The Men's Marriage Premium in the United States: What Remains after Controlling for Publication Bias and Heterogeneity?

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Abstract

Married men earn more than single men, which is a significant finding in labour and family economics. A considerable amount of research literature discusses this estimated wage effect for married men in the United States. This study finds a meaningful impact on wage after controlling for the publication bias with heterogeneity, a considering meta-analysis of 120 estimates. Marriage premium accounts for 6.8% compared to unmarried men with the evidence of publication bias after applying descriptive statistics, funnel graph, simple meta-regression analysis (MRA), and multiple MRAs. Also, this analysis identifies omitted variable bias as another important aspect for explaining this widespread empirical literature.

Keywords: Publication Bias, Meta-analysis, Marriage Wage Premium, Meta-regression Analysis

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Introduction

Married men earn more than single men, which is a significant finding in labor and family economics. That premium indicates a 10 % and 40 % premium when considering the studies in the early 1970s and 1980s. However, researchers find this marriage premium diminishing over time. Some argue reducing 20 % from 1968 to 1988 (Blackburn & Korenman, 1994), but some said it fell from 11% in the late '70s to 6% in the early 90's. When considering the literature, we can find that the premium has grown, decreased, or remained constant over time. As a result, it is possible that this marriage premium has not been fully captured or estimated by previous studies.

There are two main theories can be identified to explain this wage premium. The first theory (specialization) is that marriage makes a man more productive through intra-household specialization between husbands and wives (Becker, 1981; Korenman & Neumark, 1991; Chun & Lee, 2001; Lerman, 2002; McConnell & Valladares-Esteban, 2021). The second theory (selection) implies that men who possess certain attributes, people skills, and personal characteristics would be considered more attractive in the marriage and labor markets (Nakosteen & Zimmer,1987, 1997; Ginther & Zavodny, 2001; Ludwig & Brüderl, 2018, Indika, 2018). However, these skills and attributes are unobservable but correlated with wages. Thus, this theory does not imply that marriage increases the unobservable skills, but unobservable skills impact marriage selection. This implies that men with higher earnings are more likely to get married than single men. This explanation is not as well supported in the literature as the specialization concept. However, it does express the importance of controlling for other characteristics related to wage earnings when comparing the wages of men in different relationship status (whether they be single, divorced, or married).

Identifying whether and how much marriage is a cause or simply an effect of men's higher earnings is a complicated problem. Thus, studies consider the different types of variables and different types of models to capture this unclear marriage premium. For example, most studies have included different types of variables (for example, years of marriage) and used different models (fixed effect/random effect) to capture this premium; however, some studies do not consider these factors and they are not concerned about the statistical behavior, rather, they are concerned with how their papers get published (Stanley, 2001). Therefore, this study investigates how those omitted variable biases affect the men's marriage premium and correct the magnitude of reported marriage premiums for publication biases. Moreover, this research is conducted to find better ways to understand the marriage premium and minimize the conflicting results. These phenomena can be identified using the meta-

regression analysis (MRA) to correct the magnitude of reported marriage premium for their publication biases. The main contribution of this study is to use the empirical application of meta-regression analysis by using meta-data while employing techniques of descriptive statistics, funnel graph, simple meta-regression analysis (MRA), and multiple MRAs and correcting the magnitude of reported marriage premium for their publication biases. I found that the marriage premium accounts for 6.8 %, with evidence of publication bias. Once these biases are filtered out with heterogeneity, there exists a meaningful impact on marriage premium for men from United States of America (US). Also, this analysis identifies omitted variable bias as another essential aspect for explaining this widespread empirical literature. The paper is organized as follows; Section two discusses dominant theories for the male marriage premium; Section 3 describes the meta-data. Section 4 depicts the meta-regression analysis using meta-data by employing descriptive statistics, funnel graphs, simple meta-regression analysis (MRA), and multiple MRAs. Section 5 contains the conclusions.

Theoretical Background

This section discusses the dominant theories, ideas, and causes of the male marriage premium, considering the general method of estimating the marriage premium.

The Theory of Specialization

Two main theories can be identified to explain this wage premium. The first theory can be discussed as the theory of specialization. This theory is recognized by Becker (1981), finding that productivity is the key factor for differences between married and unmarried men. The productivity approach suggests the role of traditional household specialization or labor division by gender. Nobel laureate Gary Becker is one of the key persons to discuss this household specialization or productivity hypothesis. Becker suggests that productivity is the key factor for the difference in the wage premium between married and unmarried men. Becker suggests that our efficiency in doing day-to-day activities depends on the amount and type of "human capital" people possess (skills, appearance, reputation, credentials, experience, and knowledge). Becker defined this human capital in two parts: household-related capital and market-related capital. This human capital knowledge increases his/her productivity and has an impact to increase his/her wage.

Moreover, married partners can take advantage of this human capital investment to be more productive in home production and market-related activities. For example,

men have a small comparative disadvantage of housework and childbearing, but a small labor advantage. Thus, wives influence housework efficiency, and husbands can focus on the labor market with their comparative advantage. So, it is clear that starting with this small advantage as a division of labor can become a large advantage over time as married partners. Therefore men who never marry have to specialize in household and labor market activities using more time and energy. It is a disadvantage for them compared to married men. This specialization incorporates the women's effect on married men gaining more energy that can be used to work more productively. So, it allows married men to increase their wages in advance (Becker 1981). Hersch and Stratton (2000) test the specialization hypothesis and find that the wage premium is not considerably affected after controlling for the home production activities using panel data from the National Survey and Households. Married men only spent 45 % on traditional women's tasks, while earlier married men spent 63 % and men who never married spent 61 % on these tasks. Moreover, some studies find that women's labor force participation may negatively impact men's earnings (Gray 1997, Chum & Lee, 2001, Korman & Neumark, 1991). Also, McConnell and Valladares-Esteban (2021) identify a positive relationship between marriage and the wages of men and this finding rely on the idea that married men are focused on the labor market and their wives specialize in housework.

