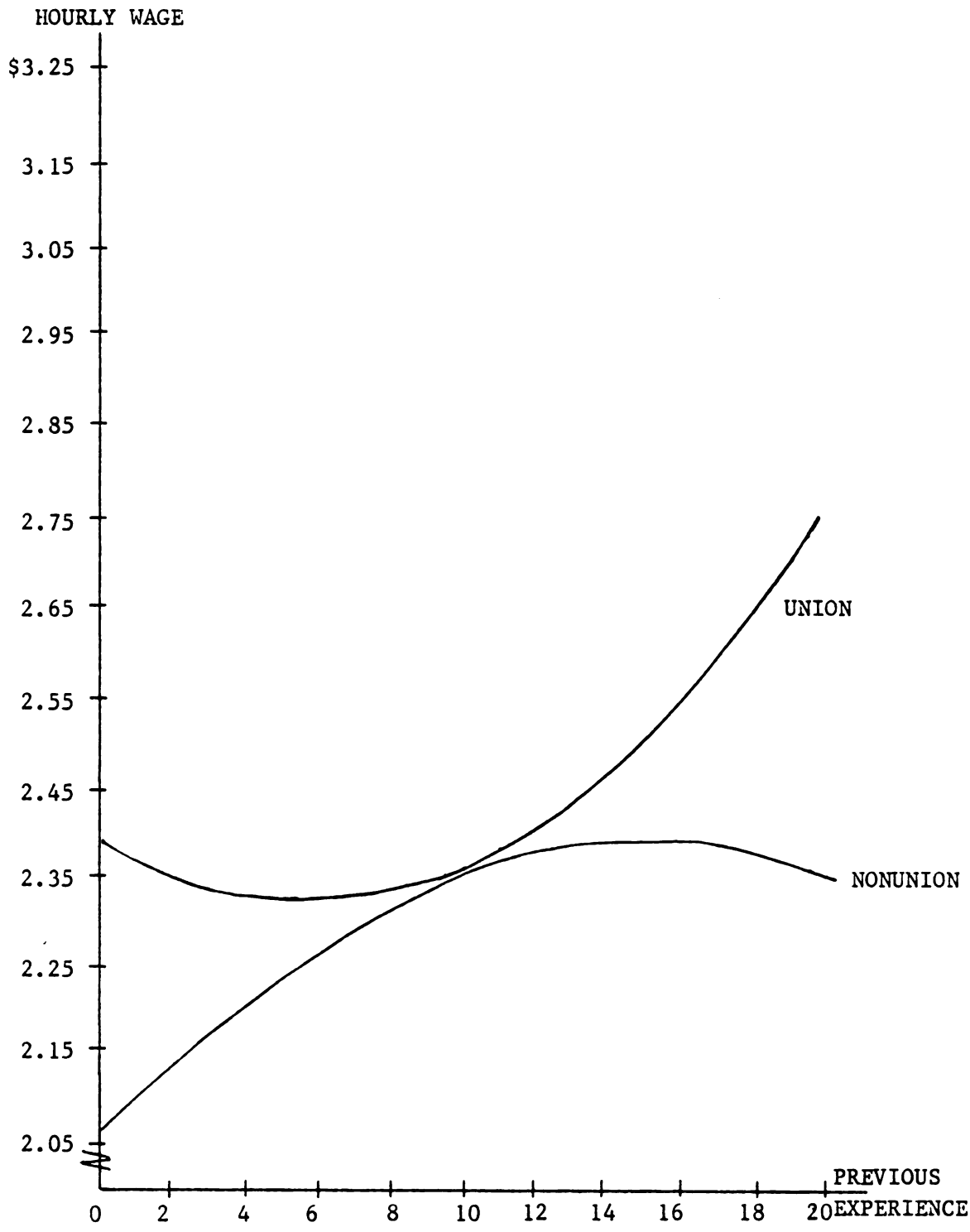

Figure 3. Predicted Wage-Previous Experience Profiles of Newly Hired Women (No Tenure) in Union and Nonunion Sectors, 1972

