
Testing Becker's Prediction on Assortative Mating on Spouses' Wages

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ABSTRACT

It is often believed that spouses' wages are positively related even when other traits such as age and education are controlled. This is mainly based on the observation of two-earner couples. This paper uses the standard sample selection technique to correct for the sample censoring and to compute potential wages for nonworking women. Using data from Taiwan, it is found that after accounting for sample censoring and cross-productivity effects, there is weak evidence that the partial correlation between spouses' wages can be negative. This lends first weak but direct support for Becker's prediction of negative assortative mating on spouses' wages.

I. Introduction

Emphasizing the gains to marriage from specialization in household and market activities, Becker (1973) shows a negative assortative mating on spouses' wages. This surprising prediction, however, has received little empirical support. Even controlling for education and age, the partial correlations of spouses' wages are typically positive.¹ As pointed out in Becker (1973), however, these correlations do not provide a good test of the prediction because they are based on samples in which both spouses work. Becker argued that since a woman is more likely to work

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1. See Becker (1973, 1991) and Lam (1988) for discussions of empirical correlations of spouses' wages.

when her wage rate is high relative to her husband's, a positive correlation for wages of the censored sample of two-earner couples is consistent with a negative correlation of potential wages in the full sample of all couples.

The persistent lack of empirical support for Becker's prediction also has led Lam (1988) to extend Becker's model to include household public goods. Lam shows that the fact that public goods are jointly consumed generates a tendency for positive assortative mating on wages since there are gains to spouses with similar demands for public goods. Lam (1988) discusses a number of additional factors that may affect spouses' observed wage correlations.²

The lack of empirical support for Becker's prediction should not be taken as a big surprise because he makes it clear that the prediction is obtained under a number of simplifying assumptions (Becker 1973, 1974). For example, Becker emphasizes that the predicted negative correlation is conditional on holding constant other traits. It is, of course, very difficult to hold constant other traits in empirical work. Moreover, he points out that the most questioned assumption may be that any division of output between mates is feasible. Some of the output may not be divisible and may even constitute a "public" or "family commodity." In particular, Becker argues that love and caring can convert the whole output into family commodities. With caring, it is shown that there would tend to be positive mating on wages (Becker 1974).

This paper attempts to estimate partial correlations of spouses' wages by taking into account nonparticipation by some wives in the labor market using data from Taiwan. The wages of nonworking wives are imputed from a wage equation using the working wives sample but controlling for sample censoring. Using U.S. data, Smith (1979) made a similar investigation and found that controlling for sample censoring lowers the estimated correlation in wage residuals from 0.098 to 0.035 for white couples. His results give partial support to Becker's prediction, although they fail to produce a negative partial correlation of wages in the full sample. It seems that no published studies have ever found a negative partial correlation of spouse wages.³ Although our results are still quite weak, we will be able to provide what is probably the first negative partial correlation of wages.

The traditional Chinese marriage system was organized and directed by the parental generation. Over the last five or six decades, however, Taiwan has experienced a dramatic revolution in intimate relations (Thornton et al. 1994). Traditional arranged marriages and the introduction of husbands and wives to one another by the older generation have both largely ended; young people are now directly involved in mate selection, and dating has become a common feature of the process. Nevertheless, the marriage system in Taiwan has not become a simple love match system, certainly not by the standards of contemporary Western societies. The older generation still retains a considerable involvement in the choice of a spouse. Using data from a 1986 island-wide survey covering birth cohorts from 1935–39 to 1960–64, Thornton et

2. These additional factors include investments in human capital (including returns to labor market experience), geographical variation in wages, and so on. Household public goods and their implications for marriage outcomes have also been analyzed by others in a bargaining framework. For example, Manser and Brown (1980) consider marriage and household decision-making and point out that Becker's (1974) work implicitly assumes a particular bargaining rule.

3. Note, however, that Becker (1973) mentions a negative correlation of 0.25 by referring to an unpublished estimate by Gregg Lewis.

al. (1994) report that most Taiwanese brides dated only with parental consent and most dated only their husbands.

