Do Marital Status and Presence of Children Affect Women's Wage Rate?

Applying 1985-1992 NLSY data, this study shows that marital status and number of children affected women's labor force participation as well as their wage rates. Standard OLS, Instrumental variable method, and Heckman's wage equation were estimated to address the issues of selection and endogeneity bias. Findings suggest that there is a difference for women who make the decision to work or not.

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Introduction

The labor force participation rate of married women has increased rapidly since 1960's. In 1960, about 32% of married women participated in the labor force, and this ratio increased to 59% in 1992. Meanwhile, the labor force participation rate for women with children experienced an even higher increase from about 28% in 1960 to 69% in 1992. Despite substantial changes in labor force participation, the median weekly wages of married women increased only 6% from $372 in 1985 to $395 in 1992 (both in constant 1992 dollars) (Bureau of Census, 1993). The effect of marital status and presence of children on women's wage rate has been the subject of the recent research.

The human capital theory proposed by Becker (1985) argues that, since women marry and rear children, the gender-specified responsibilities require them to devote more of their time and effort to household activities. As a result, they may choose less effort intensive jobs, devote less energy to market work, and invest less in human capital on the job, which in turn will lower their productivity and earnings. Various studies (Mincer and Polachek 1974, Hill 1978, Dolton and Makerpeace 1987, Korenman and Neumark 1991, and Neumark and Korenman 1994) have concluded that due to child related household work, women with children acquire less human capital on the job and consequently obtain lower wage rates than their male counterparts.

Therefore, the primary purpose of this study is to examine three questions: (1) Do marital status and presence of children affect women's labor force participation? (2) Of those who do participate in the labor force, do married women, especially those with children, have relatively lower wage rates compared with single, divorced or separated counterparts? (3) In consistent with Becker's human capital theory, does human capital accumulation increase women's labor force participation and in turn raise their wage rates? The empirical work requires considerations of simultaneity and selectivity issues. In particular, the paper controls for endogeneity and determines the importance of selection by comparing estimates from the Heckman procedure to those from standard OLS procedure.

Review of Literature

Based on the data from the ninth wave of the Panel Study of Income Dynamics, Hill (1978) suggested that number of children was better than marital status as a measure of women's human capital. OLS regression results indicated that, controlling for various job qualification variables, workers with higher financial responsibilities to their families tended to have higher wage rates.

Following Hill (1978), Dolton and Makerpeace (1987) examined the effect of marital status and child rearing on women's earnings in the graduate labor market by using 1977 UK survey data. The results suggested that women's decision to participate in the labor force was affected by both of their marital status and presence of children. When controlling for job participation, female earnings were affected only by presence of children but not marital status. The wage rate equation further indicated that women with children could lower their wages as much as 25%.

The more recent study on marriage, motherhood, and wages by Korenman and Neumark (1992), concluded that children lower wages directly by curtailing their mothers' labor supply and hence the accumulation of tenure and work experience. Using 1982 NLSY data, the result supported previous research that women's wage rates were affected by the presence of children. However, they treated marital status and number of children as the exogenous determinants of wage rates.

Based on their previous study, Neumark and Korenman (1994) analyzed the sources of bias in women's wage equation using 1982 NLSY data. The results showed statistically significant biases in OLS estimates of wage equations for white and black women. Instrumental variable approach was then employed and the findings indicated a significant and negative impact of number of children on women's wage rate. There was evidence of upward bias in the estimated return to schooling for both white and black women.

Nakamura and Nakamura (1994) studied women's labor supply based on 1970 and 1980 U.S. Census of Population data. The instrumental variable estimation was used to correct potential endogeneity of child status to women's labor supply. The results indicated that married and childless women supplied less labor than that of unmarried and childless women. Furthermore, labor supply was the lowest for the married women with children.

In summary, the papers in this literature indicate that marriage has an insignificant effect on women's wages. In contrast, children appear to significantly affect wage rate by decreasing their mother's labor force participation and the accumulation of human capital. However, there lack studies to control for selection issue and endogeneity problem simultaneously.

Theoretical Background

In order to explain the effect of human capital investment on job earnings, Becker (1985,1993) stated that education and training are the two most important investments to raise a person's income, i.e., a worker increases his/her productivity by learning new skills and perfecting old ones. However, future productivity can be improved only at costs of training, which includes the value placed on time and effort of trainees.