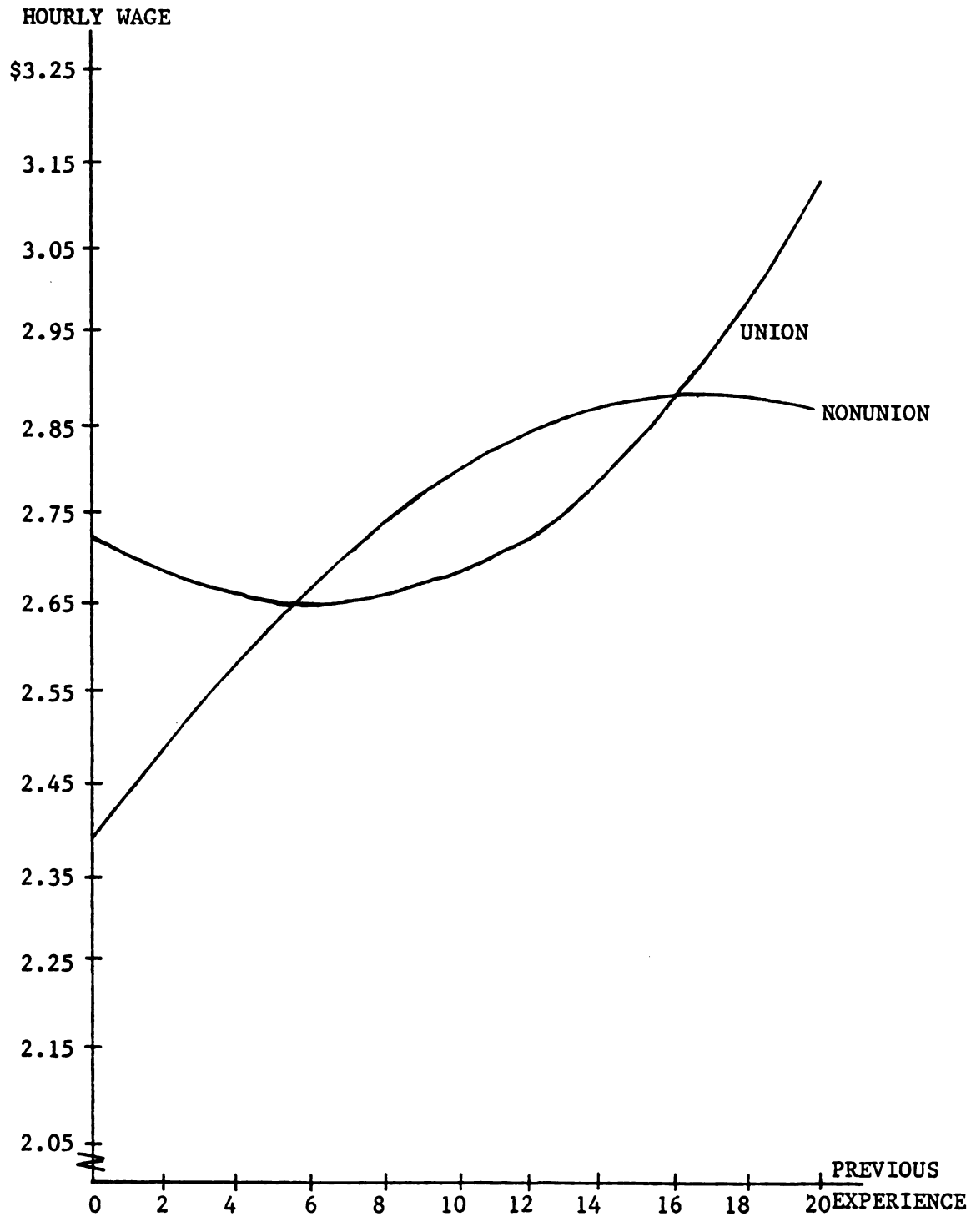

Figure 4. Predicted Wage-Previous Experience Profiles of Women With 6.3 Years of Tenure in Union and Nonunion Sectors, 1972