The Selection Hypothesis

The selection hypothesis is the second theoretical explanation for the marriage premium to understand the difference between married and never-married men. The selection theory implies that men possessing attributes like people's skills and personal characteristics would be more attractive in the marriage and labor markets. However, these skills and attributes are unobservable but correlated with wages. Thus, the theory does not imply that marriage increases unobservable skills, but unobservable skills impact the likelihood of getting married. This explanation is not as well supported in the literature as the specialization concept. However, it expresses the importance of controlling for other characteristics related to wage earnings when comparing men's wages in different relationship statuses (whether they be single, divorced, or married). Thus, researchers expect these personal characteristics to represent a group of married men with positively correlated wages compared to a group of single men.

Nakosteen and Zimmer (1987) find that men who have higher earnings are likely to select their mate. They estimate wage determinants that permit endogenous selection of marital status by using the Michigan Panel Survey Income Dynamics.

Ginther and Zavodny (2001) propose that the wage premium due to the selection effect indicates only about 10 % of the premium. Moreover, men with higher incomes are less likely to divorce than those with lower wages (Nakosteen & Zimmer, 1997). Ginther and Zavodny (2001) estimate the marriage premium by using two types of marriages: one indicates a married man without a premarital conception, and the other is premarital conception. It indicates higher wage men are more likely to get married, and they conclude that the selection hypothesis plays a significant role in marital status. Using the non-parametric matching method, Indika (2018) finds that higher-income men are more likely to get married. The significant marriage premium accounts for 6.4 % after controlling unobserved heterogeneity. Also, Ludwig and Brüderl (2018) reveal the selection hypothesis using National Longitudinal Survey of Youth (NLSY) data and find that men on a steep career track are especially likely to marry than single men.

Alternative Views on Men's Marriage Premium

A variety of explanations and reasons have been associated with increased married men's wages other than the specialization and selection hypothesis. Marriage increases earnings because of an increase in their aspiration, by stabilizing men's lives (Ahituv & Lerman, 2007). One of the common observations is that employer discrimination or bias may impact married men to earn higher wages. Employers give married men the first choice through promotions after considering that a married employee requires more money to meet family life's financial needs. However, social ideas have been changed in the United States. Blackburn and Korenman (1994) explained the marriage premium decreased by 10 % over time because of the change in employer bias's social norms.

Hamermesh and Biddle (1994) identified that physical appearance affects wages, meaning that more attractive employees get higher wages (beauty, health). They identified this by considering plain people, average-looking people, and good-looking people. As a result, beauty leads to higher earnings. Physical attractiveness is generally associated with selecting a mate and indirectly leads to a positive effect on wages.

The following factors that can influence a man's success in his career and marriage are: personal characteristics (self-esteem, extraversion, neuroticism) or social skills (communication, conflict resolution), physical appearance, education, age, etc. However, unobservable factors can impact personal life (especially marital success) rather than professional life, but unfortunately, those factors cannot be

observed. It is clear that employers can be considering observable factors to evaluate the men, and those characteristics can be associated with married men and lead to a higher wage. .However, if the marriage fails (divorced or separated), those people's wages remain high. This can explain why divorced people earn higher than never married people because, at the time of marriage, men settle down and practice a more solid lifestyle (Chiodo & Owyang, 2002).

Matters (2005) explained that married partners earn more money with partnerships, and it makes the couple more economically efficient because of the social norms, wealth accumulation, and productive behavior that gives them an advantage. Moreover, married partners could also receive wealth transfers (i.e., dowry) from family members that cohabiting couples or never-married people would not receive. Married couple have more stable personal routines (sleep and diet), which also help increase wages. Married men are less likely to be fired or quit without a new job in hand than with a new job compared to unmarried men (Gorman, 1999). McManus and DiPrete (2001) point out that marital status is a critical determinant when considering the welfare state tax and transfer policy. The majority of married partners paid lower federal income taxes than never-married persons in the mid-1990s. It negatively impacts low-income men with loss of benefits (for example, not being qualified for food stamps). McDonald (2020) find that married men are more likely to be invited for a job interview and receive slightly higher wages than single men.

Meta-Data

According to a systematic review of the marriage wage premium, I investigated the empirical estimation based on Google Scholar using keywords such as "men's marriage premium", and "men's wages". To be included for meta-analysis, each study was individually reviewed for its empirical estimate of wage premium with criterion's such as (i) having at least one empirical estimate of the effect of men's marriage premium.; (ii) how researchers presented their empirical findings because some did not mention independent variables for models using different estimation techniques (some only referred to the premium with marriage status: married, divorced, widowed, and never married; thus, it is hard to identify omitted variables for each model); (iii) standard errors or t-values should report coefficient of marriage premium (iv) studies that are primarily concerned about the marriage-wage premium otherwise, marriage is a common explanatory variable in wage regressions, such as wage differentials, occupational segregation, and other areas in labor economics; (v)

regressions included married men only in the United States and not considered women. This process identified the 19 papers (See appendix 1 for selected papers with their citations) containing 120 estimates of the marriage wage premium along with sufficient information needed to estimate the meta-analysis, such as omitted variables and calculated t values (most t values are not mentioned with their standard errors). These factors are important to identify and estimate potential reporting bias or publication selection bias (Egger et al., 1997; Stanley, 2008). Appendix 2 included the independent variables (coded as 45 variables) that were considered for an estimate in the meta-analysis. Those independent variables are evaluated under different scenarios like estimation techniques (e.g., fixed-effects, random-effects or OLS, methods), types of data, time period, measurement of the dependent variable (e.g., natural log or not, hourly wages), job characteristics, spouse job characteristics, and other demographic characteristics (e.g., urban vs. rural, education level, ethnicity, religion, veteran etc.).

