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## The Gender Wage Gap in the Economics Profession

A Search in the Return to Marriage and Fertility of Ph.D. Economists

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### **Abstract:**

Previous researchers have found that after controlling for various determinants of economists' earnings, there still remains an unexplained residual wage gap across genders in the economics profession. This study uses 1990 Census data to examine the return to marriage and fertility of male and female Ph.D. economists in an attempt to explain in part the residual gender wage gap in the profession. Marital status is found to have no impact on male or female economists' earnings. Fertility does not affect male economists' earnings, but is negatively correlated with female economists' earnings. I conclude that the different returns to fertility across genders may account for part of the residual gender wage gap in the economics profession that is unexplained by previous studies.

## **I. Introduction.**

It is well known that there exists a sizable gender wage gap in the economics profession. Previous literature has examined various determinants of economists' earnings such as prestige of one's graduate institution, volume and quality of one's publications, first job placement, etc. Despite controlling for those factors, there remains an unexplained gender wage differential. However, the impact of marriage and family lives on male and female economists' earnings is less explored. Using 1990 Census data, this paper examines the returns to marriage and fertility among male and female economists and finds that marital status has no impact on male or female economists' earnings. Returns to fertility, however, are found to be significantly different across genders, and female economists' earnings are negatively correlated with the number of children born to them. Hence, fertility may partially account for the residual earnings gap in the economics profession.

## **II. Review of Literature.**

Previous studies have consistently found that female economists earn less than their male counterparts (Johnson and Stafford, 1974, McDowell and Smith, 1992, Broder, 1993). In a sample of 392 academic economists, Broder (1993) found that the mean salary for male economists was \$64,288 in 1989 dollars, while the mean salary for their female counterparts was only \$42,302 in 1989 dollars. This gender wage gap appears to have narrowed since 1960s but still remains (Barbezat, 1991).

In an attempt to explain why such a large gender wage gap exists in the profession, researchers have examined whether women are at a disadvantage in various

determinants of economists' earnings. Regardless of gender, studies have uniformly found that economists' earnings are positively correlated with the rank of the Ph.D. granting department, volume and quality of publications, age and seniority, and the quality of first job placement, *ceteris paribus*. The academic labor market appears to only allow economists to go to lower ranked institutions after their first jobs (Rutman and Stevenson, 1979), suggesting the supreme importance of one's first job placement.

As to first job placement, results are mixed. Formby, Gunther, and Sakano (1993) find gender makes no significant difference, while McMillen and Singell (1994) conclude that women face inferior opportunities because of systematic job mismatch.

Admission to Ph.D. programs is found to be a fairly equal game for men and women in the economics profession. Attiyeh and Attiyeh (1993) find that admission does not discriminate against women and instead female applicants actually have a 4 percentage higher probability of being admitted to an economics Ph.D. program, possibly due to affirmative action. Kahn (1995) finds that in 1993 the fraction of doctorate degrees awarded to women at top-tier economics departments is the same as at all economics departments, implying that women are as likely to have graduated from a top tier program as men when entering the job market. "A similar count for 1985 and 1986 also found that the percentage female among Ph.D. recipients at the top seven schools was within one-half percentage point of the percentage female among all economics Ph.D. awarded during those years." (Kahn, 1995) The above evidence suggests that, at least in recent years, Ph.D. granting department rank is not a factor that has suppressed female economists' earnings.

The volume and quality of publications, however, differ across genders. On average, women publish less than men and publish less in esteemed journals, even after controlling for experience (Broder, 1993; McDowell and Smith, 1992). The consensus of prior research is that publication differentials offer a partial explanation for why women earn less than men.

Finally, age and seniority may play a role in explaining the wage gap. It was not until early 1970s that women increasingly earned doctorate degrees in various disciplines (Ferber and Loeb, 1997). In economics, only 6.2% of the Ph.D degrees were granted to women in 1970, 15% in 1984/1985 (Broder, 1993), while in 1993 the number surged to 22.8% (Kahn, 1995). Women are relatively new to the economics profession and hence they have less seniority.