The most striking feature of these profiles is the U shape estimated for the union sector, due to the positive coefficient of $PREV^2*U$, which is individually significant at the .05 level of confidence. Turning first to Figure 3 which depicts entry level wages across sectors, the effect of unions on returns to previous experience is mixed. Within the range of previous experience from zero to six years, unionized women receive lower returns to previous experience than their nonunion counterparts. Over three-quarters of all women in the sample possessed six years of previous experience or less. The rate of wage change in the union sector decreases between zero and three years of previous experience, as shown in Table 5. Women with seven or more years of previous experience, however, receive greater returns to tenure if they are employed in the union sector. This may in part reflect that the quadratic functional form is inappropriate in this application. It should not be interpreted as directly contradicting a priori expectations that unions will dampen the returns to previous experience for a number of reasons. Table 5, which contains the rates of wage change resulting from a change in previous experience, indicates that returns to each additional year of previous experience decline with increasing tenure in the union sector, while they increase with increasing tenure in the nonunion sector. Although relatively large amounts of previous experience influence the entry level wage in the union sector (perhaps by increasing access to job progressions which offer higher wages), the influence of previous experience on wages decreases the longer one's tenure in a unionized firm. This indicates that unions do insulate wage determination within the internal labor market, but the boundaries are not impermeable. The result of this configuration of union impacts on returns to the two

TABLE 5. Estimated Rates of Wage Change with Respect to Changes in Previous Experience for Women in Union and Nonunion Sectors, 1972 (in percent)

UNION

Tenure	Previous Experience 0	3	6	9	12
0	-1.3	-0.4	0.5	1.4	2.3
3	-1.3	-0.4	0.5	1.4	2.3
6	-1.4	-0.5	0.4	1.3	2.2
9	-1.4	-0.5	0.4	1.3	2.2
12	-1.4	-0.5	0.4	1.3	2.2

NONUNION

Tenure	Previous Experience 0	3	6	9	12
0	2.7	2.0	1.3	0.5	-0.2
3	2.8	2.1	1.4	0.7	0.0
6	3.0	2.2	1.5	0.8	0.1
9	3.1	2.4	1.7	0.9	0.2
12	3.2	2.5	1.8	1.1	0.4

experience components (shown by comparing Figures 3 and 4), is that the absolute and relative union wage advantages decline as tenure increases. In fact, the estimated union wage differential of women with 6.3 years of tenure is negative in the range of four to twelve years of previous experience when utilizing equation 2, but not equation 1. Nonunion workers continue to receive increasing returns to their previous experience as they progress in the internal labor market, while union members do not. The higher absolute level of union wage-previous experience profiles at high levels of previous experience may be due to the initial access to better jobs which previous experience provides.

Finally, a number of caveats are in order. The paucity of observations at high levels of previous experience (89 percent of the women in the sample had ten years of previous experience or less), impairs the reliability of estimates beyond this range. The measure of previous experience provided by the NLS data, the number of years in which the individual worked six months or more, contains unknown but considerable measurement error which may influence the estimated profiles. Characteristics of the jobs in which previous experience was acquired were not controlled for (e.g., union or nonunion, occupation and industry), relative to the current job, but will affect the degree of skill transferability between previous and present employer.

On the whole, these findings are consistent with prior work by Johnson and Youmans, Bloch and Kuskin and Richard Freeman which provide evidence that wage determination is less sensitive to external labor market forces in the union compared to the nonunion sector. By decomposing total work experience into previous experience and tenure with present employer, this study reveals greater complexity of union impacts

on returns to human capital investment than was previously anticipated.

The importance of individual and industry characteristics variables in the determination of women's wages is strongly supported by the regression results. Full-time work increases wages by 19 percent relative to part-time workers. The location of a job in an SMSA raises wages by 14 percent. Wages decrease by .34 percent for each percentage point increase in the proportion of women in total employment of an industry, and increase by .25 percent for each unit increase in the concentration ratio of an industry. All these coefficients are significant at the .01 confidence level. The independent effect of establishment size on wages is negligible and not statistically significant. Race was not found to have a significant effect on wages of women, and the differential was only 2.5 percent.