Meta-Regression Analysis (MRA)

Meta-analysis is characterized as a quantitative literature review (Stanley, 2001), and it is an attempt to investigate and explain the literature about some important parameters (Stanley & Jarrell, 1989). It can help to identify the variation from study to study among empirical findings by explaining the evidence of certain questions that emerge in the findings that are contradictory or overstated.

> "Meta-regression analysis is a form of meta-analysis especially designed to investigate empirical economics research" (Stanley, 2001, p.131).

MRA is a type of systematic review that uses statistical techniques to investigate and summarize in-depth, the empirical findings of the researchers. Further, meta-regression analysis helps to identify the particular type of model or methods, design, and data that affect the empirical findings. Meta-regression has been successfully applied to different fields such as social and medical sciences (economics, biology, environment, etc.). Some prominent examples of meta-analysis in economics appear in Table 1. For example, Stanley and Doucouliagos (2007) applied the meta-regression method to 75 empirical estimates from the efficiency-wage literature. After correcting for publication selection bias, they estimated the wage elasticity of output as 0.32, which is smaller than what the neoclassical version of the efficiency wage hypothesis demands.

Table 1: Selected Literature for Meta-analysis in Economics

Authors	Subject
Stanley and Jarrell (1989)	Introduction to meta-regression analysis
Jarrell and Stanley (1990)	Union wage premiums
Smith and Kaoru (1990)	Recreation benefits
Weitzman and Kruse (1990)	Profit sharing and productivity
Phillips (1994)	Education and productivity
Button (1995)	Transportation benefits
Card and Krueger (1995)	Minimum wage effects
Phillips and Goss (1995)	Taxes and local development
Button and Kerr (1996)	Urban traffic congestion
Espey (1996; 1998)	Gasoline demand elasticities
Loomis and White (1996)	Benefits of endangered species
Doucouliagos (1997)	Demand for Australian labor
Baaijens, Nijkamp and Montfort (1998)	Regional multipliers
Stanley and Jarrell (1998)	Gender wage gap
Stanley (1998)	Tests of Ricardian Equivalence
Ashenfelter et al. (1999)	Returns to education
Stanley (2000)	Tests of The Lucas Critique
Gorg and Strobl(2001)	Multinational companies and productivity
Doucouliagos and Ulubasoglu (2006)	Economic freedom and economic growth
Rose and Stanley (2005)	Common currencies on international trade
Stanley and Doucouliagos (2007)	Efficiency wage
Disdier and Head (2008)	Bilateral trade
Card et al.(2010)	Labor market policy

*Source: Stanley (2001) and updated by the author- http://ideas.repec.org/k/metaana.html*

Meta-Analysis

It is important to identify descriptive statistics with a simple graphical explanation for the marriage wage premium. The positive elasticity on a marriage dummy variable employed in the wage equation has become the norm in labor economics.

Figure 1 reflects the marriage premium in terms of elasticities, and the average marriage wage premium for this selected empirical literature is 0.10 (10 %). The smallest wage premium accounted for is -0.69, and the maximum is 0.93, with a deviation of 0.19. Thus, there is a need to explain this variation in estimated and reported marriage premium to verify that the overall impression is robust. However, it is a common practice for researchers to adjust this coefficient until they arrive at the expected estimation results, otherwise, Journal editors and referees will discount papers that do not find statistical significance in the expected direction (de Linde Leonard & Stanley, 2015).

Figure 1: Distribution of Meta-Data on Marriage-Wage Premiums

Obs	120
Mean	0.107
Std. ev.	0.199
Min	-0.691
Max	0.932
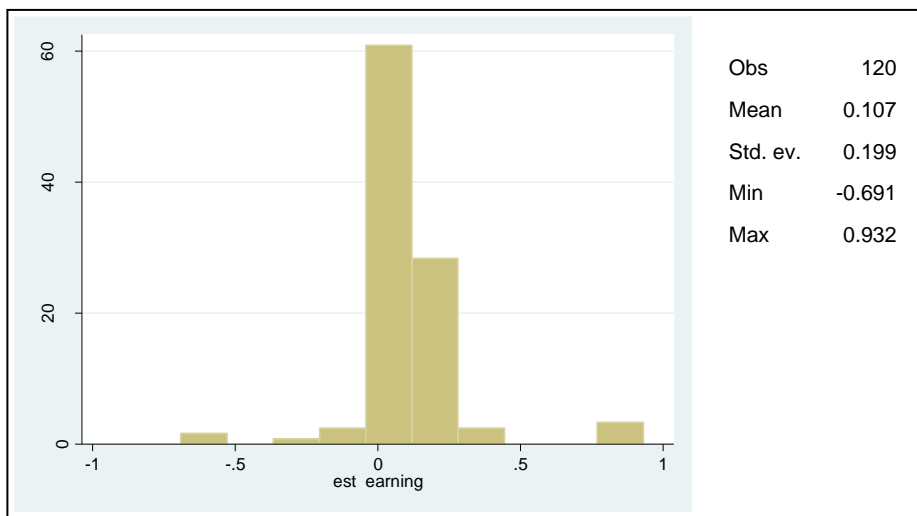
Detecting the Publication Bias

Publication bias is one of the major concerns for meta-analysis because editors, researchers, and reviewers are very concerned about the statistical significance of empirical results, leading to publication bias. Moreover, they are not concerned with insignificant results in publications most of the time (Doucouliagos & Stanley, 2012; Doucouliagos et al., 2012). Card and Krueger (1995) explain that publication bias can exist in three ways:

1. Reviewers and editors may be predisposed to accept papers consistent with the conventional view.
2. Researchers may use the presence of a conventionally expected result as a model selection test.
3. Everyone may possess a predisposition to treat "statistically significant" results more favorably" Card and Krueger (1995, p.239).

All three publication bias instances may impact the literature to become quite skewed, and distort usual empirical findings (Stanely, 2005). Publication bias has become a common problem in most fields, including social sciences, medical research, and economics.