After controlling for Ph.D. granting department rank, publications, first job placement, and age and seniority, the gender wage gap in the economics profession still cannot be fully explained. The residual signals either discrimination or some uncaptured performance-related variable (Kahn, 1995). Discrimination is a popular hypothesis in earlier literature. According to a study by Johnson and Stafford (1974) on female faculty in the disciplines of economics, sociology, mathematics, biology, and physics in 1974, roughly three-fifths of the female wage and promotion disadvantage may be attributed to discrimination. Over time, however, discrimination has become less and less pronounced. The discrimination hypothesis may still hold for older cohorts, but is no longer significant for younger cohorts. Using Oaxaca's methodology, Broder (1993) finds no significant gender coefficients consistent with the discrimination hypothesis in a sample of assistant economics professors.

An obvious deficiency of previous research is the lack of empirical testing of the relationship between marriage and fertility variables and economists' earnings. Nevertheless, the importance of marriage and fertility variables is non-negligible in the study of the gender wage gap in the profession. Johnson and Stafford (1974), along with Gordon and Morton (1974), have offered hypotheses as to why marriage and fertility may underlie the persistent gender wage differentials. Johnson and Stafford (1974) recall from the life cycle models of training that those who expect disruptions in their labor force participation will invest less in human capital, resulting in a lower prospect of earning growth. In the case of Ph.D. female economists, who may expect their marriage and fertility to affect their labor force participation, their disrupted earning curves are reflected in the fact that the gender wage gap first widens and then narrows in one's life cycle. This is referred to as the "catch-up effect" that takes place once female economists get beyond child-bearing years. However, Johnson and Stafford (1974) did not provide direct empirical evidence on the relationship between fertility and female economists' earnings.

Gordon and Morton (1974) argue that women have a steeper labor supply curve than men, because they are relatively immobile, given their preference and necessity to stay geographically close to their husbands and children. Marriage and fertility, leading to a lack of mobility, has suppressed women's earnings. Reagan (1975) indicated a steeper labor supply curve for female economists than for their male counterparts, but offered no empirical testing on the association between marriage, fertility, and earnings.

Partly, the lack of incorporation of marriage and fertility data into empirical analysis is due to the absence of family related information in both National Science

Foundation Survey of Earned Doctorates and the American Economic Association Member Survey, which are two standard data sets used by existing research. A notable exception is Kahn (1995), who found that marriage and the presence of children have no impact on female economists' earnings; the same test given to men also generated insignificant coefficients.

Using 1990 Census data, this paper searches for the potential different impact of marriage and fertility on earnings across genders, which may, in turn, contribute in part to the gender wage gap. Statistically insignificant results, conversely, suggest that marriage and fertility do not underlie the wage gap. In the following parts of the paper, I will explain some technicalities of the 1990 Census data, interpret descriptive statistics, introduce empirical methodologies and report regression results, and then conclude the paper by summarizing the limitations of this paper and pointing out directions for further research.

### **III. The Data**

This paper uses the 5% public use microdata samples of the 1990 Census of Population and Housing. The data includes variables that comprehensively define a person's characteristics such as type of residence area, education, income, occupation, marital status, and other demographic features. The choice of the 1990 Census data set distinguishes this paper from the previous literature. Previous studies of academic labor markets for economists have traditionally used either NSF Survey of Earned Doctorates data or AEA member survey data, neither of which asks family-related questions. In the 1990 Census, however, detailed marital and fertility information are included for women

and marital information for men, which makes it possible to add variables concerning marriage and fertility to earning equations.

Although a measure of men's fertility is not readily available in the data set, I derived fertility information for men by matching husbands and wives within a state using household serial number and the family relation variable and then transferring the wives' fertility data to the husbands. By using this method of derivation, I am making the assumption that all children ever born to the wives are also their current husbands' children. Fertility information for single, widowed, and divorced or separated men is still unattainable by this method. Given the data set, this is a fairly good approximation to men's true fertility, as married men constitute the majority of male Ph.D. economists. As household serial number is only uniquely valid within a state, I cannot match couples that live in different states. Hence in the following analysis that involves fertility, I have excluded the observations of married men for whom I cannot find their matching wives.

I include only records of Ph.D. economists in my final sample. For an observation to qualify as a Ph.D. economist, education attainment must be indicated as "doctorate degree;" occupation must be indicated either as "post-secondary economics teacher" or "economist." The final sample consists of 558 Ph.D. economists. 461 are male and 97 are female.