The overall performance of the regression relation is good. Forty-four percent of the variance in wages is explained by the equation, after adjusting for degrees of freedom. The overall statistical relationship is significant at the 99 percent confidence level. All the coefficients attained the predicted signs.

FOOTNOTES TO CHAPTER THREE

[37]Ryscavage, "Measuring Union-Nonunion Earnings Differences".

[38]Ashenfelter, "Union Relative Wages".

CHAPTER FOUR

SUMMARY AND CONCLUSIONS

The preceding analysis confirmed the expectation that unions have differential effects on returns to previous experience and tenure with present employer. This supports the importance of the distinction which was drawn between internal and external labor markets, and the disaggregation of total work experience for the purpose of studying union impacts on returns to human capital investment. Another finding of considerable interest is the varying and unexpectedly complex pattern of union effects on returns to human capital over time. This also indicates the presence of an essentially different dynamic through which individuals are rewarded for their investments in experience across sectors.

There are two limitations embodied in this study which constrain the ability to generalize these findings. Both are related to the data which were used for empirical estimation. The first is the restriction of the sample to women within a limited age range. As previously noted, this restricts the variation in the experience measures and may impair attainment of statistical significance. In addition, the lack of comparable estimates for men leaves the important and interesting question of any sex differentials in union effects unanswered.

The second limitation involves the lack of measures of job structures or progressions. This is especially important because such structures are a major determinant of the amount of on-the-job training embodied per unit of experience, which will vary across individuals and

possibly across sectors. The amount of training received is in turn a component of the estimated rates of return. If training does not vary systematically across subgroups it will not affect estimated rates of return. However, what evidence is available suggests that there are systematic differences between the sexes in access to training.[39] The question of union impacts on this differential access is not answerable without measures of job structures. Thus, the present effort generates more questions than it answers.

This thesis is an exploratory attempt to refine the analysis of union effects on returns to human capital. The analytical richness which is obtainable by the merging of theoretical and institutional perspectives is demonstrated by both its success and limitations.

FOOTNOTES TO CHAPTER FOUR

[39]Duncan and Hoffman, "Training and Earnings".