Stanley (2005) explains that promotion, tenure, and compensation are mostly affected by publication record in economics. This is because the structure of academia often considers the quantity of publications that researchers publish. As a result, it badly affects the young economists because they quickly learn to produce

publications by considering statistical significance. It is clear that identifying the publication bias is very important to measure the marriage wage premium's correct magnitude elasticity. Further, finding a meaningful marriage premium after controlling for publication bias is significant to test the accurate meta-regression analysis.

The funnel graph is a widely used method to identify the publication bias. The funnel graph is a scatter diagram representing the precision vs. estimated effect such as regression coefficient, partial correlation coefficient, or elasticity. This study uses the estimated marriage wage premium and its standard errors (precision) to estimate the funnel graph. The best precision estimation is an inversion of the standard error (1/Se) (Egger et al., 1997; Stanley, 2005). One common way to detect this publication selection bias by using graphical behavior, is through a funnel approach. If there is no publication bias, then estimates should vary in a normal distribution around the estimated coefficient.

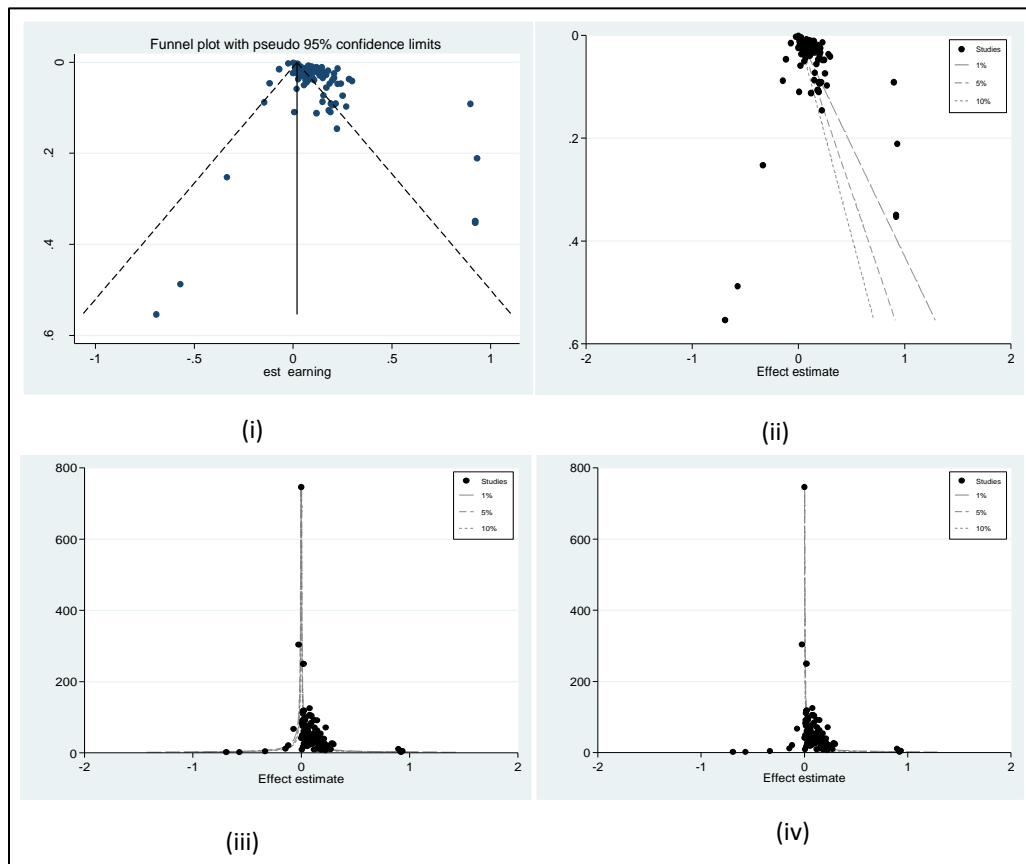**Figure 2: Funnel Plot for Estimated Marriage Wage Premium (n=120)**

Figure 2 shows the funnel graph for the marriage wage premium. It clearly shows a strong suggestion of asymmetry in the funnel, and it shows that studies are missing on the left-hand side of the plot of publication selection. Panel (i) is where standard errors of estimated wage premium are indicated on the Y-axis and wage premium estimates on the X-axis. Panel (ii) is similar to Panel (i) but based on one-sided p-values. Panel (ii) clearly shows a positive bias because there is a greater spread of estimates to the right of the mean (0.01), which demonstrates there are "missing" studies to the lower left of the mean. On the other hand, the top Panels indicate a concentration of more precise estimates near the mean with missing empirical studies in the mid-range values. Panel (iii) is where inverse of standard errors of estimated wage premium are indicated on the Y-axis and wage premium estimates on the X-axis. Panel (iii) is similar to Panel (iv) but based on one-sided p-values. Panel (iii)indicates the smaller sample, which is less reliable and spread out, on the other hand, Panel (i) shows tightly dispersed coefficients. It is more reliable because it has a low standard error. Pannel (iv) is over-weighted on one side of the plot, which provides evidence of publication selection.

Meta-Regression Analysis of Publication Bias: FAT–PET

When reviewing the graphical analysis used to detect the publication bias, unfortunately, it is weak to subjective interpretation. However, there is a simple way to detect publication bias using statistical modeling. It involves the simple meta-regression analysis between the reported effect (e.g., estimated wage premium-partial correlation, etc.) and its standard error (Egger et al., 1997; Stanley, 2005; Stanley 2008). For example, Egger et al. (1997) use the linear approximation to test the publication bias using the reported effect and its standard error.

$$Effect_i = \beta_0 + \beta_0 Se_i + e_i \qquad\qquad (1)$$

The Equation 1 indicates the estimation technique, where effect$_i$ is the estimated marriage wage premium coefficient in study *i*, *Se* (represents the publication bias) is its estimated standard error (overall average effect corrected for publication bias), and there is also a stochastic error term. The estimated *Effect$_i$* varies from study to study and randomly around the 'true' effect, *β_0*. In contrast, the publication bias correlate with the standard error (*Se*, see Stanley, 2008). The funnel-asymmetry test (FAT) is the most convenient way to detect publication bias. It can be detected by testing hypothesis- H$_0$: *$\beta_1 = 0$* (Egger et al., 1997; Stanley, 2008). On the other hand, testing the null hypothesis of H$_0$: *$\beta_0 = 0$* indicates a valid, genuine empirical effect (precision-effect test (PET)) remaining after the control for reporting bias is removed (Stanley,