The limitation of the Census data is that it does not include variables that are unique and crucial to the analysis of labor markets for economists such as rank of department, prestige of the institution, and publications. Additionally, as the public use Census data files sample 5% of the U.S. population, the sample size for Ph.D. economists turned out to be small.



#### IV. Descriptive Statistics

In the sample, male economists are found to earn significantly more on average than their female counterparts. The mean wage or salary-based income for men is \$55,944.35, whereas for women it is \$44,527.72, generating a mean wage differential of \$11,416.63. Table 1 shows that the difference is statistically significant on 5% level, according to the Welch's test for two group means without assuming equal group variances. One has to be careful, however, in interpreting this differential, because female Ph.D.s are on average younger than their male counterparts and therefore have less seniority.

Men and women also display different distributions of marital status (Table 2). Among the 461 men, 379 are married, 35 divorced or separated, 42 single, and 5 widowed. Among the 97 women, however, 62 are married, 14 divorced or separated, 19 single, and 2 widowed. It appears that female Ph.D. economists are less likely to be married and more likely to be divorced or separated. In comparison to earlier literature in the 1970s, this difference persists over time. Strober (1975) found in a sample of 678 women Ph.D. economists that 26 percent of them are single while 12 percent are divorced or separated. However in the matching sample for men, only 12 percent are single and 6 percent divorced or separated.

Interestingly, wage incomes across marital statuses also display different patterns across gender groups (Table 2). I disregard widowed economists in this comparison because there are few of them and the determinants of their incomes are rather complex. After disregarding widowed women, divorced or separated women earn the highest incomes, followed by single women, and finally married women. Divorced women

heading the list contradicts the general observation that divorced women tend to belong to less privileged groups (Arendell, 1986). In contrast, disregarding widowed men, married men earn the most, followed by divorced or separated men, and then single men. This appears to be consistent with the widely accepted observation that men experience a marriage premium in labor markets (Korenman and Neumark, 1991). It is notable that although single women are on average younger than single men in the sample, they earn significantly higher wages. This observation makes one suspect that marriage is negatively correlated with female economists' earnings but positively correlated with male economists' earnings.

Men and women also differ with respect to fertility. Among the 78 once or currently married women in the sample, 44 percent had yet to have a first birth at a mean age of 37.86. About 84 percent have fewer than two children. This appears to be simply a more extreme case than Goldin's (1995) finding that in a cohort of college educated white women, 28 percent were childless at ages between 37 and 47 in 1991. Table 3 shows that as the number of children increases, the mean income of the group decreases rapidly, despite the older mean group age. This observation signals the possibility that fertility may be negatively correlated with women economists' earnings. Because of the limitation of the data, only fertility of married men is available for comparison. Among the married men, only 16 percent have no children and 66 percent have at least two children. As the number of children increases, men's incomes first increase and then decrease, suggesting a different pattern from that of women.

## V. Regression Analysis.

In the final sample for regression, observations for widowed economists are excluded because of the multiple and arbitrary determinants of their incomes. Also excluded are observations of economists with zero incomes and those married men whose matching wives' records cannot be found.

To set up the functional form of the earning equations, I consider sex, marital status, and fertility, in addition to one's location of residence, race, citizenship, hours worked per week in 1989, sector in which one works, and seniority in the profession. Location of residence is taken into consideration because costs of living tend to be higher in metropolitan areas and hence the expectation is that residence within metropolitan areas is positively correlated with earnings. I differentiate between Ph.D. economists in the academic sector and the non-academic sector with the expectation that non-academic economists tend to earn more than their academic counterparts. Either a positive or a negative coefficient can be expected from the number of hours worked per week, since one may either argue that lower salary earners have to work harder to advance in their careers, or that economists who work more result in higher earnings. As to seniority, the concave-down curve of one's life-cycle earning is captured by two variables,  $AGE$  and  $AGE^2$ . A positive coefficient is expected from  $AGE$  and a negative one from  $AGE^2$ .