APPENDIX A

ESTIMATED WAGE-TENURE PROFILES WHEN OCCUPATION IS HELD CONSTANT

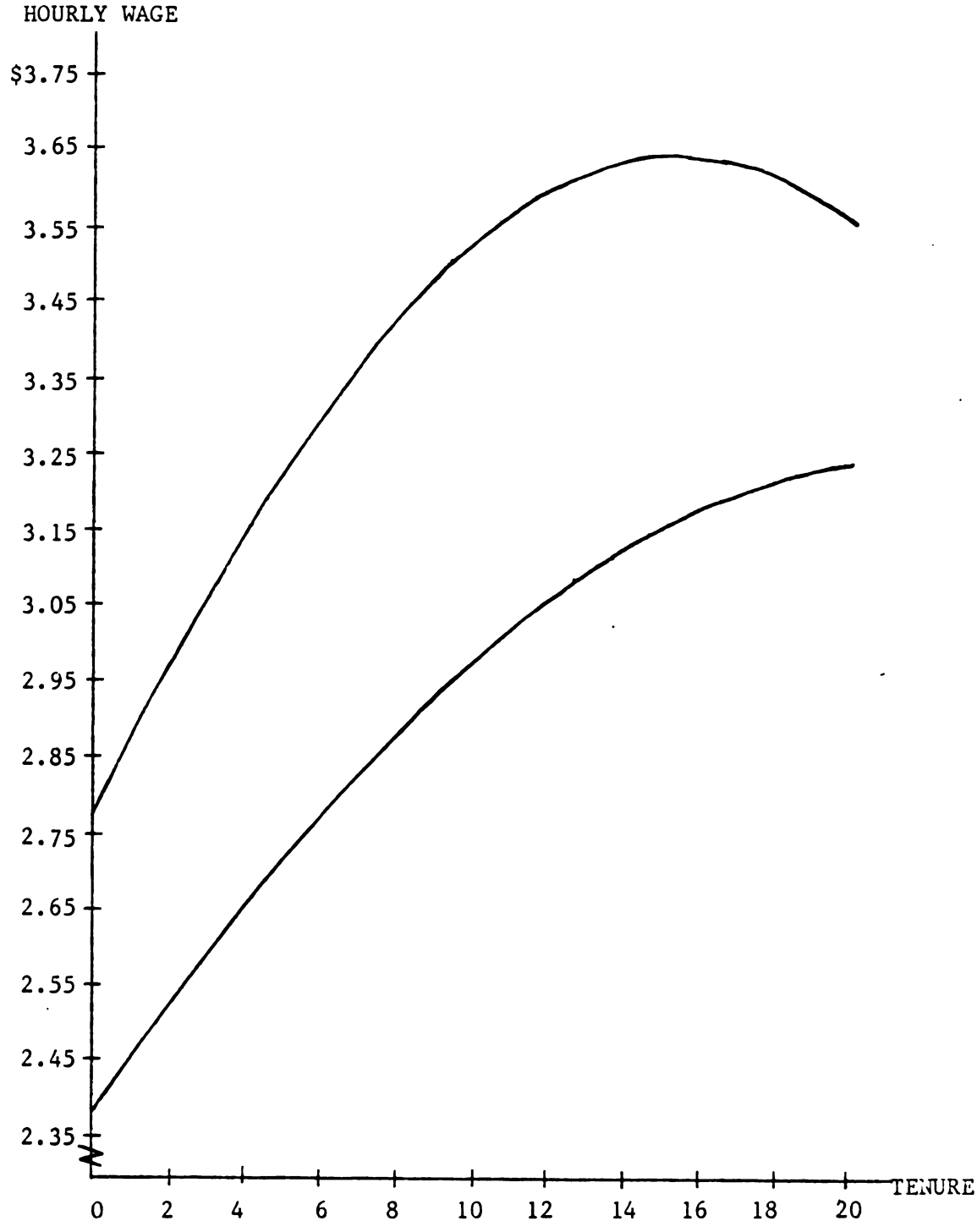

Figure 5. Predicted Wage-Tenure Profiles of Women with No Previous Experience in Union and Nonunion Sectors, 1972 (Occupation Held Constant)