2008). However, if the empirical estimates and model specifications are based on the significance of the main covariates, publication bias will differ with the standard error. Moreover, larger and smaller standard error values are associated with larger estimated effect sizes and smaller effect sizes. Thus it implies that the estimated effect varies from estimate to estimate; thus, it contains heteroskedasticity in Equation 1. It is suitable to divide Equation 1 by the standard error and estimated by Weight Least Squares (WLS) (Egger et al., 1997; Stanley, 2005). We can estimate Equation 1 by dividing with precision (1/*Se*) used as weights. More precise estimates are given greater weight to correct the heteroskedasticity, or we can implement either by using a WLS routine with $1/Se_i^2$ as the weight.

$$t_i = \beta_0 + \beta_1 (1/Se_i) + v_i \qquad (2)$$

where t_i is the conventional *t*-statistic for the ith observation for the estimated marriage wage premium, the independent variable of standard error becomes the inverse $1/Se_i$ precision, and v_i is a heteroskedasticity-corrected error term. It is important to understand the intercept and slope coefficients are reversed from the OLS version in, Equation 1. As a result, testing of H$_0$: $\beta_1 = 0$ is the precision-effect test (PET) that tests genuine empirical effect beyond publication selection bias. On the other hand, $\beta_0 = 0$ is evidence of publication selection (Egger et al., 1997). This test is known as the funnel-asymmetry test (FAT), which indicates marriage premium after correcting for publication selection.

Table 2 shows the results of this FAT-PET-MRA in Columns 1 and 2 for the estimated marriage premium. The estimation of FAT-PET-MRA in Equation 2 consists of three types of estimation techniques: robust standard errors, standard errors adjusted for data clustering, or robust regression.

The clustering method's estimation is important because of the multi-level nature of the data (or within studies for estimates). On the other hand, a robust regression corrects for the effects of influential outliers. The results are consistent without a robust regression estimation technique for PET. However, all the estimation techniques confirm the significantly positive funnel asymmetry (FAT) with the evidence of publication bias ($p < 0.01$), while the precision effect test shows a significantly positive empirical effect of estimated marriage premium only for the robust regression estimation technique ($t = 3.79$; $p < .01$). However, previous evidence has found that the wage benefit of marriage is unbiased with a 11 % marriage premium (de Linde Leonard and Stanley, 2015). The results confirm the

presence of average male marriage premium as approximately 2.2 % (0.022), at least from the perspective of this entire research literature.

Table 2: Estimate of the FAT-PET MRA (Eq. 2) and PEESE (Eq.4) for Publication Selection

FAT-PET-MRA (Equation 2)				PEESE (Equation 4)	
Regression /s.e.	(1) FAT β0=0 Funnel asymmetry	(2) PET β1=0 (1/Se) Meta-average	N	Intercept (Se)	(1/Se)
Robust s.e.	3.488161(9.55)***	0.00000847(0.00)	106	8.436659(2.00)**	0.0188602(1.77)*
Clustered s.e.	3.488161(7.29)***	0.00000847(0.00)	106		
Robust regression	2.283564(5.61)***	0.0220991(3.79)***	106		

Notes: 1. The dependent variable is the conventional *t* value. The brackets hold *t*-ratios, using robust standard errors, clustered standard errors, or robust regression, respectively. N is the number of observations. FAT measures the degree of publication bias. PET measures the effect of aid on growth corrected for publication bias. Equation 2 is estimated by using robust standard error.
2. *, ** and *** denote $p < .1$, $p < .05$ and $p < .01$ respectively
3. R-squared in the WLS method indicates 41% of FAT-PET-MRA and 19% of PEESE

Figure 3: Egger's Publication Bias Plot
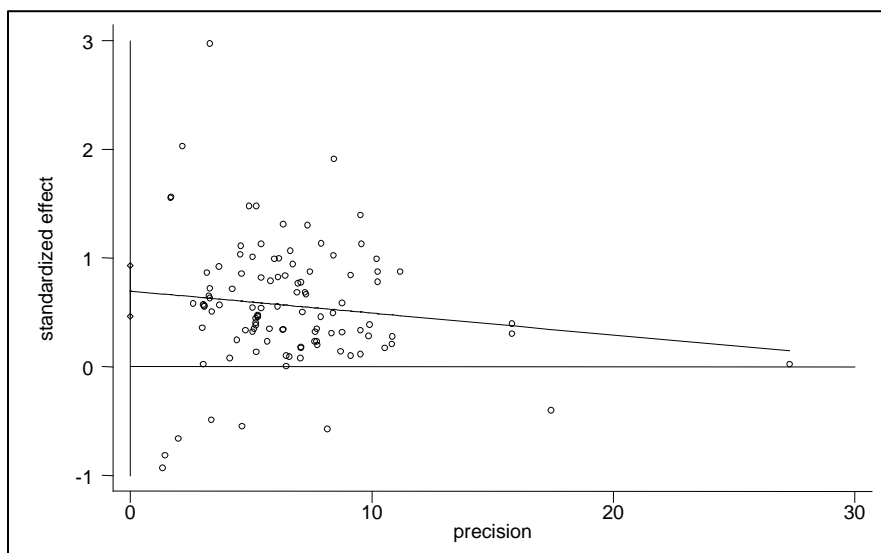
Figure 3 shows the graphical illustration of selection bias using the Egger publication plot method. To identify the publication bias, we can check the

relationship between the effects and their standard errors. The absence of publication bias implies no relationship (upward or downward) between aid-growth effects and standard errors. However, the graph indicates the negative association or downward sloping between standardized effects, and it presents evidence of publication bias.