Since the incentive to invest in human capital is positively related to the time spent on that activity, a model of the allocation of energy (or effort) between market and nonmarket activities was developed by Becker (1985), in which households are assumed to maximize utilities by allocating time and individual endowments efficiently among different members. Investments in specialized human capital would enhance the comparative advantages of household members and produce increasing returns. Thus, the household would be better off if the wife who has a comparative advantage in household work invests her human capital in household work, while her husband allocates more of his time to market work.

The allocation of effort in the household production function reinforces the division of labor and therefore lower women's human capital investment in the market. Since child care and housework are more effort intensive than leisure and other household activities, married women would spend less energy on each hour of market work than married men. As the result, married women have lower hourly wage rate than married men. Becker's human capital theory provides the economic basis for analyzing the effect of marital status and presence of children on women's wage rate. As more and more women participate in the labor force, married women or single mothers with children should have more incentives to invest in market human capital in order to obtain an increase in their earnings.

Methodology

In this study, the wage rate is estimated using the following equation:

> Wage rate = f(age, region, education, marital status, number of children, age of the youngest child, tenure, urban or rural,occupation, collective bargaining)

The wage rate estimation requires the consideration of sample selection. The issue is that women self select into the labor force. Unobservable characteristics which affect the decision to participate in the labor force may also affect the wage rate. For example, high ability women may be more likely to work in the paid labor force than low ability women; consequently, wage rates may be biased upward. Also, due to the financial responsibilities, single mothers may participate in the labor force and obtain higher wages to support the households, which again biases wage rate upward. According to Becker's (1981) economic theory of marriage and fertility, marital status and number of children may be endogenous with respect to wage rates. Therefore, the issues of selection and endogeneity are discussed in this section and addressed in the estimation procedure.

<u>The selection issue</u>

To correct sample selection bias, Heckman's (1974) standard sample selection model is employed. The wage equation is given below:

$$W = \beta_0 + \beta_1 X + \beta_2 P + \epsilon \qquad (1)$$

where W is the wage rate, X is the matrix of explanatory variables, and ϵ is a vector of unobservables.

Willingness to participate in the labor force is given by:

$$P^* = Z\delta + v \qquad (2)$$

where P^* is the utility from working, Z is a matrix of explanatory variables, and v is a vector of unobservables. A woman participates in the labor force, i.e. $P_i=1$, if $P^* \geq 0$; and she does not participate, i.e. $P_i=0$, if $P^*<0$. Because women self select into the labor force, OLS estimation of equation (1) is likely to yield biased estimates. In particular, Heckman (1974) shows that the expected value of the error term in equation (1) is:

$$E(\epsilon_i | X_i) = cov(\epsilon, v) * \frac{p(Z\delta)}{\phi(Z\delta)} = c\hat{h} \qquad (3)$$

where $h = \varphi(Z\delta)/\Phi(Z\delta)$. To address this problem, h is added as an additional regressor to equation (1). This additional term, known as the Heckman correction term, is constructed using estimates of the labor force participation equation. Probit analysis is employed to estimate the parameters of the labor force participation equation. The likelihood function is given below:

$$L = \Pi_{P_i=1} Prob(Z_i\delta + \gamma_i > 0) \Pi_{P_i=0} Prob(Z_i\delta + \gamma_i \leq 0) = \Pi_{P_i=1} Prob(\phi(Z_i\delta)) \Pi_{P_i=0} Prob(\phi(-Z_i\delta)) \qquad (4)$$

The estimated value of h is:

$$\hat{h} = \frac{p(Z\hat{\delta})}{\Phi(Z\hat{\delta})} \qquad (5)$$

$$Var(\hat{h}) = \frac{\partial h'}{\partial (Z\delta)} * Z * Var(\hat{\delta}) * Z' * \frac{\partial h'}{\partial (Z\delta)} \qquad (6)$$

The new model, which will be estimated using OLS, is:

$$W = \beta X + c\hat{h} + \omega \qquad (7)$$

where $E(\omega | X,P,h)=0$. The usual OLS standard errors are inconsistent due to the heteroskedasticity imposed by the Heckman correction term. Consequently, the variance-covariance matrix employed is:

$$Var(\hat{\beta}) = (X'X)^{-1}(c^2 Var(\hat{h}) + Var(\omega)) X(X'X)^{-1} \qquad (8)$$

The endogeneity problem

Endogeneity bias may arise if marital status, divorce status, and number of children are simultaneously determined along with wages. For example, women upon marriage may devote more of their time and energy to household work and consequently obtain lower wages. The bias thus comes from the correlation between the independent variable, marital status, and residual ϵ.