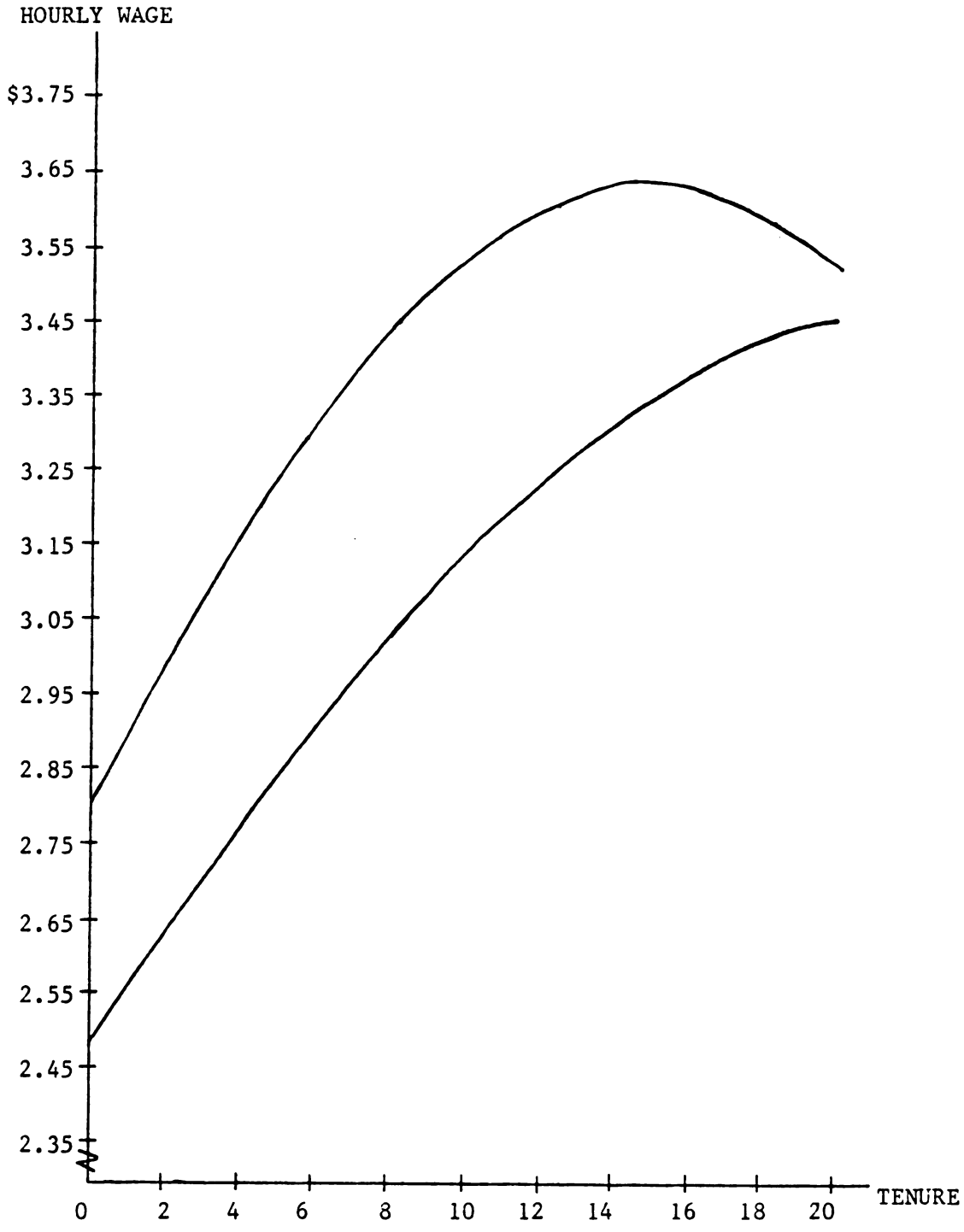

Figure 6. Predicted Wage-Tenure Profiles of Women with 3.6 Years of Previous Experience in Union and Nonunion Sectors, 1972 (Occupation Held Constant)

TABLE 6. Estimated Rates of Wage Change with Respect to Changes in Tenure with Present Employer for Women in Union and Nonunion Sectors, Occupation Held Constant, 1972 (in percent)

UNION

Previous Experience	Tenure 0	3	6	9	12
0	3.6	2.9	2.2	1.5	0.8
3	3.6	2.9	2.1	1.4	0.7
6	3.5	2.8	2.1	1.4	0.6
9	3.4	2.7	2.0	1.3	0.6
12	3.4	2.7	1.9	1.2	0.5

NONUNION

Previous Experience	Tenure 0	3	6	9	12
0	2.9	2.5	2.1	1.7	1.3
3	3.0	2.6	2.2	1.8	1.4
6	3.1	2.7	2.3	1.9	1.5
9	3.2	2.8	2.4	2.0	1.6
12	3.3	2.9	2.5	2.1	1.7

APPENDIX B

DATA APPENDIX

The data on establishment size were obtained from the Annual Survey of Manufactures, 1971, and are based on total employment and number of establishments in an industry. Industry concentration ratios are for 1967, based on the percent of value of shipments accounted for by the four largest companies. The use of data prior to 1972 was required to maintain compatibility with the NLS data, which are based on the 1960 Census industry classification system.

Since industry employment and concentration data are only available by the SIC system, a two-step derivation procedure was developed, based on data availability and the existence of conversion tables between the many versions of the SIC and Census industry classification systems. First, the 1967 SIC industries were combined into their 1970 Census industry equivalents. Then a table of derivations between the 1960 and 1970 Census classifications was used to convert the 1970 Census industries to the 1960 system. The concentration ratios by SIC were combined into the indicated Census industries using the proportion of the SIC industry's value of shipments as weights. This weighting procedure was also used for the combination of four-digit SIC concentration ratios into their three-digit categories, since the data were only available at the four-digit level.

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