Correcting Publication Selection—PEESE

When considering the above-estimated results, I have discussed how the publication bias can be detected by using graphs and equations to identify the genuine empirical effect. Furthermore, another important estimation technique can be identified to correct this publication bias because policymakers and researchers need to estimate the correct magnitude of the underlying effect. Equation 2 can be identified to present a linear relationship between an estimate and its standard error. However, if there is a genuine empirical effect, β_1 can be biased downward (Stanley, 2008). As a result, the association between the observed effect and standard error will be nonlinear for the existence of publication bias. This estimated technique is known as a precision effect estimate with standard error (PEESE). Usually, this nonlinear relationship estimate is found by using a power series. It can estimate by adding a square of standard error (the variance of each estimated marriage wage premium) in Equation 2 or by using the WLS estimate to correct the obvious heteroskedasticity in Equation 3 or 4.

$$Effect_i = \beta_0 + \beta_1 Se_i^2 + \varepsilon_i \qquad (3)$$

$$t_i = \beta_0 Se_i + \beta_1(1/Se_i) + v_i \qquad (4)$$

The estimated β_1 of Equation 4 is the value of the marriage premium corrected for publication selection (called the 'precision-effect estimate with standard error' (PEESE)), and there is no intercept. The estimation of PEESE is found in columns 5 and 6 of Table 2. The coefficient on precision (*1/Se*) is 0.019, and it indicates a PEESE estimate of the married wage premium after correcting for the publication bias. Thus, the overall marriage premium is approximately 1.9%.

Funnel Graph and Trim-and-Fill Mean Estimates

There is another method that can be used to correct the mean for publication bias. It is the trim and fills procedure suggested by Duval and Tweedie (2000). The STATA command "metatrim" can be used to correct the publication bias, which is used as an iterative algorithm to fill and recompute the mean effect size by adding missing values in the data until the observations are symmetric.

Table 3: Trim-and-Filled Meta-Analysis

Trimming estimator

Iteration	Estimate	Tn	# to trim	diff
1	0.02	4969	40	5671
2	0.012	5096	43	254
3	0.011	5099	43	6
4	0.011	5099	43	0

Filled

Method	Pooled Est	95% CI		Asymptotic	
		Lower	**Upper**	**z_value**	**p_value**
Fixed	0.011	0.01	0.013	12.137	0.000
Random	0.026	0.014	0.038	4.142	0.000

Notes: 1. Test for heterogeneity: Q= 3642.452 on 148 degrees of freedom (p= 0.000, N=149)
2. Moment-based estimate of between studies variance = 0.004

Figure 4: Filled Studies from Metatrim
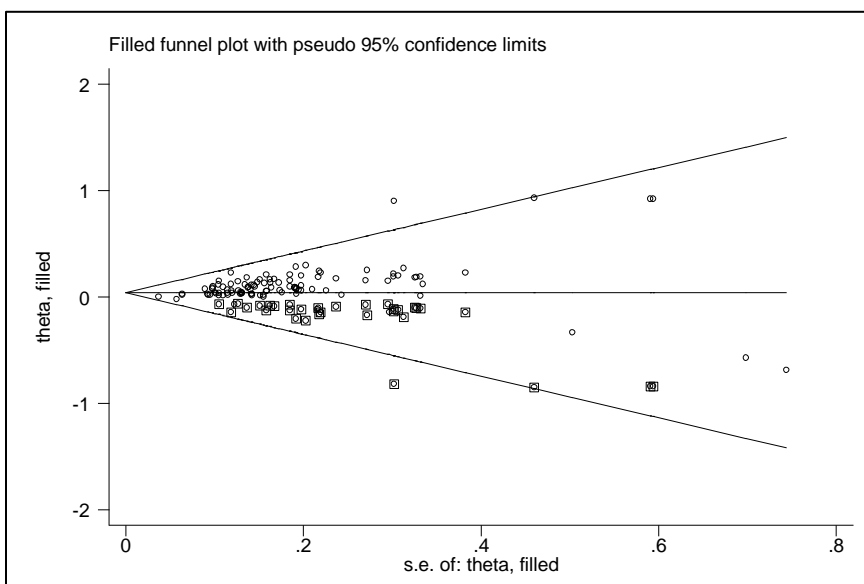
Table 3 indicates that the fixed effect of mean 0.011. Compared to the PEESE method, the trim-and-fill estimation technique reduces the mean estimation by 0.8%. Furthermore, the conventional Q-test clearly shows excess heterogeneity (Q = 3642.452; df = 148; $p < 0.001$). Figure 4 shows the trim and fill method of the studies after correcting for the missing studies, which are in the region of $p < 0.05$ confidence limits.

Multivariate MRA with Z and K Variables

The most important thing about these meta-regression analyses for publication bias is heterogeneity. Most of the research is easily affected by this heterogeneity even after they controlled the publication bias. Meta-analyses have found that, lot of choice variables, different model techniques, and different data can be used for meta-regression analysis. However, those can highly impact a practical difference in reported research results because of publication bias and heterogeneity. On the other hand, MRA's coefficient can be biased when important factors are omitted. As a result, it is necessary to identify the best strategy to detect this publication bias with heterogeneity. To identify potential marriage wage premium with publication bias: the simple MRA Model 2 can be greatly expanded by including moderator variables, Z_k, that explain variation in estimated marriage premium and other factors (omitted variables), K_j, that are correlated with the publication bias process itself.

$$Effect_i = \beta_0 + \alpha_0 Se_i + \sum \beta_k Z_{ki} + Se_i \sum \alpha_j K_{ji} + \varepsilon_i \quad (5)$$

$$t_i = \alpha_0 + \beta_0(1/Se_i) + \sum \beta_k Z_{ki}/Se_i + \sum \alpha_j K_{ji} + v_i \quad (6)$$

Moreover, the variable, Z explains the heterogeneity in the true estimates wage premium and misspecification biases (genuine empirical effect). The K variable indicates factors that can adversely impact marriage wage premium through researchers' decision to report a statistically significant coefficient to get published. In most meta-regression analysis, the K variable indicates a dummy variable, but it can affect multicollinearity (Stanley and Doucouliagos, 2012). However, which variables should be used as these Z and K variables? Because there is a debate in the literature, and it depends on the type of data at hand. In this analysis, the identified Z variables are year dummies (sixties, seventies, eighties, nineties, and thousand), model specification variables (Fixed-Effect, OLS), data type (NLSY data or not and US data or not) and structure of dependent variable used as marriage wage premium (dummy variable for log of the hourly wage) affect the reported wage premium. The identified Z-variables are divided by the standard error, *Se* (recall Equation 6).