Instrumental variables (IV) method was employed to deal with endogeneity of marital status, number of children, and wage rates (Korenman and Neumark, 1992). The instrumental variables fall into two categories: family background variables, including parents' religion and their marital status; respondents' attitudes and expectations, including attitude toward working, attitude toward marriage, and expected number of children. Korenman and Neumark (1992) reported that using family background variables and expectation variables are valid instruments, which are uncorrelated with error terms but correlated with marriage, divorce, and fertility decisions.

Data Descriptions

The data analyzed in this study are drawn from 1985-1992 National Longitudinal Survey of Youth (NLSY). The sample includes women who were age 25 to 35 and exhibited no health limitations for job participation during the survey years. The chosen age range captures women's marital status and fertility transitions as well as their labor market experience. Hill (1978) and Fan (1993) reported the existing wage differences among races, therefore only white women are included in the analysis. After deleting missing values and ineligible observations, the sample size is 6382.

In the first stage probit estimation, the dependent variable is the probability that women participate in the job market. The independent variables include a set of social demographic variables, such as, age, household income, marital status, number of children, age of the youngest child, region, and urban/rural area; human capital variable of education level; expectation variable of willingness to work; enrollment status variable of school enrollment; and labor market variable of local unemployment rate. Year dummy variables are introduced as the independent variables to capture the system differences in the pooled sample.

Table 1
Descriptive statistics for some variables used in the regression analysis 1985-1993, n=6382

Vars.	Marital status: Never married	Married /spouse	Divorced /sep.
Age	27.8	29.0	28.9
	(2.35)	(2.51)	(2.54)
Hourly wage rate	11.68	14.81	9.57
	(5.78)	(32.28)	(4.28)
Hrs work/wk	16.6	10.8	17.8
	(27.09)	(19.52)	(26.02)
Income	14,037	44,69	115,450
	(11,283)	(76,554)	(12,249)
Pres. of children			
# of children	1.36	1.80	1.67
	(0.65)	(0.83)	(0.76)
Age of youngest child	3.98	3.51	5.62
	(3.29)	(3.35)	(3.44)
Educ. level			
<high school	21.94%	9.40%	21.04%
=high school	52.04%	52.45%	55.48%
<college	18.59%	20.27%	19.89%
>=college	7.43%	17.88%	3.59%
Under collect. bargaining	20.13%	22.20%	24.42%
Professional (vs. not)	13.18%	21.91%	27.15%
Region			
North east	20.82%	18.64%	12.45%
North central	38.29%	31.96%	29.27%
West	20.07%	14.76%	22.17%
South	20.82%	34.63%	36.11%
Sample size	269	4972	1141

Note: wage rate and income were inflated to 1992 dollars.

Log hourly wage rate is used as the dependent variable in the second stage wage rate equation. The independent variables include the same set of social demographic variables except income, education variables, and year dummy variables as that used in the first stage. Moreover, human capital variables; i.e., tenure, working hours per week, and occupation of the respondents; and a labor market variable, i.e., collective bargaining, are included.

Descriptive statistics, by marital status, are presented in Table 1. Married women have the highest mean hourly wage rate of $14.81; in comparison, the average hourly wage rate for divorce or separated women is the lowest at $9.57. Never married and divorced or separated women spent more hours in the labor force per week than married ones. Married women had an average of 1.8 children compared to 1.3 children for never married women. More than half of the women in each group got a high school diploma. However, only about 4% of divorced or separated women earned a college degree or more.

Results and Discussions

Labor force participation

Probit analysis in Table 2 suggested that presence of children is an important factor to determine women's labor force participation. When controlling other variables, a greater number of children is significantly related to the higher rate of labor force participation. This observed pattern is probably due to the increased financial responsibilities of having children (Hill, 1978). The age of the youngest child has a negative relationship with women's labor force participation, which is contradictory to the previous findings. Consistent with the study by Hill (1978), marital status does not show a significant relationship with women's job participation rate.

As expected, human capital variables significantly explain the decision of women's labor force participation. Women who attain higher levels of education are more likely to be in the labor force than those with lower levels of education. High local unemployment rate (where high is defined as unemployment ratio greater than 12%) significantly decreases the probability of women's labor force participation.