Parental involvement in children's marriage should not weaken Becker's marriage theory. Because, parents tend to employ traditional marriage arrangements that are often motivated by economic considerations, their involvement should reduce the importance of emotional factors (associated with young adults) and increase the importance of economic factors in mate selection. Hence, if anything, parental involvement should strengthen the predictive power of assortative mating on wages. However, it is clear that our empirical analysis should try to take into account changing marriage systems over time.

II. The Estimation Procedure and Data

To obtain an estimate of the partial correlation between spouses' wages while controlling for spouses' other traits, consider the following equation

$$(1) \quad Wage_h = \alpha_0 + \alpha_1 Wage_w + \alpha_2 Age_h \\ + \alpha_3 Age_w + \alpha_4 Education_h + \alpha_5 Education_w \\ + \alpha_6 Bride\ Price_h + \alpha_7 Dowry_w + \varepsilon,$$

where subscripts h and w represent husbands and wives respectively. Other traits on the right hand side (RHS) are included in an attempt to hold constant other traits available in the data. Bride price and dowry are entered as regressors since they may also be relevant traits in a match involving multiple traits. As discussed in the introduction, marriage systems have been moving from arranged marriage to a more Western style. The age variables on the RHS can partially account for possible cohort effects. To estimate Equation 1 we need to circumvent the standard problem that the market wage rate is not observed for nonworking wives. We do this by first estimating a probit equation over the full sample of wives, relating the probability of labor force participation on a set of variables that might affect it: age and its quadratic, education, nonwife income, residence, the presence of young children, and education of the wife's father and mother.⁴ The computed inverse Mills' ratio, λ , from the probit is then entered into a second-round equation describing the logarithm of wages for the sample of working wives.⁵ The estimated coefficients from this equation are then used to compute potential wages for nonworking wives. The predicted wages for working wives, and for husbands obtained from a similar wage equation are used in estimating Equation 1. Thus, the resulting coefficient, α_1 , in

4. Nonwife income and the presence of young children are standard instruments used in the probit regression (see Mroz 1987). Education of the wife's father and mother reflects the woman's background that may shape her tastes toward work and thus affect her reservation wages.

5. Other variables entering the wage equation include age and its quadratic, education, and residence. We use the econometric software LIMDEP in estimating sample-selection models so correct standard errors for estimated coefficients (Lee 1982) are automatically obtained for the second-round equation.

Equation 1 estimates the partial correlation between spouses' predicted, rather than actual, wages.⁶

It is interesting to compare the estimate of partial correlations from the above procedure with estimates from other procedures that do not control for spouses' other traits or sample censoring. To see clearly how the estimates change while controlling for spouses' other traits or sample censoring, we will present these estimates separately.

Although sometimes scholars point out that all spouses' traits are endogenous variables in an equation like Equation 1, one can do little to tackle the endogeneity problem, due to the lack of truly exogenous variables as instruments. We thus caution that the estimated coefficients for Equation 1 should be taken as partial correlations without formal causal or structural interpretations. In this connection, one arguable variable in the probit equation is the presence of young children, which may well be endogenous to the mating decision. Consequently, we estimate Equation 1 with and without the young children dummy in the probit equation separately.

This study uses data from the 1989 Taiwan Women and Family Survey, an island-wide probability survey of women aged 25–60 years of different marital statuses and from all geographical locations.⁷ Included in the survey are 3,803 women, of whom 3,441 are currently married.⁸ These female respondents provide socioeconomic information for their parents, themselves, and their husbands and children. Our analysis is restricted to once-married female respondents with spouses present. After deleting observations with missing variables, the sample size is 1,549. We examined possible reasons for missing observations, but could not find any systematic patterns. Of the 1,549 wives, 1,007 worked in the market in the survey month, implying a reasonably high participation rate of 65 percent. Only 628 of the 1,549 women reported information on bride price and dowry (mean values = 871.01 and 1,233.8 in 1986 new Taiwan dollars) Table 1 reports means and standard deviations of all variables (except bride price and dowry) for different samples.