Table 4 presents the empirical findings that are estimated by using the multivariate MRA model with added Z and K variables (Equation 6). The estimations are based on a 'general to specific' (GTS) approach in which the above variables were included in a meta-regression analysis, and the insignificant variables were omitted, one at a time. Column 1 reports the estimated MRA results using robust standard errors and other alternative methods, including clustered data analysis, Random–

Effects Multilevel (REML), and robust regression analysis, respectively, in columns 3, 4, and 5. REML method is very important because, within study dependence, is a potential problem in meta-regression. After including the variables, genuine effects

Table 4: Multivariate MRA Model, General-to-Specific

Moderator Variables	Column 1: WLS		Column 2: Clustered data analysis		Column 3: REML		Column 4: Robust	
Genuine Empirical Effects (Z-Variables)								
(1/Se)	-0.079	[-4.86]	-0.079	[-5.80]	-0.079	[-5.37]	-0.081	[-6.34]
D_two thousand/Se	0.079	[8.69]	0.079	[8.04]	0.079	[7.29]	0.054	[3.12]
D_Fixed-Effect/Se	-0.022	[-2.57]	-0.022	[-4.03]	-0.022	[-1.89]	-0.015	[-1.52]
D_OLS/Se	0.037	[4.22]	0.037	[4.35]	0.037	[4.38]	0.047	[6.16]
D_US data/Se	0.060	[3.89]	0.060	[4.54]	0.060	[4.64]	0.050	[4.37]
D_log of the hourly wage /Se	-0.023	[-3.21]	-0.023	[-3.38]	-0.023	[-3.12]	0.013	[0.76]
Publication Bias (K-Variables)								
O_urbun/rural	-5.819	[-3.40]	-5.819	[-2.20]	-5.819	[-4.37]	-5.049	[-4.41]
O_female age	8.776	[4.38]	8.776	[5.58]	8.776	[5.21]	8.843	[6.10]
O_different age	6.731	[4.64]	6.731	[4.25]	6.731	[4.95]	5.516	[4.71]
O_female education	-9.973	[-5.44]	-9.973	[-7.36]	-9.973	[-3.59]	2.714	[1.75]
O_worker education	4.714	[2.94]	4.714	[2.37]	4.714	[4.29]	3.469	[3.61]
O_years of divorced	-4.874	[-3.24]	-4.874	[-3.94]	-4.874	[-4.10]	-5.157	[-5.04]
O_region	2.235	[2.73]	2.235	[2.26]	2.235	[3.26]	1.790	[3.03]
O_union/nonunion	3.411	[2.97]	3.411	[2.39]	3.411	[3.54]	3.305	[3.99]
O_years of married	2.824	[2.87]	2.824	[5.58]	2.824	[3.55]	2.192	[3.17]
O_female occupation public/private	18.256	[4.39]	18.256	[8.14]	18.256	[5.36]	-	
O_years of job experience	-1.914	[-2.40]	-1.914	[-1.94]	-1.914	[-2.63]	-0.970	[-1.51]
_cons	-17.701	[-3.62]	-17.701	[-5.43]	-17.701	[-5.71]	11.478	[-4.31]
R-squared		0.630		0.630		0.630		-
N		106		106		106		104

Notes: Dependent variable: reported t-statistics and all regressions relate to Equation 6. *t*-values are reported in parenthesis except columns 4 because REML (random-effects multi-level model) estimates are in z-value and are calculated from robust standard errors. "D" indicates the dummy variable, and "O" indicates the omitted variable.

(heterogeneity) can be identified by the combination of Z variables (variables are divided by Se), and publication biases are now captured by K variables (variables are not divided by Se) along with the intercept. After including all the variables that are selected for Z and K variables (31 coded variables: See appendix 1); D_two thousand/Se, D_Fixed-Effect/Se, D_OLS/Se, D_US data/Se, D_log of the hourly wage /Se for the Z variables and O_urbun/rural, O_female age, O_different age, O_female education, O_worker education, O_years of divorced, O_region, O_union/non-union, O_years of married, O_female occupation public/private, O_years of job experience for the K variables are the only significant variables that affect the marriage wage premium. That implies those variables are most important to estimate the marriage wage premium. However, the most important findings that I want to emphasize are the existence of publication bias and the absence of a genuine effect on marriage wage premium, which remains after including Z and K variables.

Publication Selection

To check for publication bias, we can use a jointly statistically significant test for the combination of K variables with the intercept (because the intercept does not indicate the magnitude of publication bias itself). There is clear evidence of publication bias in this multivariate MRA because $F(10, 87) = 5.58(p<.0001)$ and the calculated average estimated publication bias for the marriage wage literature is 6.66 (summation of all k variables coefficient with intercept). It is higher than the simple MRA model that accounts for 3.48 (See column 2 Table 2).

The negative omitted factors associated with publication bias are urban or rural, female education, years of divorce, and years of job experience. When defined as benchmarks of study, variables other than what was mentioned above, such as, female age, worker different age, education, union or non-union, years of marriage and female occupation public or private, have a positive impact and do not omit the estimate of marriage wage equation. Other than that, the only differences, which are whether the spouse is employed in public/ private sector (O_female occupation public/private), no longer exist in the robust method in columns 4.