Table 4 presents the variables included in the final regression, their definitions, and summary statistics. I use Ordinary Least Square linear regression method to estimate the following earning equations:

Equation (1):

$$\begin{aligned} \ln(INCOME) = & \beta_0 + \beta_1 METRO + \beta_2 RACEWHITE + \beta_3 AGE + \beta_4 AGE^2 + \beta_5 MARRIED \\ & + \beta_6 DIVORCED + \beta_7 FERTILITY + \beta_8 CITIZEN + \beta_9 ACADEMIC + \beta_{10} WEEKHOUR89 \\ & + \varepsilon \end{aligned}$$

Equation (2):

$$\begin{aligned} \ln(INCOME) = & \beta_0 + \beta_1 METRO + \beta_2 RACEWHITE + \beta_3 AGE + \beta_4 AGE^2 + \beta_5 SEX * AGE \\ & + \beta_6 SEX * AGE^2 + \beta_7 MARRIED + \beta_8 DIVORCED + \beta_9 SEX * MARRIED \\ & + \beta_{10} SEX * DIVORCED + \beta_{11} FERTILITY + \beta_{12} SEX * FERTILITY + \beta_{13} CITIZEN \\ & + \beta_{14} ACADEMIC + \beta_{15} WEEKHOUR89 + \beta_{16} SEX + \varepsilon \end{aligned}$$

Equation (2) includes several interaction terms of sex and marital status, sex and fertility, as well as sex and seniority. A statistically significant coefficient associated with the *SEX \* FERTILITY* interaction term will indicate that the correlation between fertility and men's earnings is statistically significantly different from that between fertility and women's earnings. A positive coefficient indicates that such correlation is strengthened in the case of women while a negative coefficient indicates a reduction of the correlation. Similar rules of interpretation can be applied to the interaction of sex and marital status and the interaction of age and seniority. If one suspects women experience lower returns to marriage and fertility than men, then the critical expectations will be that the coefficients of both *SEX \* MARRIED* and *SEX \* FERTILITY* are negative.

Equation (1) is estimated separately for men and women and the results are shown in comparison to each other in Table 5. Equation (2) is estimated for the entire sample. These results are presented in Table 6.

As expected, the estimated coefficients of Equation (1) indicate that number of children is negatively correlated with female income, with the result significant at a 5%

level. These results contradict those found by Kahn (1995) that the presence of children does not lead women academic economists to publish less or slow their tenure process. Results from Equation (1) also indicate that fertility is not statistically significantly correlated with male economists' earnings with a  $t$  value of 1.601. This is consistent with Kahn's (1995) finding that presence of children has no significant association with male publication and tenure rates ( $t=1.75$ ). The difference between the fertility coefficients for men and women signals that there may exist different returns to fertility across gender groups.

The marriage variable is found to have no correlation with either female or male economists' earnings. For women, Kahn (1995) also found that marriage does not have significant impact on female economists' performance. This is consistent with the finding in the general population that there is no significant correlation between marriage and female labor market productivity (Korenman and Neumark, 1989). For men, interestingly, male economists do not experience the male marriage premium that exists in the general population. Marriage is of no statistical significance to their earnings. Although divorce has not been examined by any of the previous studies on the labor market for economists, my results suggest that divorce has no statistically significant impact on either female or male economists' earnings.

The coefficients of  $AGE$  and  $AGE^2$  have their expected signs and are significant at 1% level for men but are not statistically significant for women. This result suggests the possibility that in the economics profession, men's earnings rise more rapidly but also level off substantially as they become old. Women may take longer to raise their earnings

and the leveling-off is also more gradual. This is consistent with the fact that the gender wage gap in the profession first widens and later converges (Johnson and Stafford, 1974).

This convergence is referred to by Johnson and Stafford (1974) as the “catch-up” effect women economists experience once they get beyond their child-bearing years. Johnson and Stafford (1974) believe that this catch up effect can be captured by the negative coefficient of  $SEX * AGE$  and the positive coefficient of  $SEX * AGE^2$ . My results for Equation (2), however, do not indicate statistically significant coefficients for these two interaction terms. One possible explanation is that women in the late 1980s postponed marriage and child-bearing. If child-bearing is to negatively affect their earnings, the effect of a late birth will not be as negative because it could be partly remedied by the seniority the older women have already gained. A late birth also makes the “catch-up” effect less obvious because there will not be much time left for them to speed up after a late birth. Rather than totally contradict the earlier results, my results may suggest a social trend of women delaying marriage and births in recent decades, especially for highly educated women.