Wage rate estimation

Column (1) of Table 3 reports the OLS regression of log wages on the set of explanatory variables. Both number of children and age of the youngest child have significantly negative effect on women's wage rates. As reported by Bloom (1987), given the age restriction (25-35) of the sample, the women who are relatively "late" child bearers tend to be relatively high wage earners. Human capital variables of education and tenure have highly significant effect on women's earnings. As expected, women who have at least high school degrees tend to earn more than those without high school diplomas. Moreover, the effect of education on wage rate is the largest for those who get college degree or more. Women who work at professional jobs tend to earn more than those working in other occupations. The labor market variable of collective bargaining significantly increases women's wage rate when holding other variables constant.

Marital status, divorce status, and number of children were treated as endogenous variables in the IV estimation as shown in column (2) of Table 3. An important finding is that married women earned a

Table 2
Result of Probit analysis - Probability of women's labor force participation 1985-1992, n=6382.

Explanatory vars.	Coef.	Std.D.
Age	-0.0113	0.0093
Income	1.1E-7	2.48E-7
Region (vs. South)		
North east	-0.0025	0.0514
North ctl.	-0.0303	0.0427
West	0.0165	0.0538
Marital status		
(vs. never married)		
married	-0.0473	0.0880
div./sep.	0.0019	0.0946
Edu. level		
(vs.< high sch.)		
=High sch.	0.3250	0.0543***
<college	0.4241	0.0655***
>=college	0.2409	0.0722***
Urban		
(vs. rural)	0.0052	0.0398
Local unemply. rate		
(vs. low<6%)		
High (≥12%)	-0.1666	0.0843*
Average		
(6%-12%)	-0.0750	0.0394
Pres. of child.		
# of children	0.0778	0.0218***
age of youngest child	0.0426	0.0058***
Enrollment stat.		
High sch.	-0.3152	0.3957
College	-0.2141	0.0793**
Willing to work	0.0184	0.0411
constant	-0.2419	0.5234
Log likelihood test	-3635.21*	

Note: dummy year variables of year 1986, year 1987, year 1988, year 1989, year 1990, year 1991, and year 1992 (omitted one is year 1985) were not significant and are not shown in the table.
* significant at 0.05 level
** significant at 0.01 level
*** significant at 0.001 level

significantly lower market wage than their never married counterparts. This is comparable with Becker's hypothesis (1985) that marriage tends to have a negative impact on women's earnings. However, this conclusion is not captured when using OLS regression. Both IV and OLS show that number of children is negatively related to women's market wage rate, but the magnitude of the change is much higher (0.7929) by using IV than by using OLS (0.0376).

Column (3) of Table 3 shows the results of Heckman second stage wage rate estimation. When taking selection bias into account, number of children has a statistically insignificant, though negative, effect on the wage rate. Meanwhile, the coefficient on the Heckman correction term is statistically significant and positive. In particular, the finding suggests that the unobservables in the labor force participation equation are positively correlated with the unobservables in the wage rate equation. Thus, women who are more likely to work are the ones who earn higher wages.

Conclusions and Implications

The findings suggest that marital status does not explain women's labor force participation. Moreover, women who have higher financial responsibilities (e.g., more children) are more willing to work.

Wage differences across women are mainly caused by human capital variables, i.e. education and work experience, and the labor market variable of collective bargaining. The effect of marital status and number of children on wage rates seems complementary with respect to OLS, IV, Heckman, and Heckman with IV.

(1) OLS alone finds that having more children decreases women's productivity due to the fact that women need to allocate more of their time and energy to child related household work. However, there is no evidence of detrimental wage effect caused by women's marital status.

(2) When controlling for endogeneity of marital status, divorce status, and number of children, marriage does show a significant effect on wages. Married women tend to have a lower market wage than never married counterparts.

(3) The Heckman correction term is significant in the wage rate equation, which suggests that there is a difference for women who make the decision to work or not. The findings suggest that women who work either require higher wages or have higher ability levels, or both.

In general, the family is veiwed as an economic unit which shares consumption and allocates production between market and nonmarket activities. In this view, the division of labor emerges due to differential skills with which family members are endowed. In the short period of time, the endowments can be taken as given. From the long run perspective, individual endowments are not merely genetic, they can be augmented by the investment in human capital.