Genuine Effect of the Married Wage Premium

The genuine effect can be identified by using Z variables: D_two thousand/Se, D_Fixed-Effect/Se, D_OLS/Se, D_US data/Se, D_log of the hourly wage /Se. Thus, the marriage wage premium is a combination of coefficients of Z variables. Hence, all of these Z variables are zero; the estimated marriage premium indicates a positive effect, which accounts for 0.068 with approximately is 6.8 % in the robust method (0.058 for the WLS method with approximately 5.8 %). This is much higher than the

simple MRA model that is used for Table 2 in Equation 2, which accounts for 0.022. Together, these Z variables represent the genuine positive marriage wage premium with statistical significance, F (6, 87) = 18.42;p<0.001. This positive marriage premium is due to the period from 2000 to 2009 (D_two thousand/Se), which estimates coefficient to increase by 0.079 (using the WLS) and using U.S. data (D_US data/Se), which is an increase by 0.060. Moreover, the estimated technique of the OLS method has a positive impact on wage premium (0.047 by robust in column 4). At the same time, there is a negative impact from the natural log of the hourly wage (D_log of the hourly wage /Se), which is -0.023.

Conclusion

A systematic and comprehensive meta-analysis of a male marriage wage premium from research literature finds a meaningful impact on wage. It accounts for 6.8 % with evidence of publication bias after applying descriptive statistics, funnel graph, simple meta-regression analysis (MRA), and multiple MRAs of 120 estimated coefficients. However, it is hard to correct the identified publication bias, and its effects on the marriage premium, because of heteroskedasticity among reported econometric estimates of the marriage premium. The simple MRA method detects the publication bias and leads to testing for genuine effect beyond the publication bias. However, after applying the MRA model of the precision-effect estimate with standard error (PEESE), which reduces the bias, the estimated marriage premium is approximately about 2% (0.018). Finally, multivariate meta-regression models are applied to the empirical literature on estimated marriage premium.

The method used for estimating genuine marriage premium by controlling publication bias is proof that the genuine effect exists while failing to reject the publication bias. The detected publication bias is also evidenced by the funnel-asymmetry test. Thus, the average estimated publication bias accounted for 6.6 %. However, the genuine marriage wage effect is much higher than the simple MRA model. Finally, all the estimation techniques confirm that hard to control publication bias exists among marriage premiums. However, it is much harder to control this publication bias, resulting from the nature of empirical research in social science. Thus, it is important to clarify and filter the publication bias from any summary of empirical findings to provide clear evidence of research results.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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Appendix 1 Selected Meta-Articles

Authors	Citations
Waite, L. J. (1995)	1490
Korenman, S., & Neumark, D. (1991)	1001
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Note: Citations are based on Google Scholar in January 2020

Appendix 2: Meta-Independent Variables

Dependent Variable		Measurement of DV		Other Demographic Characters	
Var	**Variable Description**	**Var**	**Variable Description**	**Var**	**Variable Description**
Estearning (estimated effect)	Estimated wage premium	lnofho url~ge	1 if the dependent variable in the regression was the natural log of the hourly wage	oyears ofma~ d	1 if the study omitted the number of years that the respondent had been married
		hourlyc ons~d	1 if a study used hourly wages computed from daily, weekly, monthly, or annual salary	oyears ofdi~d	1 if the study omitted the number of years that the respondent was divorced
Model and data					
so	standard error of the estimated marriage-wage premium	annual wages	1 if a study used annual earnings	okids	if the study omitted whether or not the worker has children
sixties	1 if the data was from the time period 1960-1969	**Job**		omarit alki~n	1 if a study omitted interaction children
seveties	1 if the data was from the time period 1970-1979	opublic sec~r	1 if a study omitted the wages of workers in the public sector only	whiteo nly	1 if the sample was restricted to white men only
eighties	1 if the data was from the time period 1980-1989	oprivat ese~r	1 if a study omitted the wages of workers in the private sector only	wasdiv orced	1 if the study is omitted whether the worker was divorced
nineties	1 if the data was from the time period 1990-1999	onarro wocc~ n	1 if a study omitted the wages of workers of a narrowly defined occupation	oworke rage	1 if the study omitted the workers age
twothousand	1 if the data was from the time period 2000-2009	ounion nonu~s	1 if a study omitted workers union/non-union status	odiffer en~ge	1 if the study omitted the workers different age stages
fixe	1 if the study used fixed effects estimation	oindust ryo~t	1 if a study omitted worker's industry of employment	oworke redu~n	1 if the study omitted the workers educational level

Dependent Variable		Measurement of DV		Other Demographic Characters	
Var	**Variable Description**	**Var**	**Variable Description**	**Var**	**Variable Description**
re	1 if the study used random effects estimation	oworki ngtime	1 if the study omitted the worker's age	ourbun rural	1 if a study omitted urban
ols	1 if the study used OLS estimation	oselfe mplo~d	1 if the study omitted the worker's as self employed	orace	1 if a study omitted the race
gls	1 if the study used OLS estimation	oyears ofj~ce	1 if the study omitted the worker's years of job experience	oregio n	1 if a study omitted the region
dnlsy	1 if the study used data from NlSY			oreligi on	1 if a study omitted the religion
		Spouse characteristics			
dusdata	1 if the study used data from USA	ofemal esin~n	1 if the study omitted the spouse occupation	oworke rwas~n	1 if the study omitted whether the worker was a Veteran
dpanaldata	1 if the study used Panel data	ofoccu pati~v	1 if the study omitted the spouse occupation as public/private sector	tenureo nth~b	1 if the study omitted the worker's tenure with his current employer
		ofemal eedu~n	1 if the study omitted the spouse education		
		ofemal eage	1 if the study omitted the spouse age		
		ofemal ewage	1 if the study omitted the spouse wage		
		onoohh ours~m	1 if the study omitted the spouse no of hours in working		