III. The Empirical Results

The probit estimates are reported in Appendix Table A1. Consistent with the literature, the presence of young children and a higher nonwife income lower the probability that a randomly selected woman works. Women with more education are more likely to work. Somewhat surprisingly, Taiwanese women in urban areas are less likely to work. It is interesting to note that the probability of a woman's participation in the labor market is positively (negatively) related to her mother's (father's) education, although none of the coefficients is statistically significant at any conventional levels. Wage rate regressions are reported in Appendix

6. Note that Smith (1979) computes the correlation between spouses' residuals wage. Much as in Becker (1973, 1991), we compute the correlation with other traits held constant.

7. This survey was designed by William L. Parish and Robert J. Willis of the University of the Chicago and conducted in March 1989 as a collaborative project between NORC and the National Taiwan University. Parish and Willis (1993) used the same data and provided more background information. Zhang (1995) and Zhang and Chan (1999) also used the same data.

8. Marriage includes both formal marriage and cohabitation.

Table A2. The coefficients of the inverse Mills' ratio are statistically significant, implying the presence of sample censoring.

Table 2 reports estimates for Equation 1 and its variants using different samples. Using the censored sample of two-earner couples, the simple regression coefficient between spouses' wages is 1.0269. Even controlling for age and education, the partial regression coefficient remains as high as 0.9370. Relying on these estimates would lead to strong rejection of Becker's prediction on assortative mating by spouses' wages.

Moving to the center part of Table 2, we see that correcting for sample censoring changes the estimates dramatically. Using the full sample, the simple regression coefficient is only 0.0206 (children dummy not in probit) or 0.0960 (children dummy in probit). Controlling for age and education, the partial regression coefficient is even smaller (0.0037). In the case of not including children dummy in probit, the partial regression coefficient is even negative (-0.0004). Controlling for bride price and dowry reduces the partial regression coefficient further from 0.0037 to 1.209×10^{-5} if children dummy was in probit, and from -0.0004 to -0.0023 if children dummy was not in probit.

Notice that the estimated coefficient for husband's age is all negative. This may be due to the cohort effect since older cohort may have been paid less than the younger cohort. To check whether this is the case and to see how robust the partial correlations for wages are, we repeated the whole procedure for the sample of all couples with husbands not older than 40 years of age. The resulting estimates for Equation 1 are reported in the last six columns of Table 2. Note that the coefficient for husband's age is now all positive as expected. The earlier results on partial regression coefficients between spouses' wages continue to hold. If children dummy was included in probit, the partial coefficient becomes negative after controlling for age, education, and marriage transfers. If children dummy was not included in probit, the partial coefficient becomes negative once age and education are controlled, as in the full sample.

It is interesting to see that the partial correlation for wages becomes more negative for the younger cohort (that is, husbands not older than 40 years of age) than for the whole sample that includes older cohorts. To the extent that old cohorts involved more traditional marriages, one would expect a less negative partial correlation in the younger cohort. In fact, the finding goes in the other direction suggesting the existence of other factors. Indeed, Becker has emphasized the importance of holding constant nonmarket attributes, and a simple equation like Equation 1 cannot control for many nonmarket attributes. The whole sample is certainly less homogeneous than the younger cohort sample. For example, technology for household production has changed over time, and mating criteria may also have changed. Hence, working with a smaller but more homogeneous sample enables a better control for unobserved attributes that affect mating and, thus, a better estimated partial correlation.

Note that once sample censoring is corrected, the partial regression coefficients between spouses' wages are normally not statistically significant. Only in the case of using the younger generation sample without including the children dummy in probit, are the partial regression coefficients negative and marginally signifi-

Table 2
Assortative Mating on Wages in Taiwan (Left-Hand-Side Variable: Husbands' Wages)