Complementing Johnson and Stafford’s (1994) indirect and suggestive approach, the availability of fertility data allows this study to examine directly the relationship between fertility and earnings. In the estimation of Equation (2), there is a negative coefficient for the interaction of  $SEX$  and  $FERTILITY$  that is statistically significant at a 5% level. This is consistent with the finding in the estimation of Equation (1) that men and women have different estimated coefficients for the fertility variable. The negative coefficient of the  $SEX$  and  $FERTILITY$  interaction conclusively indicates that female economists experience statistically significantly lower return to fertility. As a matter of

fact, from the estimation of Equation (1) we know this return is negative. The gender difference with regard to fertility offers a partial explanation why gender wage gap persists in the economics profession.

Contrary to our expectation, the interaction of *SEX* and *MARRIED* and the interaction of *SEX* and *DIVORCED* do not generate significant coefficients, suggesting that male and female economists do not experience different returns to marriage or divorce. Hence, marital status may not account for the residual gender earning gap in the economics profession.

## **VI. Conclusion.**

In an attempt to shed light on the gender wage gap residual in the economics profession, this paper examines the returns to marriages and fertility of men and women economists. The results suggest that neither marriage nor divorce has a statistically significant impact on women or men economists' earnings. Therefore, marital status does not account for the gender wage gap residual that was not explained in the previous literature. Fertility, or the number of children, however, is found to have a negative return among female economists but does not affect their male counterparts' earnings. One can hence conclude that the different returns to fertility of male and female Ph.D. economists may account partly for the residual gender wage gap in the economics profession.

However, further study is needed. This paper is limited by a small sample size and the use of approximate and incomplete data for male economists' fertility. Additionally, because of the restriction of the 1990 Census data, crucial variables such as rank of the departments and publications are not included in the analysis.

The ultimate goal of studying residual gender wage gap is to test whether discrimination still exists in the profession. Readers should be aware that though fertility is found to account for part of the residual wage gap, the part it accounts for is not necessarily free of discrimination. It is possible that child-bearing may exogenously reduce women's productivity, or less productive women to have more kids because of the lower opportunity cost, but it is also possible that pregnant women and women with children are simply discriminated against. Why residual gender wage gap persists, either because of discrimination or other unobserved performance-related variables, remains inconclusive. In further research, more sophisticated empirical methods will be needed to test the presence of discrimination in the economics profession.



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Table 1. Two-sample t test with unequal variances

Men: Number of obs = 461

Women: Number of obs = 97

	Mean	Std. Err.	t	P> t	95% Conf. Interval	
Men	55944.35	1786.457	31.3158	0.0000	52433.72	59454.98
Women	44527.72	3163.087	14.0773	0.0000	38249.04	50806.4
Diff	11416.63	3632.705	3.14274	0.0020	4244.016	18589.24

Welch's degrees of freedom: 164.88937

	Women				Men			
	number of observations	percentage of the total	mean income	mean age	number of observations	percentage of the total	mean income	mean age
Married	62	64%	\$40,675.98	40.03	379	82%	\$ 57,830.20	47.22
Divorced or separated	14	14%	\$64,447.28	41.57	35	8%	\$ 55,522.11	46.8
Single	19	20%	\$44,158.74	34.36	42	9%	\$ 39,820.02	37.76
Widowed	2	2%	\$28,000.00	38.5	5	1%	\$ 51,396.80	56.6
All	97	100%	\$44,527.70	39.11	461	100%	\$ 55,944.35	46.43

Fertility	Married men's fertility (N=369)				Married/ divorced or separated/ widowed women's fertility (N=78)			
	Number of observations	Percentage of the total	Mean income	Mean age	Number of observations	Percentage of the total	Mean income	Mean age
No child	59	16%	\$49,002.93	45.10	34	44%	\$55,378.14	37.86
One child	66	18%	\$54,601.43	43.15	12	15%	\$53,939.50	38.58
Two children	142	38%	\$63,280.34	46.49	20	26%	\$31,095.85	42.3
Three children	65	18%	\$60,751.75	50.66	3	4%	\$30,041.67	44
More than three children	37	10%	\$49,900.73	56.59	9	12%	\$26,444.45	45.89

Table 4. Summary of variables in the final regression.