Indeed, the results of this study show that human capital variable significantly explains women's labor force decision as well as their earnings. Women are

Table 3
Log wage rate estimation by OLS, IV, Heckman, and Heckman with IV 1985-1989, n=4885.

Exp. vars	Standard OLS	IV[1]	Heckman[2]	Heckman with IV[3]
Age	0.0106**	0.0622	0.0072	0.0635
	(0.0040)	(0.0223)	(0.00128)	(0.0816)
Region (vs. South)				
North east	0.1232***	0.2082***	0.1227	0.2120
	(0.0219)	(0.0341)	(0.0657)	(0.1310)
North ctl.	-0.0279	0.1043*	-0.0159	0.1354
	(0.0184)	(0.0455)	(0.0538)	(0.1715)
West	0.1119***	0.2240***	0.1121	0.2291
	(0.0227)	(0.0313)	(0.0679)	(0.1209)
Educ.level (vs.<highs)				
= High sch.	0.1019***	-0.1003	-0.0020	-0.3074
	(0.0253)	(0.0596)	(0.0858)	(0.2348)
< College	0.2504***	-0.0632	0.1175	-0.3361
	(0.0296)	(0.1020)	(0.1026)	(0.3890)
>= College	0.3988***	-0.0949	0.3217**	-0.2865*
	(0.0346)	(0.1540)	(0.1066)	(0.5700)
Urban vs. rural	0.0713***	-0.0600	0.0636	-0.0896
	(0.0168)	(0.0527)	(0.0495)	(0.1969)
Marital stat. (vs. single)				
Married	0.0166	-0.9293***	0.0314	-0.9492*
	(0.0374)	(0.1605)	(0.1090)	(0.4847)
Div./sep.	0.0348	-0.5662**	0.0347	-0.5497
	(0.0401)	(0.1954)	(0.1180)	(0.5741)
Pres. of child.				
# of children	-0.0376***	-0.7929**	-0.0117	-0.8211
	(0.0100)	(0.2722)	(0.0314)	(1.0087)
Age of youngest child	-0.0084***	-0.0040	-0.0208*	-0.0295*
	(0.0024)	(0.0024)	(0.0081)	(0.0144)
Professional (vs. other)	1.0395***	1.0142***	1.0396***	-0.9955***
	(0.0580)	(0.0570)	(0.1483)	(0.1883)
Tenure (year)	0.1790***	0.1478***	0.1787***	0.1428***
	(0.0137)	(0.0136)	(0.0411)	(0.0526)
Collect. bargain	0.1777***	0.1590***	0.1797**	0.1639
	(0.0224)	(0.0220)	(0.0674)	(0.0851)
Working hrs/wk(vs.<35)	0.0046			
	(0.0303)	0.0171	0.0040	0.0136
35-40 hrs		(0.0297)	(0.0882)	(0.1114)
	-0.0592*	-0.0431	-0.0598	-0.0442
over 40 hrs	(0.0247)	(0.0242)	(0.0710)	(0.0896)
	-	-	1.6894**	3.0672*
λ	-	-	(0.0467)	(1.3573)
IVs				
Fam. background vars.	No	Yes	No	Yes
Exp./attitude vars.	No	Yes	No	Yes
constant	5.1423***	5.9830***	4.2594***	4.3721***
	(0.1216)	(0.2630)	(0.4941)	(0.3688)
Adj. R^2	0.3013	-	0.3017	-

Note: Dummy year variables year 1985 year 1986 year 1987 year 1988 year 1989 year 1990 year 1991 year 1992 did not show a significant impact on Log wage rate. [1]. IV estimates allows marital status, divorce status, and number of children as the endogenous variables. [2]. White standard errors were shown in the parentheses. [3]. Marital status, divorce status, and number of children were treated as endogenous variables and with standard errors were shown in parentheses.

* significant at 0.05 level
** significant at 0.01 level
*** significant at 0.001 level

increasingly the sole support of families either because of marital disruption or nonmarital fertility, which may consequently result in a higher rate of poverty or near poverty among female headed families. The investment in market human capital increases women's earnings and thus improves their future economic status.

It is important for public policy makers to know that improved access to child care might reduce some of women's housework burden and increase their chance to be in the labor force. At the same time, consumer educators should advise women to obtain more education and job training so that they have better chance to get employed or higher wage rates.

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Endnotes

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