| Right-Hand-Side Variable | Full Sample | | | | Sample of Couples with Husbands' Age Less Than 40 | | | | | | | |
|--------------------------|---------------------------------------|--------------------------------------|--|--------------------------------------|---|--|--------------------------------------|--|------------------------------------|-------------------|--------------------|------------------------------------|
| | Censored Sample of Two-earner Couples | Presence of Young Children in Probit | Presence of Young Children Not in Probit | Presence of Young Children in Probit | Presence of Young Children in Probit | Presence of Young Children Not in Probit | Presence of Young Children in Probit | Presence of Young Children Not in Probit | | | | |
| Wage _h | 1.0269 (37.91) | 0.9370 (19.80) | 1.209×10 ⁻⁵ (0.002) | 0.0206 (4.485) | -0.0004 (0.227) | -0.0023 (0.773) | 0.1573 (11.92) | 0.0050 (0.48) | -0.0043 (0.25) | 0.0164 (3.905) | -0.0035 (1.383) | -0.0064 (1.502) |
| Age _h | — | -0.0115 (8.216) | -0.0111 (5.098) | — | -0.0171 (14.44) | -0.0110 (5.075) | — | 0.0156 (5.798) | 0.0147 (3.245) | — | 0.0158 (5.898) | 0.0146 (3.222) |
| Age _w | — | 0.0179 (10.12) | 0.0061 (0.795) | — | 0.0059 (4.223) | 0.0019 (0.780) | — | -0.0011 (0.410) | -0.0018 (0.393) | — | -0.0009 (0.323) | -0.0013 (0.303) |
| Education _h | — | 0.1313 (53.28) | 0.1019 (33.99) | — | 0.1020 (52.69) | 0.1062 (34.01) | — | 0.0644 (25.16) | 0.0671 (14.93) | — | 0.0644 (25.21) | 0.0673 (15.04) |
| Education _w | — | -0.0808 (4.81) | 0.0097 (2.894) | — | 0.0116 (5.713) | 0.0099 (3.021) | — | 0.0089 (3.039) | 0.0066 (1.317) | — | 0.0102 (3.833) | 0.0071 (1.538) |
| Bride Price | — | — | -1.264×10 ⁻⁵ (1.109) | — | — | -1.326×10 ⁻⁵ (1.164) | — | — | -1.176×10 ⁻⁵ (0.919) | — | — | -1.255×10 ⁻⁵ (0.983) |
| Dowry | — | — | 5.111×10 ⁻⁶ (1.002) | — | — | 4.990×10 ⁻⁶ (0.978) | — | — | 2.748×10 ⁻⁶ (0.483) | — | — | 2.322×10 ⁻⁶ (0.410) |
| Constant | -0.5471 (3.855) | -0.9105 (4.142) | 4.0944 (59.01) | 4.8111 (244.5) | 4.2369 (109.3) | 4.0992 (62.15) | 4.2923 (65.78) | 3.7253 (48.99) | 3.7856 (28.45) | 5.0050 (279.3) | 3.7318 (51.76) | 3.7733 (30.46) |
| R ² | 0.5884 | 0.8989 | 0.8245 | 0.0128 | 0.8430 | 0.8247 | 0.1501 | 0.6633 | 0.6139 | 0.1859 | 0.6640 | 0.6167 |
| N | 1,007 | 1,549 | 628 | 1,549 | 1,549 | 628 | 807 | 807 | 310 | 807 | 807 | 310 |

Note: Absolute values of *t*-ratios are in parentheses beneath the estimated coefficients.

cant. Hence, while the results provide some evidence of a negative partial correlation between wages, the evidence is not very strong. Nevertheless, we find little support for the common belief in a positive partial correlation between spouses' wages.

The coefficients of bride price are all negative and those of dowry are all positive (though the coefficients are not statistically significant). A negative partial correlation between husbands' wages and bride price suggests that a more productive man may need to offer less bride price. Similarly, a positive partial correlation between husbands' wages and dowry suggests that a woman (or her parents) would offer a higher dowry to a more productive man.

IV. Cross-productivity Effects

Some evidence suggests that wives' education increases husbands' market productivity. Benham (1974) finds that labor-market benefits to men are positively associated with their marrying well-educated women. This cross-productivity effect can be interpreted as human capital accumulation within marriage.⁹ Kenny's (1983) empirical results also support the hypothesis that married men have higher wage rates than unmarried men because marriage facilitates the financing of human capital accumulation. We find no reported effect, however, of husbands' education on wives' labor-market productivity. If husbands' wages are raised from marrying more educated wives but wives' wages are not increased or even reduced by marrying more educated husbands, we would expect a negative correlation between spouses' post-marriage observed wages. It is thus important to examine whether the negative correlation found in Section III continues to exist after within-marriage cross-effects on wages are taken into account.