Variable	Definition	Female economists (N=90)				Male economists (N=409)			
		Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
<i>INCOME</i>	Wages or salary income in 1989 (140001 or more=state median of topcode values)	47368.77	30349.89	2400	195516	60862.5	36097.99	563	195875
<i>SEX</i>	0=male; 1=female	1	0	1	1	0	0	0	0
<i>METRO</i>	0=residence not within metropolitan areas; 1=residence within metropolitan areas.	0.966667	0.1805111	0	1	0.9633252	0.1881924	0	1
<i>RACEWHITE</i>	0=non-whites; 1=whites	0.9	0.3016807	0	1	0.8679707	0.3389373	0	1
<i>AGE</i>	age in years	38.7	7.494492	23	58	45.62347	10.0235	21	78
<i>MARRIED</i>	0=not married; 1=married	0.644444	0.481363	0	1	0.8264059	0.379224	0	1
<i>DIVORCED</i>	0=not divorced or separated; 1=divorced or separated	0.155556	0.3644639	0	1	0.0806846	0.2726837	0	1
<i>FERTILITY</i>	0=missing; 1-11=number of children plus one	1.888889	1.275917	1	6	2.418093	1.646078	0	11
<i>CITIZEN</i>	0=not citizen of the U.S.; 1= U.S. citizen by naturalization; 2=Born in the U.S., or Puerto Rico, Guam, and outlying areas, or born abroad of American parents	1.655556	0.7214391	0	2	1.567237	0.7707918	0	2
<i>ACADEMIC</i>	0=Non-academic economist; 1=academic economist	0.188889	0.3936132	0	1	0.1711491	0.3771005	0	1
<i>WORKHOUR89</i>	usual hours worked per week in 1989 (99=99 or more usual hours)	44.12222	10.8419	8	99	45.33496	10.03463	8	99

Table 5. OLS Regression of Equation (1)

Variable	men		women	
	Coef.	t	Coef.	t
<i>METRO</i>	0.4702	2.22	0.1163	0.357
<i>RACEWHITE</i>	0.0294	0.229	0.2324	1.055
<i>AGE</i>	0.1669	5.634	0.0925	1.311
<i>AGE</i> <sup>2</sup>	-0.0018	-6.106	-0.0010	-1.138
<i>MARRIED</i>	0.9765	0.572	0.2651	1.468
<i>DIVORCED</i>	0.1968	0.986	0.3190	1.432
<i>CITIZEN</i>	-0.0392	-0.691	-0.0216	-0.237
<i>ACADEMIC</i>	-0.1137	-1.049	-0.2332	-1.546
<i>FERTILITY</i>	0.5425	1.601	-0.1305	-2.382
<i>WORKHOUR89</i>	0.1479	3.673	0.0316	5.499
Constant	6.2468	8.965	6.8297	4.922
Adjusted R squared	0.1649		0.3200	
N	409		90	

Table 6. OLS Regression of Equation (2)

Variable	Coef.	t
<i>METRO</i>	.4041	2.193
<i>RACEWHITE</i>	.0308	.337
<i>AGE</i>	.1643	5.882
<i>AGE</i> <sup>2</sup>	-.0018	-6.302
<i>SEX*AGE</i>	-.0572	-0.565
<i>SEX*AGE</i> <sup>2</sup>	.0007	0.532
<i>MARRIED</i>	.0891	0.548
<i>DIVORCED</i>	.1836	0.964
<i>SEX*MARRIED</i>	.0760	0.261
<i>SEX*DIVORCED</i>	.0723	0.202
<i>FERTILITY</i>	.0530	1.640
<i>SEX*FERTILITY</i>	-.1918	-2.371
<i>CITIZEN</i>	-.0379	-0.731
<i>ACADEMIC</i>	-.1431	-1.547
<i>WORKHOUR89</i>	.0178	5.197
<i>SEX</i>	1.342	0.682
Constant	6.128	9.253
Adjusted R squared	.1821	
N	499	