To do this, we use the following procedure. Spouse's education is included as an additional regressor in the wage equations for men and women. We deduct the effect of spouse's education when we use estimates from the wage equations to impute wages for each individual. The imputed wages net of the cross-effect are used in Equation 1.

In results not reported here, we find that, consistent with the literature, wives' education has a positive and (statistically) significant coefficient in the husbands' wages equation. In the wives' wages equation, the coefficient of husbands' education is also positive but is not precisely measured (t-ratio less than 0.5). These findings suggest an intra-marriage cross-effect from wives to husbands but not the other way around.

Using imputed wages net of the cross-effects, the results are reported in Table 3. (We only estimated the four equations that gave a negative partial correlation and did not have young children in probit, reported in Table 2.) While the wage coefficient in Column 1 becomes positive now, the wage coefficients in other three columns remain to be negative. It is not surprising to see that the wage coefficient in Column 1 is

9. Becker (1973) offers an alternative interpretation along lines of his theory of sorting. He argues that wife's education can be viewed as a proxy for traits affecting her nonmarket productivity so that women with higher nonmarket productivity marry men with higher earning power.

Table 3
Assortative Mating on Wages Net of Cross-productivity Effects

| Right-hand-side variable | Full Sample | | Sample of Couples with Husbands' Age ≤ 40 | |
|--------------------------|--------------------|------------------------------------|--|------------------------------------|
| | Wage _w | 0.0011 (0.659) | -0.0011 (0.427) | -0.0031 (1.424) |
| Age _h | -0.0072 (7.147) | -0.0013 (0.700) | 0.0223 (9.853) | 0.0211 (5.533) |
| Age _w | 0.0063 (5.258) | 0.0025 (1.233) | -0.0017 (0.743) | -0.0021 (0.545) |
| Education _h | 0.0387 (23.54) | 0.0422 (16.23) | 0.0009 (0.424) | 0.0034 (0.889) |
| Education _w | 0.0090 (5.202) | 0.0075 (2.759) | 0.0080 (3.594) | 0.0053 (1.367) |
| Bride price | — | -1.236×10^{-5} (1.303) | — | -1.027×10^{-5} (0.955) |
| Dowry | — | 4.723×10^{-6} (1.111) | — | 2.151×10^{-6} (0.450) |
| Constant | 3.6395 (110.4) | 3.5108 (63.87) | 3.3219 (54.66) | 3.3627 (32.20) |
| R ² | 0.5343 | 0.5151 | 0.1983 | 0.1761 |
| N | 1549 | 628 | 807 | 310 |

Note: Absolute values of *t*-ratios are in parentheses beneath the estimated coefficients.

now positive after the cross-effect adjustment, given the small magnitude (-0.0004) of its counterpart in Table 2. The magnitude of the three negative coefficients is slightly smaller than that of their counterparts in Table 2. These results show that the negative assortative mating on wages found in Section III remains even after controlling for the intra-marriage cross-productivity effect.

V. Conclusion

Most people believe that spouses' wages are positively related even when other traits such as age and education are controlled. This is mainly based on the observation of two-earner couples. This paper uses the standard sample selection technique to correct for the sample censoring and to compute potential wages for nonworking women. Using data from Taiwan, after accounting for sample censoring and cross-productivity effects, we find weak evidence that the partial correlation between spouses' wages can be negative. This lends weak support for Becker's prediction of negative assortative mating on spouses' wages and for Becker's conjecture that positive partial correlation based on two-earner couples is consistent with a

negative partial correlation over all couples. The presence of the cross-productivity effect resulting from wives' education to husbands' wages is consistent with the literature, and does not vitiate against negative assortative mating on spouses' wages.

It is worth noting that the above conclusion should not be generalized to any data. There are many factors, such as love and caring within marriage or prior-marriage human capital investment emphasized in Becker (1985) and household public goods emphasized in Lam (1988), that may affect spouses' wage correlations in different directions. Becker's prediction can only be clearly verified in situations in which the specialization effect is sufficiently strong relative to other factors. Indeed, parental involvement in children's mate selection may have reduced the importance of such other offsetting factors as love and caring, and may thus have contributed to the observed possible negative correlation of wages in the present paper. Future exploration of how to sort out different forces affecting observed wage correlations appears to be warranted.

Table A1
Probit Estimates

| Variable | Full Sample | | Sample of Couples with Husbands' Age \leq 40 | |
|-----------------------------------|------------------------------------|------------------------------------|---|------------------------------------|
| Age | 0.1578 (3.765) | 0.2193 (5.708) | -0.0103 (0.046) | -0.0394 (0.178) |
| Age ² | -0.0020 (3.994) | -0.0026 (5.548) | 0.0004 (0.113) | 0.0011 (0.328) |
| Education | 0.0411 (3.626) | 0.0343 (3.075) | 0.0616 (3.619) | 0.0502 (3.024) |
| Nonwife income | -7.729×10^{-6} (3.124) | -7.895×10^{-6} (3.197) | -4.871×10^{-6} (1.485) | -4.995×10^{-6} (1.540) |
| City | -0.2597 (3.607) | -0.2574 (3.587) | -0.1915 (1.975) | -0.1926 (1.995) |
| Presence of preschool children | -0.3497 (3.732) | — | -0.3596 (3.268) | — |
| Father's education | -0.0109 (0.967) | -0.0116 (1.033) | -0.0014 (0.095) | -0.0019 (0.129) |
| Mother's education | 0.0121 (0.906) | 0.0126 (0.946) | 0.0112 (0.641) | 0.0120 (0.688) |
| Constant | 2.4988 (2.864) | -3.9908 (5.165) | 0.0387 (0.011) | 0.0861 (0.024) |
| Chi-squared | 69.17 | 55.16 | 31.03 | 20.23 |
| <i>N</i> (working wives) | 1,007 | | 495 | |
| <i>N</i> (nonworking wives) | 542 | | 312 | |

Note: Absolute values of *t*-ratios are in parentheses beneath the estimated coefficients.

Table A2
Estimates of Log Wage Rate Equations for Husbands and Wives

| | Wives | | | | | |
|----------------------|------------------------------------|------------------------------------|--------------------------------------|--|--------------------------------------|--|
| | Husbands | | | Full Sample | | Husbands' Age ≤ 40 |
| | Full Sample | Husbands' Age ≤ 40 | Presence of Young Children in Probit | Presence of Young Children Not in Probit | Presence of Young Children in Probit | Presence of Young Children Not in Probit |
| Age | 0.0678 (1.048) | 0.1685 (0.352) | 0.3612 (3.801) | 0.6025 (3.419) | 0.0184 (0.081) | -0.0433 (0.190) |
| Age ² | -9.278×10 ⁻⁴ (1.307) | -2.289×10 ⁻³ (0.327) | -4.474×10 ⁻³ (2.991) | -7.193×10 ⁻³ (3.503) | 2.262×10 ⁻⁴ (0.113) | 1.815×10 ⁻³ (0.328) |
| Education | 0.0950 (3.155) | 0.0562 (2.023) | 0.1209 (4.875) | 0.1466 (5.251) | 0.1280 (4.617) | 0.1917 (4.103) |
| City | 0.4321 (2.890) | 0.3715 (1.898) | -0.1654 (1.451) | -0.4663 (2.494) | 0.0276 (0.242) | -0.2231 (1.487) |
| Inverse Mills' Ratio | — | — | 1.7475 (2.659) | 3.8568 (3.615) | 0.7789 (1.583) | 3.1276 (3.009) |
| Constant | 2.5231 (1.727) | 1.1546 (0.142) | -3.7056 (2.161) | -9.8351 (2.405) | 2.7435 (0.737) | 1.1090 (0.296) |
| R ² | 0.0392 | 0.0133 | 0.1349 | 0.1501 | 0.1293 | 0.1407 |
| N | 1,549 | 807 | 1,007 | | | 495 |

Note: Absolute values of *t*-ratios are in parentheses beneath the estimated coefficients. Wage rates were derived from dividing weekly earnings by days and hours worked.

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